

## Applying the Digital Doorway design research model in facilitating skills transfer in rural communities

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### Abstract

*The purpose of this article is to indicate how skills can be transferred through the application of the Digital Doorway (DD) design research model. Skills transfer takes place between the initiators of Digital Doorway (CSIR Meraka Institute) project, the implementers/support and maintenance company (Ingwapele Technology) and the community champion in charge of a Digital Doorway (DD) in their respective communities. The purpose of the DD is to provide internet experiences in public locations to underserved, poor populations, based on similar principles of informal learning as demonstrated through the Hole in the Wall project in India. The aim is to advance and support basic computer skills which can be transferred through unsupervised experimentation and exploration in the use of the DD. For this purpose DD design research model is the method which was applied to implement the DD. The DD project involves two phases of development, phase one is depicted through the DD design research model and phase 2 highlights the current situation of the DD project as well as provide a reflection on future developments envisaged for the project.*

*After the installation of over 200 DD across South Africa and Lesotho a specific design research model became evident which supports the transfer of specific skills between the three entities involved from inception through to the support and maintenance phase of the project. Lessons were learnt and specific skills transferred of which the most obvious seem to be the application of good communication skills, a specific technical skill set and hands-on experience. During this transfer of skills the three entities are also dealing with socio-technical and political power plays between different stakeholders in rural communities as well as trust relationships and how communities take ownership of technology challenges.*

Key words: Digital doorway, processes, design research models, skills transfer, community informatics, development informatics

## **Introduction and background**

One of the greatest challenges when it comes to the uptake of Information Communication Technology (ICT) in the developing world is the digital divide that exists between those who have access to technological infrastructure, skills and knowledge and those who do not have this access (Loader, Keeble et al. 2004; Steyn 2007). The Digital Doorway (DD) project, which was initiated by the CSIR Meraka Institute together with the Department of Science and Technology (DST) as part of the Government of South Africa's strategic mandate for ICT development, articulated by President Thabo Mbeki in 2002, is one project which endeavoured to minimize the digital divide and provide access to technology for skills transfer. The previous president of South Africa, Mbeki, specifically referred to 'technological literacy [being] key to the country's future in an increasingly globalised world', and he called for local solutions to solve the digital divide challenge, with the intent also to lead Africa on the issue.

In South Africa, as in many developing countries there exists a scarcity of ICT skills amid rapidly growing ICT and services sectors. According to Meteru (2009:3) this reduces potential returns on ICT investments, acts as a disincentive for new investors and reduces quality of service delivery. In addition there is an emerging opportunity for job creation in IT/IT enabled services, of which only a small percentage is being tapped (Meteru 2009:3).

According to Dr. Blade Nzimande, South African Minister of Higher Education and Training, "the development of human potential is a priority for South Africa" (Nzimande 2010). In order to achieve the envisaged development and growth goals for South Africa, all South Africans must participate in economic activity. This can amongst others, be achieved by developing skills to support labour intensive industries, infrastructure investment and rural development (Nzimande 2010). Quality education is needed in early childhood education, through the years of schooling and in post-school education and training. Skills development faces major challenges. To succeed in removing the structural impediments to faster job growth, Nzimande states that South Africa must ensure that young and less-skilled workers can access jobs. Further education and training programmes must provide the real-world skills needed by public and private sector employers (Nzimande 2010).

With these priorities in mind the DD team at the CSIR Meraka Institute developed the DD for use specifically in rural communities.

## **Problem and objectives**

The problem which is addressed in this article is determining how the application of a specific developed design research model of the DD project has been applied over a period of time (4-5 years) to transfer specific skills from the DD team to Ingwapele Technology (the company contracted to assemble, configure, install as well as support and maintain the DD) and from the DD team and Ingwapele Technology to the community champions in rural communities in South Africa and Lesotho.

The objectives are therefore to:

- Indicate the research design and how the DD processes and development can be linked to the research design methodology;
- Describe the DD design research model with its processes and influences on skills transfer at various phases of the DD development.

### Digital Doorway and skills support

The DD project team at the CSIR Meraka Institute has developed robust single and multi-terminal Digital Doorway devices to provide both cached and direct internet experiences in public locations to underserved, poor populations, based on similar principles of informal learning as demonstrated through the Hole in the Wall project in India. Basic computer skills can be transferred through unsupervised experimentation and exploration (Gush 2004; Mitra, Dangwal et al. 2005). Thus, informal education for school-age children outside of the classroom setting has been the first target of the DD project, with the consequent desire to develop an Africanized technology using Open Source products. While the focus has been upon the production of interfaces in English, limited materials in South Africa's other official languages have been installed. The standard Open Office suite, cached Wikipedia, and multimedia tools such as NASA videos and PHET science simulations are available for users to explore.

The core Digital Doorway terminal is a robust digital kiosk with up to four screens, and keyboards with touch-pads, built to withstand the rigors of the African climate, enthusiastic use, as well as physical vandalism. It is securely bolted to the ground or floor. DDs can be Bluetooth-enabled. Hardware configuration includes a standard desktop PC running Xubuntu Linux and serving content to several Fat Clients. The configuration includes web cameras, speakers and an external Status / Reset panel. Units can be configured for offline cached accesses as well as direct internet access via broadband (wireless, cable) or satellite, and remotely administered. A key role in adoption of the terminals has been a local champion who can demonstrate the relevance of the device to children's education and as an information source for adults. DDs are technically reliable and can be remotely supported with little need for local support other than a reboot or cleaning. There are now well over 200 DD installations throughout the country (Gush 2008), as well as terminals in Ethiopia, Uganda, Lesotho and the Solomon Islands, and a demonstration unit at Monash University in Australia, where there is interest in its adaptation for use by indigenous communities.



The DD can also assist in contributing to the development and transfer of skills which will be illustrated in the DD design research model.

The National Master Scarce Skills List for South Africa compiled by the Ministry of Labour is aimed at giving “a comprehensive account of the skills that lie at the heart of the binding constraint on economic growth and development” (Dept of Labour 2008:1). According to the Ministry this list “reflects the skills that are most needed in

our country and on which we as a country need to focus efforts on acquiring and developing”.

In the ICT domain three groups are identified as having scarce skills (Dept of Labour 2008:12-15):

1. “ICT Network and Support Professionals” with scarce skills in the following areas:

- **Computer network professionals**
- **ICT support and test engineers**
- **Telecommunications and engineering professionals**

2. “ICT and Telecommunications Technicians” with scarce skills in the following area:

- **ICT Support Technicians**
- **Telecommunications Technical Specialists**

3. Electronics and Telecommunications Trades Workers

- Of interest here is the **Telecommunications Trades Workers** specialisation area. These workers install, maintain and repair data transmission equipment, aerial lines, conduits, cables, radio antennae and telecommunications equipment and appliances.

These scarce skills set above specifically focus only on the ICT field and it is evident that while doing the installation and support of the DD by trained champions in the community they can all acquire some of these skills. The following table indicates how the DD can support the mentioned skills:

**Table 1: DD supporting the identified scarce skills**

Scarce skill	Explanation of required skills	DD supporting the skills transfer
Computer network professionals	Research, analyse and recommend strategies for network architecture and development, implement, manage, maintain and configure network hardware and software, and monitor and optimise performance, troubleshoot and provide user support	Ingwapele senior team members’ skills development which they acquire during training by Meraka team. This builds on their existing skills set in the field of implementation, managing and maintaining hardware and software of DD also to do troubleshooting and provide support to junior Ingwapele members
ICT support and test engineers	Develop procedures and strategies to support, create, maintain and manage technical quality assurance processes and guidelines and systems infrastructure, investigate, analyse and resolve system problems	Ingwapele team Investigate and analyse and resolve system problems during maintenance and support as part of their mandate as installation company.
Telecommunication and engineering pro-	Design, construct, install, service and support telecommunications	Ingwapele team are involved with installing, setting up and

professionals	equipment, systems and facilities.	troubleshooting of satellite data broadcast systems and wireless equipment in areas where the DD has been connected to form a Mesh Network.
ICT support technicians	Provide support for the deployment and maintenance of computer infrastructure and web technology and the diagnosis and resolution of technical problems.	Ingwapele support technicians (junior team members) do assembly, configuration and installation as well as support and maintenance of infrastructure of DD in the communities and resolve technical problems. During these activities they provide training to the identified community champion. They can assist new users with using the DD as well.
Telecommunication technical specialists	Develop, monitor and carry out technical support functions for telecommunication networks and install computer equipment, computer systems and microwave, telemetry, mixing, satellite and electromagnetic wave communication systems.	Ingwapele junior team members monitor and carry out technical support functions of the DD system which includes the telecommunication network (where applicable)
Telecommunications trade workers	Install, maintain and repair data transmission equipment, aerial lines, conduits, cables, radio antennae and telecommunications equipment and appliances.	Trained community champions provide first level support and has to provide accurate and reliable feedback to the Ingwapele team when DD is not functioning as expected. They are involved in the installation, maintenance and repairing of hardware and software related problems of equipment of DD to a limited extent in conjunction with Ingwapele team.

It is thus evident that Ingwapele Technology is involved in the implementation, installation and supporting functions of the DD hardware, software and telecommunication equipment with the assistance of the Meraka project team using existing skills as well as those transferred by the DD team. The community champion provides first level support if a problem occurs which the champion cannot resolve, Ingwapele Technology has established a helpdesk which can be contacted for assistance.

The Meraka project team consists of a software specialist, a hardware specialist, project manager and project owner responsible for overall strategic direction of DD project as well as stakeholder management. The Ingwapele technical team involves two teams of 3 people who conduct the site visits, assemble and configure the DDs, install the DDs and do the post installation support and maintenance. Ingwapele Technology also runs a helpdesk for community champions to call in order to report problems with the DD. Interaction with the community is handled by one of Ingwapele Technology's senior staff members. The Meraka software and hardware specialists

provided the Ingwapele technical team with the training necessary to successfully fulfil their tasks.

The training that the Meraka team provided to the implementation team (Ingwapele) was a combination of demonstration, hands-on experience, on-site demonstrations and provision of manuals and check lists. E.g.: the Meraka hardware specialist demonstrated the assembly of a DD to the Ingwapele team, they then assembled a DD together with the Meraka specialist, after which they assembled a DD on their own with the Meraka specialist conducting a post assembly/pre-installation QA inspection. Mistakes were pointed out and the Ingwapele team showed how to correct them. The same process is also followed to transfer the skills from the implementation team to the identified community champion who will maintain the DD.

The Meraka team is available to assist via telephone or SMS. Initially the DD project manager assisted Ingwapele Technology with planning, scheduling and other project management related issues. The DD project owner gives guidance to Ingwapele Technology's senior member regarding commitments they are permitted to make on the DD team's behalf, which DD related queries they can deal with and which should be referred to the DD team, indicates work/deliverables that should take preference above others, etc.

The community champion is identified by the community before the installation is done and gets trained on a basic skills set consisting of :

- What the DD is and what it can do;
- Rebooting DD;
- Turning DD of and on;
- How to contact help desk; and
- How to accurately describe problem to help desk.

The duration of the champion training is one day and is done by Ingwapele Technologies, mostly while installation is taking place. Continuous support is provided on a needs-to-be basis.

Without effective consultation and community acceptance, all sorts of projects and interventions flounder, and ICT projects are no exception to this experience (Stoecker 2005). The diversity and social circumstances of communities present a great challenge to assumptions about linear project implementation or simplistic forms of evaluation, because working with on-the-ground issues in collaboration with communities takes forbearance, patience, flexibility, time, and especially humility. However, because ICT policy and practice for needy communities is often driven by political imperatives that can be risk averse and time-driven, finding a solution that bridges community, and other funding and political interests, is an enormous challenge. This was also experienced by the DD project team in all the communities where this technology was implemented.

The DD is also another mechanism which can be applied to try and solve the problem of working across the ontological and epistemological boundaries that exist

between IS designers and those focused on broader social processes in which technology plays a significant part. Mainly because it influences the innovation process, whether in the social or technological domains that can be outlined for different IS processes (Hirschheim, Klein et al. 1996). The application of design research will be used to indicate how the development and implementation of the DD in communities can support the development of skills and skills transfer between a development team, implementation team and the user or community champion maintaining the DD.

## **Methodology**

This is an explorative study which investigates or explores the dimensions or processes of the DD model. The development of the DD model involved design research principles.

Garcia and Quek (1997, p. 450) point to the difficulty of defining the actual object of information technology systems research: "*Is the object of research in information systems of a technological or social nature?*" The proposed research encompasses two disciplines, Information Technology Research (engineering endeavour) and Development Research (social endeavour). The development and feedback from one domain will influence and report success in the other. There is thus a trans-discipline interaction that needs to be navigated in order to achieve the desired results. The research needs to acknowledge the existence of two worlds, an intransitive world (natural) in which the engineering endeavour would take place and is relatively unchanging, and a transitive world where the social endeavour would be placed and is social and historical (Bhaskar, 1991; Dobson, 2002).

The research approaches the nature of being from a critical realist perspective. The critical realists position is that "*there is a world existing independently of our knowledge of it (Sayer, 2000, p.2).*" From a critical realist view  
...there is no conflict between seeing scientific views as being about objectively given real words, and understanding our beliefs about them as subject to all kinds of historical and other determinations (Norris, 1999, p.34).

Critical realism accepts "*the relativism of knowledge as socially and historically conditioned (Mingers, 2004, p.91).*"

## **Focus of Design Research**

Van den Akker et al (2006) describes design research as the systematic study of designing, developing and evaluating interventions (programs, processes and products) as solutions to address complex problems in practice. Reeves (2006) holds forth that "*it investigates the development of solutions to practical problems in learning environments with the identification of reusable design principles (Reeves, 2006, p.52).*" He argues that design research aims at developing optimal solutions for problems in context rather than comparing methods in artificial contexts. Plomp (2007) notes that design research follows a holistic approach, and does not emphasize isolated variables, this is expounded on by Van den Akker (2006) stating that the focus on specific objects and processes (interventions) are in context and are studied as integral and meaningful phenomena. This context bound nature of much design research also explains why it usually does not strive towards context-free generalizations.

## Phases of design research

Although there are several individual interpretations of the phases in design research, most authors agree that design research comprise of three distinct phases (Plomp, 2007):

- Preliminary research: needs and specific context analysis, literature review and the development of initial framework for the investigation.
- Prototyping phase: iterative design that incorporates micro cycles of the design characterised by formative evaluation and refinement of the product.
- Assessment phase: semi summative evaluation and assessment

Reeves (2000) gives the following outline presented in figure 1 below for design research which includes the above three phases:

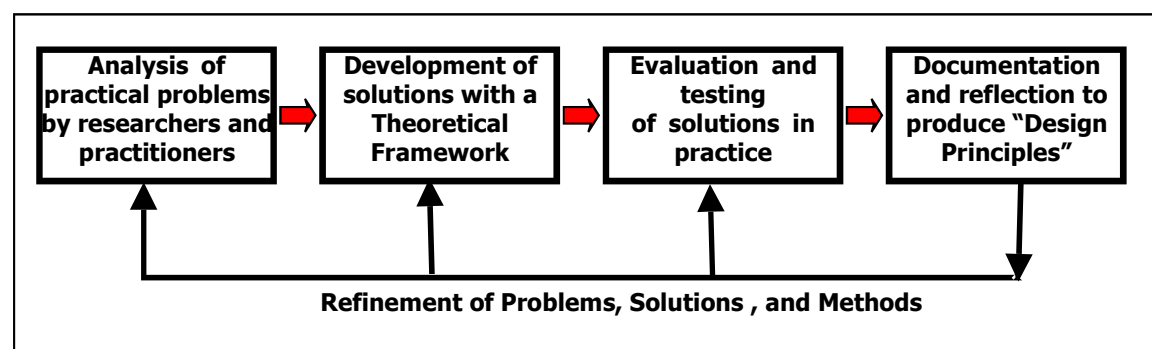


Figure 1: Development approach to IT research (Reeves, 2000, p.9)

## Nature of outputs

Developmental research, attempts to produce models and principals that guide the design, development and evaluation processes (Richey, Klein and Nelson, 1996) while allowing for the skills transfer and growth of participating partners (Plomp, 2007). Design research is regarded as having a multifaceted focus (Richey et al., 1996; Van den Akker and Plomp, 1993), delivering:

- **Design principles.** Plomp (2006) refers to this as intervention theory while DiSessa & Cobb (2004) calls it ontological innovations, Cobb et al.(2001) domain specific theories and Van den Akker (1999) heuristics.
- **Prototypical product.** The application is informed by prior research, a review of the relevant literature and developed and tested in collaboration with practitioners (Plomp, 2006).
- **Professional development.** The nature of Design Research is characterised by the collaboration of participating role-players. This participation facilitates the professional development of the participants and knowledge transfer within the research team.

The conclusions are generated in context and include the conditions that promote successful use of the product and its impact (Richey et al., 1996). These deliverables are incorporated by two types of development research distinguished by Richey and Nelson (1996, p.1103 ). This documented development corresponds to the Type 1 (shaded in Table 4-1 below) development research as it is orientated towards the design and development of a product and the identification and confirmation of context-specific design principals.



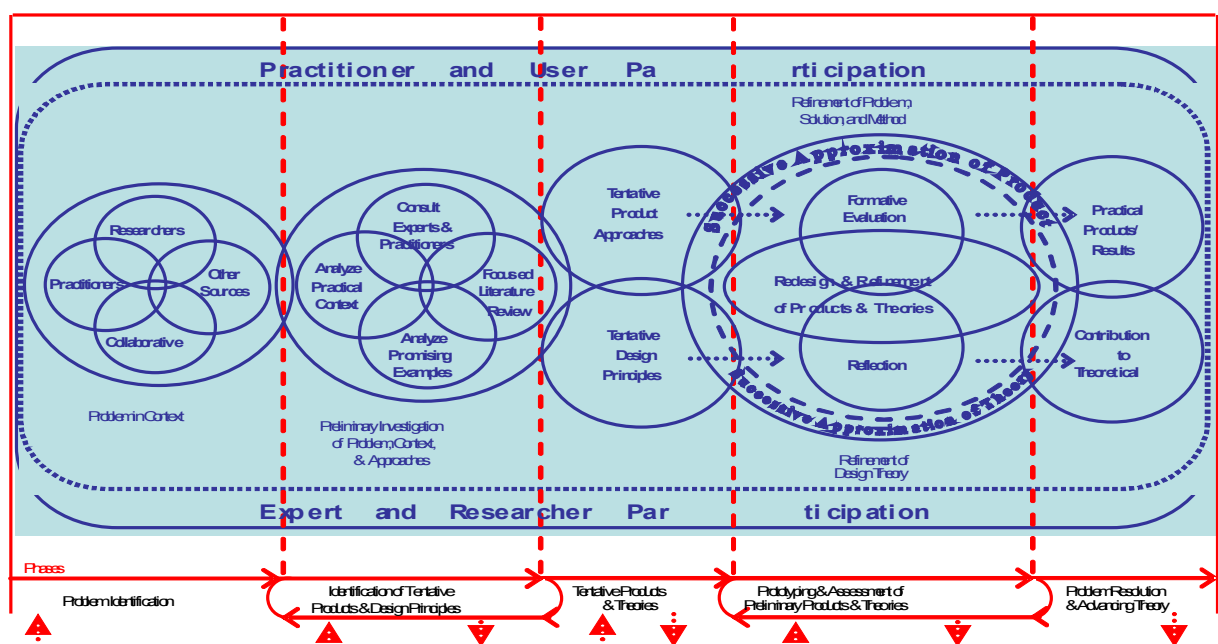
Table 4-1: A Summary of the Two Types of Development Research (Richey et al., 1996, p.1103)

	Type 1	Type 2
<b>Emphasis</b>	Study of specific product or program design, development, &/or evaluation products	Study of design, development, or evaluation processes, tools, or models
<b>Product</b>	Lessons learned from development specific products and analyzing the conditions that facilitate their use	New design, development, and evaluation procedures &/or models and conditions that facilitate their use
	Context-specific conclusions	Generalized conclusions

This development is comparable to studies that Driscoll (1991) calls “*model development and technique development research*” and Plomp (2006) refers to as “*Development studies*”.

The features and characteristics of design research are nicely captured by Wademan (2005) in what he calls the Generic Design Research Model (Figure 3). His model clearly illustrates that the ‘successive approximation of practical products’ (what we call ‘interventions’) is going hand in hand with the ‘successive approximation of theory’ (which he also calls ‘design principles’). It is important to note that design research follows a holistic approach, and does not emphasize isolated variables. Van den Akker et al. (2006: 5) point to it that yet design researchers do focus on specific objects and processes (interventions) in specific contexts, but they try to study those as integral and meaningful phenomena. This context bound nature of much design research also explains why it usually does not strive towards context-free generalizations. If an effort to generalizing is made, then it is an analytical generalization (in contrast to statistical generalization where the researcher may generalize from sample to population).

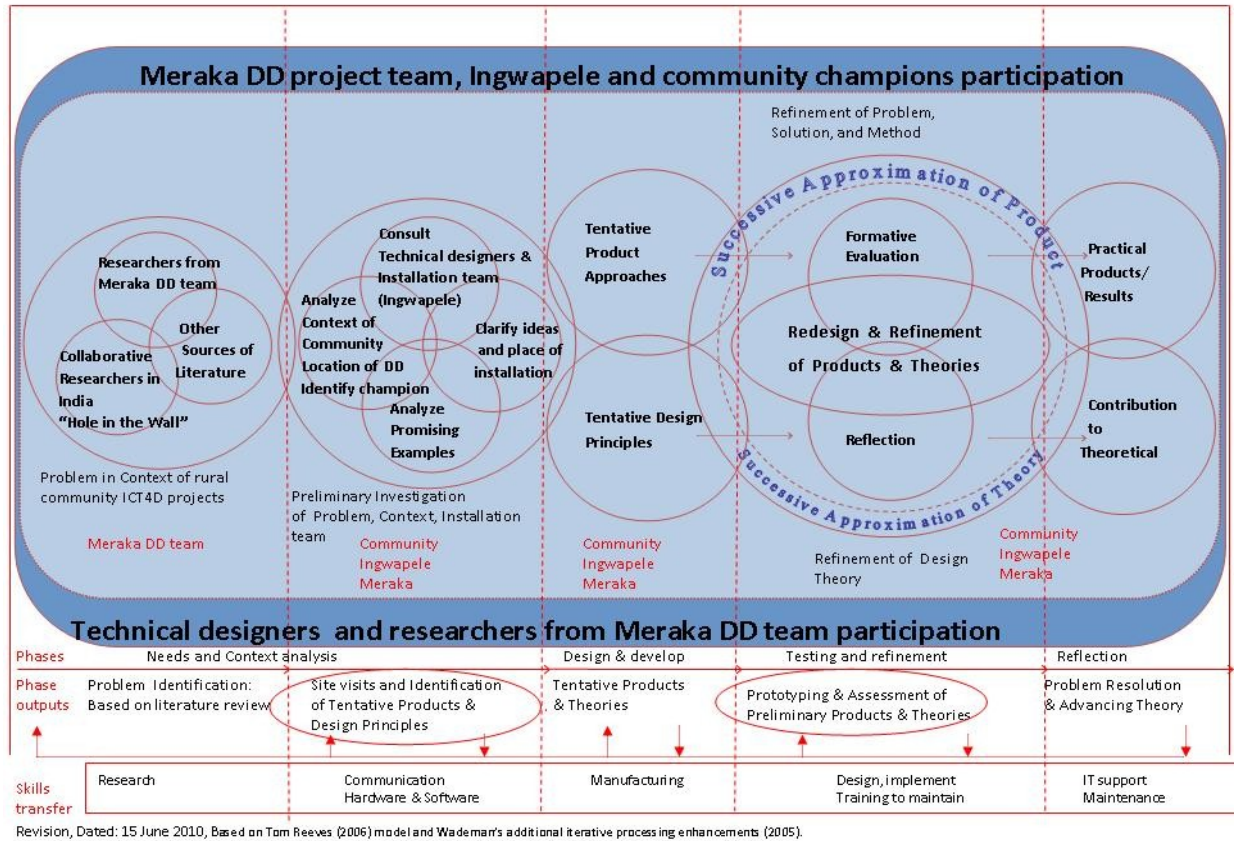
Figure 2: Generic Design Research Model (Wademan, 2005)



This above generic design research model was used to develop the DD design research model where the above principles were applied.

The DD design research model have incorporated the different stages, which were discussed in figure 1 above. The following figure 3 provides the DD design research model which was adapted from Reeves (2006) and Wademan (2005):

**Figure 3:**  
**Digital Doorway (DD) Design Research Model**



From this model it is evident that there are three role players involved in this design research model, which are:

- The CSIR Meraka Institute DD project team (focussing on research, design and implementation of the prototype which is the DD and has a software specialist, hardware specialist and telecommunications expert);
- Ingwapele Technology (the company responsible for doing site visits, installing the DD in the different communities, doing post-installation support and maintenance as well as doing the training with the Meraka team of the identified community champions); and
- community champions (who are identified by their own communities and are responsible for the first level maintenance and support but also assist during the installation phase of the DD as part of their training).

The four specific stages or phases in this model is based on Reeves (2006) model in figure 1, the McKenney (2001) model in figure 2 as well as the Wademan (2005) model in figure 3. The four phases are:

1. Needs and context analysis
2. Design and develop
3. Testing and refinement and
4. Reflection

Each phase involves specific role players (indicated in the circles as well as the red inside the blue area) and specific skills are transferred in each phase or stage (bottom in red).

Each phase also involves the phase outputs (bottom middle) which are:

- Phase 1: The problem identification based on literature or theory, site visits and identification of product and design principles based on each context and site selection in each community
- Phase 2: Tentative products and theories
- Phase 3: Prototyping and assessment of preliminary products and theories where there is an interplay between theory and practice and where the design is refined.
- Phase 4: Problem resolution and advancing of theory is the last output which one finds during the reflection phase. Here any problems experienced with the prototype is indicated based on specific feedback from the community champion and the implementers (Ingwapele) and the cycle of refinement of the prototype is influenced and adapted to suit the needs indicated.

To indicate how this model can influence the National Masters scarce skills list (Department of Labour, 2008) the following figure only highlights the phases, outputs of the phases as well as the skills that are transferred based on this specific scarce skills list:

**Figure 4: DD design research model addressing the various skills during the phases of the DD design**

# Processes of the DD which influences the different phases

Phases

Needs and Context analysis

Design & develop

Testing and refinement

Reflection

## Skills transferred by Meraka during this phase to community :

- How to do a site survey
- Use of GPS
- To draw a site diagram
- To draw a detailed map
- Use of Google earth
- Market community
- Motivate for sponsorships

## Skills transfer to Ingwapele :

- Communications skills
- Assessment based on requirements
- User equipment
- User needs assessment
- Cable/route lines
- Countering findings

### Phase 1 Community Awareness

- 1 Community exposed to Digital Doorway
- 2 Community contact DD team expressing interest in obtaining DD
- 3 Community asked to apply / submit a motivation
- 4 Application successful / funded DD available
- 5 Community asked to complete preliminary site information form
- 6 Preliminary site information form submitted to DD team

### Phase 2 Site Visit

- 1 DD team visits preliminary site information
- 2 Appointment to visit community space (person to submit application / motivation)
- 3 Logistics arrangements: transport, accommodation, S&T, team, take equipment
- 4 Visit community
- 5 Meet with community leaders
- 6 Meet with community champion (s)
- 7 Visit proposed DD site
- 8 Take notes with community / fundraise specific needs. Action route agreed
- 9 Explain DD to community : finalise site visit observation form, etc.
- 10 Capture all relevant information about site into DD team

### Phase 3 Manufacturing and assembly

- 1 DD team receives site visit document from site visit team
- 2 DD team assesses site requirements and determines whether standard DD can be manufactured or whether modifications are needed
- 3 Compile bill of materials
- 4 DD team member places order on CSIR e-procurement system
- 5 Orders forwarded to suppliers
- 6 Ele-Spec manufactures DD housing and installs keyboards, screens, Flat clients, web cams, switch, status / reset boards / speakers and internal cabling
- 7 Partially assembled DD delivered to Meraka
- 8 Xubuntu server and UPS installed
- 9 Xubuntu server and Flat clients configured - hard drive imaged to install O/S, applications and other content
- 10 Pre-installation ATP and burn-in
- 11 Package DD for shipping

## Skills transfer to Ingwapele :

- Understand technical documentation
- Basic understanding of Linux / Ubuntu
- Understanding of networks and protocols
- Understanding of vi editor
- Ability to use variety of hand tools (e.g. Screw drivers, drill, allen keys)
- Troubleshooting
- Fixing problems
- Testing system pre-delivery

### Phase 4 Installation

- 1 Installation team confirms installation date and site readiness with community sponsor. Arrange to have community champion on site
- 2 Make logistical arrangements: transport of DD, accommodation, S&T, vehicle
- 3 Installation team ensures that they have all installation materials required
- 4 Installation team ensures that they have relevant tools
- 5 Unpack DD - ensure no damage
- 6 Move DD and peripherals into position
- 7 Finalise and mount cable runs
- 8 Bolt DD into position
- 9 Install Xubuntu server and UPS
- 10 Complete post-installation ATP
- 11 Take photographs of completed site
- 12 Ensure site is left clean and neat
- 13 Leave DD on

## Skills transferred to Ingwapele :

- Project management
  - Logistics
  - Identify installation material required
  - Planning for installation (select best way to run cabling)
  - Use of tools and equipment
- ## Skills to community champion :
- Use of DD
  - Describing a problem
  - Rebooting DD
  - Troubleshooting
  - Communicating how it operates to community
  - Basic ICT skills
  - Basic installation skills

### Phase 5 Support and Maintenance

- 1 Maintain database of site locations, DD configuration, community champion, sponsor contact details
- 2 Something goes wrong with DD that community champion can't fix
- 3 S&M person tries to assist person reporting problem over the phone
- 4 If problem cannot be fixed over phone, appointment is made for site visit
- 5 On arrival at site, S&M person confirms problem and its cause
- 6 Rectify problem (replace hardware, apply software fix as appropriate)
- 7 Confirm that DD is operating properly
- 8 Implement any upgrades if required
- 9 Confirm that DD is operating properly

## Skills transfer to Ingwapele :

- Communication skills
- Troubleshooting and diagnosing
- Identify and apply relevant solution
- Recordkeeping
- Apply skills in different contexts
- Process of support & maintenance
- Time management and planning
- Acknowledge limitations of own skills
- Teamwork

Figure 4 above indicates the different processes involved during the life cycle of the DD project and the skills transfer that takes place between the different teams involved.

All parties involved learnt from the interaction with one another and valuable trust relationships were built.

Significant learning regarding community involvement and skills transfer and development informatics are the following:

- In order to foster community ownership of the DD communities have to apply to get a DD and have to be committed to select a specific champion based on an excitement about the potential for ICT4D. The use of the DD by the whole community is extremely important and therefore they have to identify the person who will be trained to maintain it and to support them if they have any questions about the usage of the DD;
- Communities need to identify the site for the DD and the community champion in order to take ownership of the DD in order to ensure sustainability of the technology;
- Succession planning/agreement with the community champion to transfer skills to a replacement should he/she leave in order to ensure that relevant skills to look after the DD are available in the community. Complete community involvement and buy-in here is essential for the DD to address its purpose;
- The installer/support and maintenance company (Ingwapele Technology) team should have at least basic Linux skills and be able to use relevant equipment and tools. Meraka DD team's interaction with Ingwapele was an iterative process through which increasingly specialised skills were transferred, building on basic skills set.
- Ingwapele Technology team was eager to learn and acquire new skills in contrast to other suppliers that were found to display a know-it-all attitude; therefore Ingwapele's work was more successful and improved in quality over time. They were also able to transfer their newly acquired skills to other projects, which is proof of the success of skills transfer; and
- The processes mainly focus on the transfer of skills which takes place from Meraka team to the Ingwapele team as well as from Ingwapele to the community champion. However it is also important to indicate that skills were also transferred from Ingwapele to Meraka team, notably in the area of community engagement, awareness and understanding of cultural issues in every community where the DD was installed.

## Conclusion

The DD initiative is reaching the second phase where the standard design of the DD will be influenced by specific new requirements which will present the DD team with new challenges. DDs will be ordered by new international funders, based on context specific requirements, customized for specific community or funder needs, have to use new suppliers, installation companies, and champions from different types of communities and cultural contexts than in South Africa as well as These developments will not influence Ingwapele Technology, but it will influence the support and maintenance of the DD in other countries, in new communities with their own new skills or lack thereof and therefore the way in which the DD team transfers the skills required to assemble, install as well as support and maintain the Digital Doorway.

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