Emerging Technology for Emerging Peoples:
Evaluation of an African AIDS-Awareness Training System

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Abstract: Technology is playing a part in the struggle against HIV/AIDS in Africa. Edu-Touch is a multi-media HIV/AIDS-awareness and health-care training system designed for indigenous people and operated by touch-technology. This paper records an educational usability evaluation of Edu-Touch based on triangulated methods: surveys in the workplace and, in particular, a heuristic evaluation investigating conformance to contemporary learning theory, using as an approach the Hexa-C Metamodel of learning and instructional theory. We note issues regarding computing technology in the training of formerly disadvantaged African learners. The findings serve as a precedent in the design and construction of culturally-sensitive training systems for emerging peoples.

Keywords: Technology for indigenous peoples, multi-media touch technology, health-care training systems, HIV/AIDS awareness, learning theory, instructional design, evaluation, human-computer interaction, usability, culture-sensitivity

1. Introduction

HIV/AIDS is increasingly claiming lives on the African continent. Technology has been summoned to the struggle. As part of a study which combines the disciplines of learning theory and usability, this paper describes and evaluates a multi-media AIDS-awareness and health-care training system and makes observations regarding technological communication with emerging peoples. The target group of Edu-Touch Training System comprises employees in the South African mining and industrial sectors, many of them under-educated indigenous peoples. Edu-Touch technology is currently operating at sites in different provinces of South Africa, and use is expanding rapidly - nationally and beyond. We set out to determine the factors underlying its effectiveness, and did so by evaluating its educational utility and usability using triangulated methods. First, a small-scale ethnographic survey among users in the workplace, based on questionnaires, observation and interviews; second, a criterion-based heuristic evaluation, using the Hexa-C Metamodel as an approach to examine Edu-Touch and its usability from the perspective of contemporary learning theory, touching also on aspects relating to African culture.

The paper is written by a team of two - a corporate entrepreneur responsible for developing the system and an academic researcher who led an evaluation of this e-learning artefact. Section 2 sets the context by introducing the Edu-Touch technology. Section 3 outlines the Hexa-C Metamodel and describes the evaluations and their findings. We note issues regarding computing technology used in the training of formerly disadvantaged African learners.

2. Edu-Touch Health Care Training System

Apart from the human tragedy of HIV/AIDS, the impact on business and the economy is large and costly. Efforts are being made by public and private sectors to curtail its spread and improve quality of life among HIV-positive individuals. Edu-Touch Health Care System is an interactive artefact designed and built by Wild Cactus

Communications (Edu-Touch, 2002), a software house headed by one of the authors, to support industry in its campaign to combat HIV/AIDS. The target group ranges over a spectrum of cultural and educational levels, with many users being barely-literate and technologically illiterate. Subtitled 'Educating for Life', the health training system is a stand-alone, walk-up-and-use communication system that offers users multi-media information and video clips via touch technology. User-control allows them to select a topic/s of their choice in the language of their choice. The 32 modules (each containing a fixed teaching segment followed by an interactive test) are structured into three series, which are briefly outlined:

1. General information (HIV/AIDS issues):
This series informs users about the immune system, transmission of HIV/AIDS, and means of protection. There are modules on AIDS-related diseases such as tuberculosis and cholera. Overlay text communicates concepts and terms visually, supplementing the background music and audio narration. Modules integrate photographic video clips, animated graphics, diagrams with highlighting, visual stills and collages. Flashing text is discriminatingly used to emphasize key concepts, but does not distract.

2. A Healthy Body (general health care and hygiene):
To show how HIV+ persons can lead normal lives, these modules focus on correct eating, the importance of vitamin and mineral supplements, exercise, and avoiding infections. It is valuable for uninfected persons as well and we noticed the popularity of this series amongst users. The medium is mainly photographic video. combined with stills and diagrams. A gender-free, race-free character is used with good effect to illustrate the points made. Two continuity role-players participate throughout – a mature woman and a young listener-responder.

3. A Healthy Mind; a Healthy Soul:
Addressing emotional wellness when facing full-blown AIDS, this series empathetically discusses interpersonal relations and support, AIDS testing, transparency about HIV-status, and issues of faith and attitude. The presenter and sole communicator is the woman who is the advisor in Series 2; she personifies serenity and dignity. The series is video-based and has no tests.

3   The Evaluation

During a small-scale but in-depth pilot evaluation (de Villiers & Dlepuma, 2002) of the usability of Edu-Touch, using qualitative and quantitative research methods, it became clear that the system was easy to learn, enjoyable to use, and that its message was making a major impact. Clearly, the system was good. But why was it good? To determine the features behind its educational effectiveness we extended the study as described in this section.

3.1   The Hexa-C approach

We set out to evaluate the Edu-Touch technology, techniques and content, using various methods, and focusing particularly on its conformance to contemporary learning theory. The main instrument used in the heuristic expert-evaluation, conducted by the academic researcher to assess its educational utility, is the Hexa-C Metamodel (HCMm) (de Villiers, 1999; 2000; 2002). The HCMm is a framework of interrelated elements of contemporary learning and instructional theory, and is so called because its six elements all start with the letter 'C'. It can be used as a design aid for teaching and training systems, and as a six-sided approach for evaluating existing learning resources and environments, investigating whether and how its elements are implemented in the system being examined. Figure 1 shows the HCMm framework, indicating the elements – *cognitive learning, constructivism, components, creativity, collaborative learning,* and *customization* – as merging segments. Implementation of the various C's varies from situation or artefact to another, hence the embedding in *context* and the hub of *technology*.

We took information from our various sources and instruments and structured it under the six C's of the HCMm as umbrella headers. In the following subsections each element is briefly outlined and then used to integrate findings from the heuristic evaluation with culture-related aspects and information from our surveys (questionnaires, observation and interviews) – some of the latter being data which we obtained, hard hats on our heads, at an Edu-Touch site on a diamond mine.
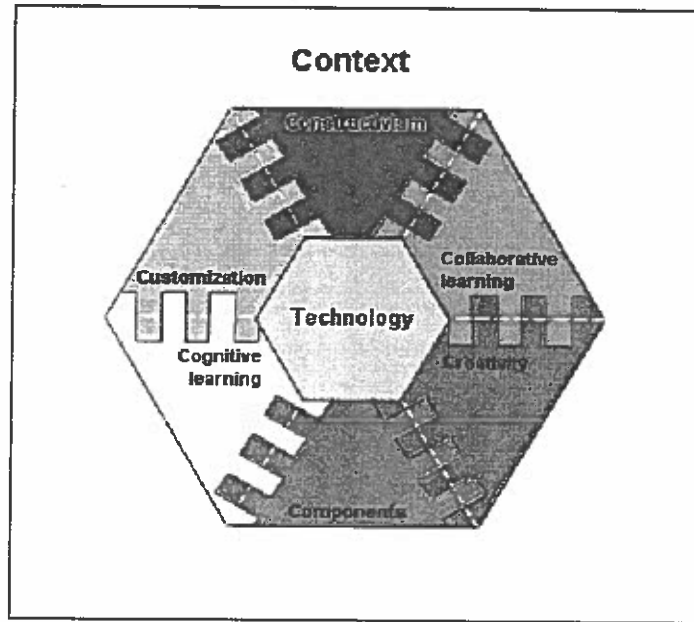
Figure 1: The framework of the Hexa -C Metamodel

3.2. Cognitive learning

Cognitive psychology stresses the *process* of learning more than the *products*. Cognitive learning is concerned with human information processing, integration of new with prior knowledge, metacognition, internal schemata, retention and transfer of learning, and the use of cognitive strategies (Gagné & Merrill, 1990; Inhelder & Piaget, 1958; Jonassen, Campbell & Davidson, 1994; Newell & Simon, 1972; Reigeluth & Moore, 1999; Winn, 1990).

Edu-Touch is characterized by *integration* and *reinforcement*. The basic information in Series 1 is re-iterated and contextualized in subsequent lessons, moving from the general to the particular, for example, from nutrition principles to specific dietary advice and cooking tips. Certain material is re-used in different modules, examples being (i) a striking graphic caution against contact with blood, and (ii) the value of exercise. Strong *reinforcement* occurs in a module on sexually transmitted diseases, where (i) a gender-free race-free avatar pair, (ii) a diagrammatic couple, and (iii) a human couple, all three, make the same point. Integration of *new with prior learning* is supported by inter-module cross-references. There is minimal short-term memory load (Schneiderman, 1998) in that all that users need is made evident and understandable at every point. Edu-Touch must be commended for the strong *visibility* (Nielsen, 2002) of its objects, actions and options.

By contrast to Western users who want variety, African users like *familiarity* and *predictability* (Green & Lascaris, 1990). Repetition and re-use are not redundancy, rather they are a strength, enhancing coherence and *consolidating* prior learning. *Consistency* (Dix *et al*, 1998; Schneidermann, 1998) is implemented by role players, e.g. the same doctor- and nurse figures throughout.

Cognition is facilitated by *analogy*. Using the familiar, a lesson suggests that a healthy body builds 'walls around germs like scabs round a cut'. The battle against HIV is metaphorically compared to soldiers fighting. The immune system is described as a defence system, an army at war against infection. When the 'soldiers' cannot protect, sickness takes over. Furthermore, cultural patterns play a role in cognition. Tropenaar's *Model of Culture* (Woolliams & Gee, 1992) examines behaviour and cognition in different groups. For the dimension of *Time*, the traditional African user tends to sequential rather than synchronic behaviour – starting at the beginning, thinking serially, and completing an action before starting another. Natural usage patterns of a system and educational optimization may not always coincide. For example, the placing of 'How to use a condom' as Module 1.1 may have

been arbitrary, but in a study on the effectiveness of Edu-Touch, Dlepuma (2002) observes that 6 of 15 participants in his survey chose it as their first lesson. In this situation a general introduction might have been more appropriate.

Retention and *transfer* of learning are fostered in the final series which, amongst others, reviews critical issues and myths, such as 'raping a child or virgin will not cure AIDS' and 'contraceptive pills do not protect against HIV'. In the interviews (de Villiers & Dlepuma, 2002) we encountered transfer from the workplace to the home, as participants described sharing their learning with the family. Transfer is not easy to measure or quantify. However, points are so forcefully made and reinforced that, on encountering a similar real-world scenario – not explicitly addressed yet where the same principles apply – a sober user should be able to reason through to the correct action.

3.3 Constructivism

Constructivism relates to personal knowledge construction, active learning, anchored instruction, and multiple perspectives on an issue. Constructivist learning is usually not direct instruction: it includes open-ended problem/project-based learning and real-world situated learning (Bednar et al, 1992; Bruner, 1967; Hannafin, 1992; Jonassen 1999; Reeves & Reeves, 1997; Willis, 1998).

The Edu-Touch system is not an open-ended environment nor does it give learners the opportunity to manipulate data. However, it effectively *supports knowledge construction*. Striking visuals *concretize the concepts*, as lessons show graphic documentary photographs, e.g. of fetuses, injections, breast feeding, symptoms and manifestations of syphilis. *Dual-messaging* and *multi-gate communication* present concepts via aural, visual and textual means. Overlays and flashing text subtly reinforce points without distracting. *Multiple perspectives* communicate messages both by computer graphics and by video clips with human actors. Users indicated that they learn the most from *visuals*. Picture power (Green & Lascaris, 1990) is used to convey messages. Animated diagrams communicate basic bodily functions. A dynamic graphic on tuberculosis demonstrates the infection process, as an infected individual (coloured red) moves among other persons, who turn red on contact. This illustration is repeated in another lesson to depict transmission of diarrhoea and cholera.

Active learning is facilitated by demonstrating procedures, e.g. in handling wounds and injuries, although this should be supported by class-based practice sessions. Relevant real-world information is given, such as the AIDS Helpline telephone number.

In a match between system and *real-world* (Nielsen, 2002), Edu-Touch achieves the common touch by its use of vernacular options and everyday situations which illustrate the text. The pilot project (de Villiers & Dlepuma, 2002) showed that users felt at ease with the technology, enjoying the movie-style visuals with some of them perceiving the computer as a 'TV', which is familiar in even the most rural regions of South Africa! Simple language and colloquial terms reached the target effectively, with 75% agreeing that Edu-Touch helped them change their behaviour. In Series 3, the mature presenter-counselor does well in a difficult task. The text is dignified and empathetic, as befits counseling of those infected by HIV/AIDS, but it could offer a more contextualized constructivist approach if supplemented by authentic *case studies*.

3.4 Components

Components of learning refer to the basic knowledge, skills and methods of a domain (Merrill, 1983; 2001). There are unitary components and composite components, as well as decontextualized skills.

Edu-Touch teaches informally and contextually, avoiding a didactic, authoritarian style. It focuses more on integrating concepts into a real-world context than on direct point-by-point instruction. However, where appropriate, there is *systematic communication* of basic components, e.g. in listing the symptoms of AIDS-related diseases. A danger of contextualization is that some concepts can be overlooked. However, evaluation showed that Edu-Touch addresses most of the basic issues, with very few possible omissions being identified. Series 3 conveys some conventional *direct instruction* and *revision* – appropriate in this section, which is aimed at those who know they are HIV-positive or are exposed to infection. In particular there is an excellent 'True or False?' module consolidating the basic facts.

Test segments reinforce the basic knowledge components. Edu-Touch tests are an integral part of the learning experience and not a formal exam to gain credits. They offer revision, diversion and interaction. Dlepuma (2002) found that users liked a predictable pattern and preferred doing lessons in Series 1 and 2, which conclude with a test. They were disappointed by the lack of testing segments in Series 3. This is interesting – the traditional fear and dislike associated with a test was not present. Instead of being intimidating, tests were perceived as desirable.

3.5. Collaborative learning

Collaborative learning involves joint work, a team approach and social negotiation. It optimizes on complementarity (Johnson & Johnson, 1991; Nelson, 1999). By contrast, a computer-based lesson is usually designed as an individual learning experience, yet in practice, it is common to find two or three learners working jointly on one. With Edu-Touch where the computer experience is more a case of absorbing information than entering data, *collaborative learning* occurs naturally. In the interviews we found that illiterate users approach Edu-Touch feeling inadequate and intimidated. Consequently the system is frequently used by groups while 'the one who knows' operates it. However, *learnability* (Dix et al, 1998) and ease-of-use are so high that confidence grows and even computer-illiterate users soon manage with ease and show others. An optional tutorial explains clearly how to activate the touch screen technology, and when to use a single-touch-tap or a double-touch-tap. All the respondents in the pilot survey (de Villiers & Dlepuma, 2002) agreed that 'Edu-Touch is easy to use'.

A further form of informal collaboration is *learning-in-the-home*. Sexual behaviour is not usually discussed in the African family. Traditionally, it is handled in initiation schools and circumcision ceremonies, yet six of the seven interviewees in the pilot study (de Villiers & Dlepuma, 2002) and 60% in Dlepuma's (2002) usability-and-effectiveness study told us that Edu-Touch helps them communicate about sensitive issues with family and teenagers. With regard to communication with friends and community, 70% stated that they told others what they had learned.

The traditional African belongs to the *strong group, strong grid* social grouping (Douglas, 1978) where individual behaviour and social experience are constrained by deference to the group. The extended family plays a major role in societal patterns. Despite this, paradoxically, AIDS-sufferers in South Africa may be stigmatized and rejected. Series 3 discusses the HIV/AIDS individual in society – optimal living, how others can support them, and how those infected can play an active role in AIDS awareness in the community.

3.6. Customization

Customized learning relates to user-centric instruction, adapting to individual profiles, supporting personal learning needs, and allowing learner initiative regarding methods, time, place, and content of learning (Alessi & Trollip, 2001; Bruner, 1967; Norman & Spohrer, 1996; Reigeluth, 1999).

> *In the early days ... users adapted themselves to the requirements of the computer. Now... systems must be adapted to the needs of their users. Computer users approach computer systems with a specific set of cultural requirements ....* (Greenwood, 1993:8).

Edu-Touch's touch-screen selection of vernacular *language* satisfies this. Day (1996) proposes *cross-cultural perspectives*: coupling metaphors to systems; matching shapes to the user's visual patterns; and the use of sound within an interface. Edu-Touch meets the second and third requirements. Furthermore, users interact at the *time* of their choice in one of several workplace *locations*, choosing which *modules* to view and the *sequence*. For cost-effectiveness, the same video segments are shown to all users, but where clinics and support centres are introduced, the required local areas can be selected by touch control.

A caution against over-customization to the needs of the HIV+ individual: as an employee program, the system is used by many who are HIV-. The lesson called 'Watching your weight' suggests how sick people can <u>gain</u> weight. Predictably, one stocky fellow we observed in the pilot project (de Villiers & Dlepuma, 2002) chose the lesson hoping to <u>lose</u> weight.

Sometimes *lack of customization* and anonymity are important. Edu-Touch achieves this by using neutral avatars in sensitive scenes. However, some documentary *personalization,* using real people (possibly celebrities) in video clips, could strengthen the message. Anonymity can be replaced by lively actuality where appropriate. Future versions could also be enlivened by more cameo roles.

3.7. Creativity

Creativity supports the affective aspects of training, aiming for innovation within functionality in ways that motivate learners intrinsically, that engage them, and that strengthen the cognitive-affective bond (Caropreso & Couch 1996; Csikszentmihalyi, 1990; de Bono, 1970; Keller & Suzuki, 1988; Price, 1998). In particular, Series 1 holds attention, resulting in *flow* (Csikszentmihalyi, 1990). We observed users engrossed, repeating the same lesson up to three times consecutively. The *novelty* and ease-of-use of Edu-Touch prevent alienation and techno-anxiety (Day & Makirinne-Crofts, 1997). In the pilot study 5 of the 7 users had been previously exposed to the technology, but were total novices with regard to its operation. We trained them to use it; they all grasped it rapidly and enjoyed the learning experience or 'edu-tainment'. Each one spontaneously said they would use it again.

Media, graphics and colour are applied with *originality*. The use of colour to indicate infection has been mentioned. A lesson on 'Your rights' makes an impact with its use of music and the South African flag (associated with SA's liberal constitution) as a context for setting out the rights of HIV-positive individuals. A graphic of a natural scene, a rocky African 'kopjie' (small rocky hill) is a recurring metaphor with positive connotations among the target group. A metaphor of red X's (representing 'incorrect') is used to highlight dangerous practices.

For some, Series 3 is less engaging than the more lively programs of Series 1 and 2, but for those who know they are HIV+, the ethos and empathy of the mature counselor figure would indeed motivate and encourage.

4   Conclusion

This evaluation of an AIDS-awareness and health-training artefact contributes to the body of knowledge about technology for indigenous peoples and appropriate application of contemporary learning- and instructional-design theory in workplace training. The system investigated falls within a best-practice ambit; its features and communicative strategies provide a precedent study in the design and construction of training technology for emerging peoples. Edu-Touch achieves its effectiveness by conforming to criteria from the perspective of learning theory and by satisfying certain established usability principles, thus attaining educational usability. Moreover, it exhibits culture-sensitivity, not in the sense of localization/culturalization to a single group, but by its use of non-offensive culture-neutral objects and symbols.

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