Breaking the Sound Barrier:

Using technology to bridge the divide between lecturer and student in an ODL setting

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Research Question

"How can educators use technology effectively to teach and instruct ODL learners?"

This is the leading question posed at the beginning of a project to introduce the LivescribeEcho Smartpen[©] as an educational tool in the course Life Orientation: Biblical Perspectives (OTS2603), presented by the Department of Biblical and Ancient Studies in the College of Human Sciences at the University of South Africa.

A simple question, it might seem, but one touching many important aspects that need to be taken into account when teaching Open and Distance Learning (ODL) course materials. ODL education is characterised by a transactional distance (Moore 1993:76), where learner and educator are separated in terms of location and time, with a resulting possibility of misunderstanding and even psychological distance. In contiguous teaching, participants can talk in real time, but distance education fell silent for many years because of the use of correspondence print (Taylor 2001), thereby creating a sound barrier. Technological advances create new opportunities every day, whereby this sound barrier can be breached. The question now is how to do it in educationally responsible ways.

According to Mikropolous (2000: 11) "Researchers exploit the technological features of Information and Communication Technologies for the design and development of ODL environments, without paying much attention to and applying theoretical models, pedagogical principles and instructional goals."

This paper describes the use of a specific technological teaching aid, namely the LivescribeEcho Smartpen[©], in the light of relevant ODL theory and practice. The reason for taking ODL theory and practice into account is to ensure that technology in general and this piece of technology in particular is not used merely for the sake of using technology or just because it is available. The use of technology should be substantiated when taking relevant educational theories into consideration and also to understand why and how this technology might contribute to effective learning.

To set the stage for the description of the use of the LivescribeSmartpen, themes suggested by the leading question will be addressed, taking into account relevant ODL theories. Thereafter the Livescribe Echo Smartpen© will be introduced and described, including an example from the specific course mentioned.

Themes suggested by the question, are the following:

- The *how* part of the question reveals interest in real life application of underlying theories and realities related to ODL teaching.
- In *ODL*, a distance exists between educator, learner and institution –transactional distance, as it were.
- The *educators* mentioned bring various sets of skills to the teaching process - skills related to subject content, teaching strategy, delivery method, personal and interpersonal characteristics.
- *Teaching* involves pedagogy and learning theory.
- *Learners* in an ODL environment are real human beings in concrete situations; but being ODL students, can be anyone anywhere on the planet. Who are they and what do they want and need?
- *Effective learning* relates to matters of the mind in interaction with self, educators, fellow students, and learning material.

Elements of the question posed above will act as themes to be discussed, with the intent to set the stage for the discussion of the Livescribe Echo Smartpen©as a teaching aid in an ODL context, as well as a practical example of how aspects of relevant theories have been implemented in the use of the Smartpen in the course OTS2603.

How to break the barrier

The how part of the question reveals interest in real life application of underlying theories and realities related to teaching. Formal classroom teaching might seem to have been the norm since forever, but in actual fact it is a fairly recent development. It was preceded by informal "show and tell" practices, with many subsequent teaching strategies being developed and implement currently.

Spoken communication is what set *homo sapiens sapiens* apart from other primates, according to the cognitive archaeologist Steven Mithen (1996). Where people previously had specialised mind modules devoted to specific tasks completed in relative isolation, spoken communication broke down the barriers between modules, and added the ability "to tell" to the existing strategy "to show" when guiding novices to master necessary survival knowledge and skills. It is, in some instances, easier to talk some-one to a distant hunting ground than to walk him there, as it were. Since then, teaching seems to be a universal cognitive trait and activity (Strauss et al 2002: 1475 ...). Because the human mind has remained basically unchanged, how the mind handles training, instruction and teaching remains the same today, even though some versions of teaching became formalised and many more teaching strategies have been developed

subsequently. Bottom line is that teaching always has and always will have "telling" and talking as some part of it, with students expecting it and reacting positively to it.

What has been added to the intuitive teaching and learning process, is thinking about it. The intention of meta-cognition, or theories about learning and pedagogy, is to create a better understanding of teaching and learning processes, taking into account a variety of aspects, with ODL being but one. Theories have to be formed based on sound, Multi-, Inter- and Transdiciplinary research (Frodeman*et al* 2010; Mehlenbacher2010: 79-108), and with real life application as an important goal (Mehlenbacher2010: 171). No aspect or strategy of teaching is sacrosanct, e.g. inadequacies of the lecture format will also have to be taken into consideration, as well as the 5 dimensions of teaching, namely learner background and knowledge, learner tasks and activities, social dynamics, instructor activities, and learning environment and artefacts (Mehlenbacher 2010: 194).

Technological and cultural advances have made communication over a distance possible. Teaching over a distance followed as a natural consequence, utilising models and delivery technologies available at the time (Taylor 2001). Delivery of teaching during the first generation, according to Taylor (2001), was correspondence print, followed by a second generation characterised by multimedia print. Then followed telelearning, with audio-teleconferencing, video-conferencing and broadcast as its main features. The fourth generation is characterised by flexible learning, which refers to interactive multimedia and online internet-based access to web-resources. The current, fifth generation of Distance Education is Intelligent Flexible Learning, making use of computer mediated communication and campus portal access to educational material. Technology advances, and educational institutions follow and utilise available technology.

There is, however, no linear and necessary progression of distance education institutions from the first to the fifth generation, in the sense that previous delivery technologies have become obsolete. ODL institutions in general, and the University of South Africa in particular, still utilise delivery technologies from all generations. There are at least four reasons for this. A first reason is the level of students' access to technology, and the fact that in Africa printed material is still the most accessible. Access to computers and computer literacy is low, with mobile phones the preferred way of communication. A second reason regards financial affordability. In Africa, ODL institutions still have to make use of mixed delivery technologies, in order to meet the needs of students with differing abilities. A third reason is the preferred delivery technology chosen by the lecturer. A lecturer might be on the forefront of subject knowledge, but may still prefer correspondence print as the preferred delivery technology. Technological advancement is taking place at such a pace, that it is almost as difficult to keep

abreast of those advancements as it is to keep up to date with subject content. A fourth reason is what students prefer. Although many students do have access to the latest technology, some may still prefer a physical book in the hand to learn from.

The implications of this are that delivery techniques and technologies should be varied, in order to cater for differing contexts, students and lecturers. In similar vein, technology should allow flexibility in the sense that it should be able to deliver in educationally sound ways.

ODL - within hearing distance

ODL is characterised bythe distance that exists between educator, learner and institution – transactional distance, as Moore calls it. Transactional distance, according to Moore (1997, 2007: 91), is **"**the space where instructors and learners accomplish the work of learning in an environment that separates actors in both time and geographic distance", and also "the interplay of teachers and learners in environments that have the special characteristic of being spatially separate from one another". This situation creates a cognitive space between educator and learner, "a psychological and communications gap, a space of potential misunderstanding between the inputs of instructor and those of the learner" (Moore 1991). This disconnectedness may impact on student performance, motivation and engagement. This is especially true of ODL situations which are still text-based, whether on paper or online.In the mean time technology has advanced to create many more possibilities of delivery, making real-time and face-to-face communication possible even in ODL contexts.

Whatever the situation may be, education will always imply some kind of communication, and the more natural it is, the better educators and students will react to it and perform. Delivery technologies should therefore be within "hearing distance" of expectations, preferences and abilities of both lecturers and learners.

Audible Educators

The educators mentioned in the leading question bring various sets of skills to the teaching process - skills related to subject content, teaching strategy, delivery method, personal and interpersonal characteristics.

Educators are - or should be - the facilitators of autonomous learning. To this end they should provide Proactive Motivational Support (Simpson 2001). Part of this is to make use of current teaching strategies and teaching aids, the latter including current technology.

Educators, especially at University level, are often not trained to be lecturers. They might be subject specialists and knowledgeable in their disciplines, but not trained to share their

knowledge educationally in the most effective ways. It becomes a bit of a pot-luck situation, where someone might almost by nature be a good lecturer, utilising effective teaching strategies. Some lecturers are in fact interested in learning sound pedagogical techniques and teaching strategies, and enthusiastic to include relevant technologies available to them. In many cases, however, lecturers are so focused on their subject content that they do not take time to reflect on teaching strategies, or do not take time to learn effective or new ways of delivering content. They often fall back on the known, which is more often than not traditional lecture-based teaching, whether in contact or in ODL settings. In short, educators are often subject specialists, but educational novices.

Dan Berrett, reporting on a conference dedicated to teaching and learning at Harvard University, wrote:

A growing body of evidence from the classroom, coupled with emerging research in cognitive psychology and neuroscience, is lending insight into how people learn, but teaching on most college campuses has not changed much. Too often, faculty members teach according to habits and hunches, said Carl E. Wieman, a Nobel Prize-winning physicist and associate director of the White House Office of Science and Technology Policy, who has extensively studied how to improve science education. In large part, the problem is that graduate students pursuing their doctorates get little or no training in how students learn. When these graduate students become faculty members, he said, they might think about the content they want students to learn, but not the cognitive capabilities they want them to develop. (The Chronicle of Higher Education, February 5, 2012).

Currently there is much talk about the changing role of the academic. Academics should not only be subject specialists, but also be educationally informed and up to date with technological advancements. The introduction of any new teaching tool or instructional strategy, however, should take into account many factors, including the personality types of lecturers, the time it takes to master new techniques or technology, and the intuitiveness and nearness of the new technology to what is known to the lecturer. In order to get buy-in from academics, it is therefore important that innovation should also be within "hearing distance" of what educators are used to.

Learners within hearing distance

According to Visser (2005:38), "for the sake of human rights, and for the sake of good common sense, there is an increasing need to dramatically develop the learning capacity of our species in

entirety". However, according to Day (2005:183) UNESCO's *Education For All* drive is failing in Africa. Learners need effective tuition in order to meet their educational needs.

Learners in an ODL environment are real human beings in concrete situations. Who are they and what do they want and need?Students at tertiary institutions are usually of a fairly similar age and locality. ODL students, however, span ages from 18 to 80 or more, and may be from anywhere in the world. Their reasons for choosing the ODL route for studying may vary considerably, their needs as students might have some similarities, but also reflect vast differences, and their learning styles might differ substantially. Therefore the teaching strategies will have to be flexible, in order to cater for all these differences.

Several theories should be taken into account when preparing learning material to be used in an ODL setting, such as Generational Theory and Multiple Intelligence Theory.

Generational Theory as formulated by Strauss and Howe (2000) is widely used in the world of commerce and business, and also in educational circles. The theory describes generations of people according to similarities in traits, outlook and preferences at a certain level of generalisation. Even though there is critique leveled against it, the theory is useful when used with circumspection. The contribution of the theory to education is that it sensitises the educator for differences between students of different age groups. For example, sometimes it is said that Millennials are avid users of computer technology, while Silents and Boomers might not be.That is, however, not a real difference, as all Boomers who use computers every day will contest. What is a real difference, though, is the level of ease of use between generations. Millennials grew up with technology as part and parcel of their lives, and do not know a world without it, while Silents, Boomers and X-ers saw it being developed. The difference of use is comparable with language acquisition. When exposed to a language before 12 years of age, the acquisition is natural and with ease. If a language is learnt after 12 years of age, it will always be a "second language", even though a person might be conversant in it (Pinker 1994).Therefore, for Millennials, who arethe current student population, technology is a given and natural, while for other generations, it might range from alien to well-accepted. The realisation of this has an impact on how technology is to be used in education, in particular that it should be used in a way that technology makes studying and learning easier, not more difficult. There should not be a steep learning curve in how to use the technology before the course content that technology should carry, could be accessed.

Students also have preferential ways in which they study and learn. There are many theories that attempt to describe such differences, some more successful than others.

Howard Gardner's Multiple Intelligence theory is well-known, and has been used with success in a variety of educational settings (Gardner 1999; 2006).The most valuable contribution

of Gardner's theory is that it sensitises educators to the fact that there are different learning styles, and that there is not only one way in which course content could or should be taught. Alleducator should therefore be aware of his or her own preferences and resulting teaching style. They should also be aware that a particular teaching style will appeal to like-minded learners, but others might experience it as not unappealing or not resonating with their learning style. Awareness of this should urge educators to widen their scope of teaching strategies. Any technological teaching aid will be more successful and helpful if it is flexible enough to support teaching in differing styles.

In short, technology should be within "hearing distance" of all generations and all kinds of educators and learners.

Effective Teaching

Effective teaching is about pedagogy and learning theory. According to McHaney (2011:164), pedagogy is about strategies of instruction and teaching methods. Learning theory, on the other hand, is a philosophical approache that enables and facilitates learning. Mchaney (2011: 165 - 168) discusses four learning theories, namely Behaviourism, Cognitivism, Constructivism and Connectivism. Behaviourism concerns learning as testified by observable behavioural change. An educational approach based on this is teacher centered direct instruction, where information is transferred from expert to novice in lecture format, the level of effectiveness testified by exam scores.

Cognitivism is a reaction to the focus on overt behaviour, rather focussing on learning as internal cognitive changes and the brain processes underlying an individual's acts of learning.

Constructivism also stresses the role of the individual, particularly the active role an individual play to construct ideas and understanding. Seen from this vantage point, learning is active, self-directed, experiential and building on previous experience, with the intent to solve real life problems.

Connectivism is a learning theory formulated by Siemens (2004). In information scarce environments, traditional teaching is required. However, information is so abundant now, that no individual is able to master and store it all. It is therefore stored in and manipulated by technological devices. Learning becomes collective, residing in connections between individuals, societies and technologies.

It is important to know that subsequent learning theories do not render preceding theories obsolete. Every theory highlights a certain valid aspect of the multifaceted reality we live in. Pedagogical strategies should therefore take into account relevant theories, as well as local realities. The almost inevitable result will be a mixed method approach to teaching.

An important reality in South African context, is learners' lack of reading ability (Pretorius 2000, 2001, Bharuthram 2012). It is therefore not enough to teach content only - the skills necessary to master the content should be part and parcel of what is presented to learners. Metacognitive reading strategies is a productive field of study, and core reading strategies are, amongst others,goal setting, schema activation, prediction, monitor of own understanding, the posing of questions, visualisation, continuous reflection, the making of deductions, the reaching of conclusions, evaluations and synthesis. The reality that learners do not know about or use these strategies, make it necessary that they are introduced while teaching the subject content.

Teaching with technology should thus also be within "hearing distance" of what comes naturally and what is known to students, and if the technology is flexible enough to allow for guided reading, it will be helpful.

The LiveScribe Smartpen

The Livescribe Echo Smartpen$^{©}$ (www.livescribe.com) is a "pen-computer" – a pen writing in the traditional sense of the word, but with extraordinary abilities. It has a replaceable ink tip, a digital camera, microphone, built-in speaker, OLED display, either 4 or 8GB memory storage, a micro-USB connector and an audio jack. When writing on Anoto paper (www.anoto.com), the pen digitally records what is being written and audio-records what is being said or played at that time, making a link between image and sound. The 8 GB Smartpen can record 800 hours of sound. Anoto paper comes in numbered books with a non-repeating pattern on each page, enabling the pen to determine in which book and on what page the pen is. By selecting the paper replay mode, the pen can play back the sound linked to a specific page, or the image and sound can be exported to a PDF file. When the PDF file is opened, the reader can click anywhere on the image of the handwritten text, and the sound linked to that point is played.

The interface with the computer is efficient and easy to use. One merely has to link the pen to the computer, and all pages are being copied, numbered and sorted on the computer. There it can be manipulated, e.g to export it to a PDF file, or shared via email, Google Docs, Facebook, Evernote, Microsoft OneNote, and to mobile phones.MyLivescribe Connector provides 500MB of free online storage for pencasts, and there are literary hundreds of pencasts on almost every thinkable subject on the site to watch or to download. MyScript for Livescribe is an application that converts handwritten notes to digital text. There is an online store with many applications, such as "Paper Tablet", which turns the pen into a mouse, and the paper as an extension of the screen, making it possible to use in real-time presentations.

The pen has many uses, often used to record lectures or take minutes at meetings. It works well in interview situations, where interviewees' responses to questions can be recorded both in

writing and in sound. It is also used to prepare lectures while teaching in class, or while alone. Learning to use the Smartpen is easy and intuitive, and apart from the pen itself, the Anoto paper and a computer with Adobe Reader installed, no special equipment is needed. This is a huge advantage, because it puts the educator in full control.

The digital camera in the pen records what is being written or drawn. Although handwriting is not as neat as printed text, there is an intimacy to it. Add a real voice, and it becomes a very personal way of teaching.

The Smartpen is reasonably priced. The 8GB Echo™ Pro Pack which includes an 8GB Echo smartpen, Smartpen Portfolio, 3-D Recording Premium Headset, and a download code for a full version of the MyScript® for Livescribe transcription software, at the time of writing this article (September 2012) retailing for US$229.95.

In sum, the Livescribe Echo Smartpen$^{©}$ lends itself to lecturing in a fairly traditional way, linking text and sound, with the added benefit that of being a take-away lecture. The Smartpen enables hybrid, mixed method delivery, by combining printed material with classroom pedagogy, all delivered digitally.The technology allows educators to be in full control of the learning process, in the sense that they can plan and deliver the lesson according to sound pedagogical principles and learning theories. By using this pen, educators could duplicate themselves, and lecture to learners wherever and whenever. Learners could listen and relisten to the lecture or parts of it as needed and when needed. There is no steep learning curve, not for educators, nor for learners. Everything needed for producing lectures is included in the pen, and no extra equipment or staff is necessary to complete the process.

All that needs to be added, is taking note of ODL teaching theories in preparing and presenting lectures for students. To this effect a Smartpen Worksheet has been devised to guide a lecturer when preparing for a pencast.

Teaching with the Smartpen

The Livescribe Echo Smartpen is being tested in a course OTS2603 – Life Orientation: Biblical Perspectives, presented at the University of South Africa, starting in the second semester of 2012. Aspects of the course are being presented by means of this medium, and made available to students via the internet and email. The effect will be evaluated by sending out questionnaires after the November 2012 examinations to obtain feedback from students regarding their use and experience of the pen. Second semester results will be compared with that of the first semester, where the Smartpen has not yet been used as a teaching aid. An attempt will be made to link exam results with the reported use or not of the Smartpenpencasts.

For the moment, however, the focus is on how educators can use the Smartpen effectively to teach and instruct ODL learners enrolled for the OTS2603 module at Unisa.

As in any lecture, there are two parts to it, namely a preparation phase and the actual delivery. The preparation phase entails the following:

- Choose the scope of the lecture, namely the textbook chapter and pages involved, as well as the pages in accompanying study guides.
- Identify important key concepts and technical terms.
- Formulate sets of questions, some for guiding attention during the lecture, some for testing and self testing after the lecture.
- Plan strategies realted to the leading learning theories. Behaviourism is about content and testing, Cognitivism is about reflection and internalisation, Constructivism is about experiential learning and real life application, and connectionism is about sharing information, teaching to and learning from people and by means of technology.
- Plan pedagogical strategies according to learning styles, by including strategies related to Gardner's Multiple Intelligence Theory. Linguistic or wordsmart learners respondto written and spoken communication, especially the relationships between ideas; Logical-mathematical learners respond to logical flow, patterns, reasoning and analysis; music smart learners value sound, music, pattens and emotion; bodily-kinesthetic smart learners need hands-on experience and active learning; spatial-visual smart learners responds to sketches, graphs and their meanings; interpersonal or people smart learners value relationships and the effect of what is learnt on people and their situations; interpersonal or self-smart learners are interested in self-enlightenment and insight, and naturalistic or nature-smart learners react to order, classes, systems and an eco-awareness. As said, it is impossible to know the intelligence style of each student. The only way is to include aspects of each learning style at some stage of the lecture, when possible.
- Plan which meta-cognitive reading strategies will be feasible to use, such as guiding them to first skim-read, then ask questions, then in-read, reflecting and synthesising.
- Plan and practice the drawing of relevant end elucidating sketches.

The challenge for using the Echo Smartpen, is to be able to write and talk at the same time, without losing tempo during the lecture. Educators in contact or contiguous teaching situations are used to it, but many ODL lecturers are more used to either writing or talking. It takes some practice, but improves the more it is been used. While recording the pencast, it is important to keep the following in mind:

- Speak in a tone of voice that is conversant, modulated and enthusiastic. Listen to yourself, and ask whether you would have enjoyed being talkedto in that manner.
- Establish rapport by introducing yourself, and by inviting students to contact you by email or phone.
- Announce the theme and scope of the lecture
- Refer to preceding aspects of the work that has a bearing on or forms the basis of this lecture.
- Guide the students through the reading process, by giving them parts to read before they continue with listening to your lecture. Include the meta-cognitive reading strategies. This part also is about active involvement and learning.
- Comment on real life application of important aspects of the work.
- Conclude with a summary of the work, and ask questions to help students reflect, synthesise and test their understanding.

Each of these "How-to" strategies addresses an aspect of ODL theory. Transactional distance is lessened by the tone of voice while communicating, by the handwritten notes, and by the invitation to make contact. Pedagogy and learning theory is being addressed by the strategies such as orientation, structure, flow, activites, relevance, drawings and more. Meta-cognitive reading strategies addresses realities of students in Africa and even further afield.

The Livescribe Echo Smartpen mirrors real life lecturing and enhances it by digital delivery.

The pen, however, is not a perfect or final solution. Other delivery methods which are more visual such as pod-casting, and presentations which enable more extensive text delivery, each has its own validity and strengths. The aim of this lecture was not to compare different technological aids, but to describe the useability and in the long run evaluate the effectiveness of the Livescribe Echo Smartpen in an ODL setting.

Conclusion

There are several reasons why the LiveScribeEcho Smartpen has been chosen as an instructional tool, the most important being the following:
- In terms of the sender, it is near to known and traditional actions of writing and lecturing

- In terms of the receiver, it is near to known and traditional instances of classroom education.

However, it has additional benefits, such as the following:

- It is extremely affordable

- It is user friendly

- It is portable – lecturers can take it wherever they go, lecture wherever they are, and share it from there, without the need of expensive and intricate equipment other than a computer and internet access

- It is multi-sensory

- Students merely need access to a computer with sound capabilities and Adobe Reader installed onto it – no special programs needed

- Students can review the lesson as many times as they need or want, or only those aspects they need or want to repeat at their own pace and leisure

The Smartpen enables smart teaching, even from a distance.

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