Learning from a free-access digital information kiosk in Africa - An objectivist – constructivist investigation

Johannes C. Cronjé  
Dirk Burger

Johannes C. Cronjé, University of Pretoria, South Africa  
Dirk Burger, University of Pretoria, South Africa

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Purpose – The purpose of this paper is to consider the type of learning that takes place if members of an under-resourced community are exposed to a free-to-use computer that is connected to the internet.

Design/methodology/approach – Qualitative application of an instrument that was developed to evaluate the information resource for the extent to which it facilitates both objectivist and constructivist learning. Video recordings of the interactions of people at the information kiosk were viewed and transcribed, and subjected to classical analysis to answer the questions posed by the instrument.

Findings – It was found that this particular information resource contained both objectivist and constructivist elements. Furthermore, it was found that objectivism and constructivism are complementary to one another and the degree of integration varies according to certain pedagogical dimensions. An open-access information portal affords opportunities both for direct instruction and constructivist learning.

Research limitations/implications – Based in a peri-urban environment in South Africa with a small sample.

Practical implications – The main contribution of this study is to investigate the interaction between information, knowledge, learning and pedagogy, which will help the information designer to better understand these interactions when designing an information resource. Furthermore, the instrument developed for this study can be used to evaluate other information resources, thus ultimately improving the standard of such resources.

Originality/value – The paper proposes a solution to the age-old objectivist/constructivist debate that prevails when considering the cognitive functioning of information users.
Introduction

The Internet is widely seen as a tool holding much promise in bringing information to developing countries (World Bank, 1998; Braun, 1999; Heeks, 1999; Kengwennyane, 2000; Thapisa, 2000; Kirkman and Sachs, 2001; UNDP, 2000). The question that arises is to what extent people with no previous computer experience would find such information useful. Mbambo and Cronjé (2002) reported that adults in developing countries had little trouble in learning to use Internet-based information portals by cooperative learning and peer tutoring.

In a slum area in India Professor Fugato Mitra conducted the so-called “Hole in the Wall” experiment in which he placed a computer in a wall and investigated the interaction of people with the machine (Judge, 2000). Mitra coined the phrase “Minimally Invasive Education” and explains that “…basic computing skills can be acquired by any set of children through incidental learning provided they are given access to a suitable computing facility, with entertaining and motivating content and some minimal (human) guidance” (NIIT, 2004). In South Africa the Council for Scientific and Industrial Research (CSIR) launched a similar project, called the Digital Doorway, using computers encased in protective cabinets. The site that formed the basis of our research was an information kiosk in a disadvantaged community to the east of Pretoria, South Africa. Grobler (2004) researched the project for feasibility primarily by observing recorded videos of the interaction of users of the portal. This research takes her work one step further, by investigating the capacity of the portal to facilitate two modes of learning: objectivist and constructivist.

The importance of researching a resource such as the Digital Doorway is underscored by authors such as De Azevedo Filho and Lundy (2004) who plot information portals as highest on the “peak of inflated expectations” in Gartner's hype cycle on e-learning (Figure 1). They describe this peak as follows:

This phase of over enthusiasm, unrealistic projections and a flurry of well publicised activity by technology leaders results in some success, but more failures, as the technology is pushed to its limits. The enterprises that make money during this phase are generally conference organisers, magazine publishers and consultants.

This is evident in the explosion of information portals that are created currently. Public access computer kiosks, either free or for profit, are a strong growth point, particularly in developing countries.

The rationale for this study is to explore the possibilities of the medium to prevent it from bottoming out on the trough of disillusionment, “because the technology does not live up to its inflated expectations, it rapidly becomes unfashionable, and the press abandons the topic or touts its failure to meet expectations” (De Azevedo Filho and Lundy, 2004, p. 48). In order to minimize the harm of a slump into the trough of disillusionment it would be useful to determine heuristics for the appropriate use of the technology so that it may reach the slope of enlightenment.
The foundation of the enquiry rests upon the ongoing debate between objectivism and constructivism in instructional design. This investigation is aimed at determining the versatility of a public-access terminal in allowing anytime learning drawing from either of the two epistemological extremes, objectivism or constructivism. Our article responds to Spector's (2004) call for an African perspective on the debate: “Where are the African, Asian, European, Pacific Islander, and South American voices in this dialogue?”. From Europe the German Terhart (2003, p. 42) argues: “‘New’ constructivist didactics in the end is merely an assembly of long known teaching methods”. Essentially, there is something called good teaching, which draws upon elements both of objectivism and constructivism as the need arises. This article builds upon Terhart's argument that constructivism is not new. We disagree with authors such as Vrasidas (2000) who place constructivism and objectivism at opposite ends of a continuum, and support Bednar et al. (1991, p. 19) who say that “Constructivism is completely incompatible with objectivism”. We thus explore further the proposal by Cronjé (2000, 2006) that the two perspectives are better plotted at right angles to form an integrative matrix. We apply this argument to the Digital Doorway, a public-access information kiosk intended to provide incidental learning to a disadvantaged community, and we ask: To what extent does the same information resource support both objectivist and constructivist learning?

The research builds upon Reeves' (2000) and Deacon's (2000) call to explore the possibility of integrating objectivism and constructivism by considering the pedagogical dimensions proposed by Reeves and Harmon (1994) and Reeves (1997), and is a continuation of theoretical work by Cronjé (2000, 2006) and observation research done by Grobler (2004)

**Context: the Digital Doorway**

The South African Digital Doorway project was derived from an idea of unsupervised learning pioneered in an experiment started in India by Professor Sugata Mitra of the NIIT Centre for Research in Cognitive Systems (CRCS). Mitra placed computers in rural areas of India without an instructor to help the people to use it. The name “Hole in the Wall” (NIIT, n.d.) was given to the project. Coining the term Minimally Invasive Education (MIE) Mitra proposed that basic computer skills could be acquired by children through incidental learning, and by peer tutoring (Judge, 2000).

A similar project was launched in South Africa by the CSIR. An unsupervised computer was installed in Mamelodi, a township to the east of Pretoria, South Africa. The computer is in a corner of the room. It is fixed to the wall and cannot be removed. The screen, keyboard and computer form a single unit with the stand. The screen is approximately 1.2m from the ground. There is a footstool for smaller children who cannot reach the screen and the keyboard. **Plate 1** shows the computer in the kiosk. The photo is a screen capture from the videos provided by the CSIR.
The kiosk is situated next to the busy entrance road to the township. There are always people there and merchants sell food next to the room. It is a safe venue with many people passing by. Figure 3 shows the kiosk from the outside.

Theoretical underpinning

In considering a minimally invasive approach our focus falls on the relationship between direct (objectivist) and indirect (constructivist) teaching and learning. In order to establish the extent to which the information resource fulfils its purpose in supporting both epistemologies it is necessary to understand the two concepts and their relationship. The literature survey covers a theoretical proposal by Cronjé (2000, 2006) to integrate the two, as well as a set of indicators that can be used to measure the extent to which a resource supports either one (Reeves, 1997; Reeves and Harmon, 1994). Upon this follows a discussion of Kurtz and Snowden's (2003) Cynefin framework that links learning and knowledge, and finally we consider Fresen's (2004) model that shows the relationships between information resources, knowledge and learning. Thus the scene is set for an analysis of the extent to which the Digital Doorway provides information that leads to knowledge through learning.

Objectivism and constructivism

It is generally accepted (Molenda, 1997) that the debate between objectivism and constructivism in educational technology was sparked off by Jonassen's (1991, p. 46) challenge to the instructional design and technology community to “question the ‘objectivist epistemology’ underlying practice in the field” and his call for a constructivist approach to instructional design. Table I provides a brief summary of the points of view held by supporters of each epistemology.

Refining the epistemological position, Reeves (1997) and Reeves and Harmon (1994) identify some 16 pedagogical dimensions that range between two extremes of a continuum (Table II). After considering the work of Kurtz and Snowden (2003) and Fresen (2004) (which is discussed later) six dimensions were eventually selected to conceptualise this study.

Although many researchers argue that there exists a pendulum between these two extremes (Cook, 1993; Lebow, 1993; Phillips, 1995; Trilling and Hood, 1999; Von Glaserfeld, 1996) authors such as Terhart (2003) argue that the so-called “new paradigm” is not new at all. In fact, debate between positivism and relativism can be traced as far back as Plato and Socrates. Smith and Ragan (1999) take an information-processing approach, suggested that the primary load of information processing could either be generated by the learner (generative) or supplied by the instructor (supplantive). Attributes to learning that explain the two terms can be found in Table III.
All the authors mentioned thus far plot the two aspects on opposite ends of a continuum. The problem with a continuum, however, is that it automatically makes one extreme the opposite of the other, which means that for something to be high on one, it has to be low on the other, and it is impossible for it to have “the best of both”. The middle ground can have no more than just a little of each.

Cronjé (2000, 2006) proposes a solution by plotting the two dimensions at right angles. He argues that, given that objectivists and constructivists have different points of departure and different anticipated outcomes, they cannot be placed on a continuum, and suggests instead that they be plotted on a matrix forming four quadrants of learning (Figure 2). One axis would range from zero to one hundred per cent objectivist, with generative learning tasks that range from simple to complex. The other axis ranges from zero to one hundred per cent constructivist, with supplantive instruction ranging from indirect methods (or even no method at all) to direct instruction.

Four quadrants emerge. Construction is high in complex knowledge and constructivist elements. The pedagogy of this quadrant is of the type where learners are given a problem to solve, usually involving constructing some solution, in the belief that they “will do best by finding (‘fishing’) for themselves the specific knowledge they need” (Papert, 1993, p. 139). Learning tasks could typically involve the construction of websites, databases or even toy robots. Diagonally opposed is the quadrant of Injection, which amounts to direct instruction along the lines of traditional computer-based tutorials or drills, and military training, where the instruction seeks to optimize efficiency by a transfer of knowledge in as clinical, undiluted and sterile a fashion as a medical injection.

The third quadrant is Integration, which refers to carefully-planned learning events or lessons during which tasks and exercises are blended to achieve efficient transfer of knowledge by direct instruction and effective learning by constructive application of that knowledge.

The Immersion quadrant refers to learning that is predominantly incidental by nature and usually gained in an unplanned fashion, often referred to as serendipity or experience. An example would be that of a small child learning the hard way that a bee stings painfully.

Cronjé's (2006) model forms the theoretical underpinning for this research. Essentially we wanted to see to what extent users of the Digital Doorway kiosk functioned in each quadrant. Our argument is that, in a free-to-use, unstructured digital environment, learning and knowledge are very closely related, as shown in the following mapping of Cronjé’s model onto Kurtz and Snowden's (2003) Cynefin framework of learning and knowledge.

From learning to knowledge

Cronjé's (2000, 2006) model of integrative learning maps well onto Kurtz and Snowden's (2003) Cynefin framework of learning and knowledge (Figure 3). Their
framework consists of four quadrants, divided into three domains. Two quadrants (knowable and known) fall under the “ordered” domain and two (complex and chaos) under the “un-ordered” domain. The third domain is called the “disordered” domain and connects all four quadrants. The domains and quadrants are used to explain the role of knowledge under different circumstances and how the acquiring of knowledge (learning) differs for each. Movement between the quadrants affects the learning process.

The “ordered domain: knowable causes and effects” contains stable cause and effect relationships that may not be fully known or only known to a limited number of people in an organization or learning environment. This domain maps onto Cronjé’s Integration quadrant. Everything in this domain can move to the known domain. What impacts on the movement is the amount of time and resources available. Organizations often lack time or resources, and rely on expert opinion, thus becoming dependent on expert advisors and decision makers. This is the domain of systems thinking, the learning organization and adaptive enterprises. The emphasis in this domain is on methodology. The decision model is to sense incoming data, analyze it and to respond on it in accordance with expert advice or interpretation of the analysis.

In the “ordered domain: known causes and effects” the causes and effects are linear, empirical and not open to dispute. The domain maps onto Cronjé’s Injection quadrant. The focus is on efficiency, and thus on repetitiveness, which requires predictive models. This is the domain of process re-engineering where consistency is obtained when knowledge is captured and embedded in structured processes. Field manuals, standard operating procedures occur in this domain. The decision model is to sense incoming data, categorize the data and then to respond in accordance to predetermined practice. Structured techniques are mandatory in this domain.

In the “un-ordered domain: complex relationships” the main focus is on complexity theory, which studies how patterns emerge through the interaction of many agents. The domain maps onto Cronjé’s Construction quadrant. There are cause and effect relationships between the agents, but the number of agents and relationships defy categorization or analytical techniques. This means that every time you look at something the meaning depends on which angle you look from, because the patterns may appear only stable for a short period of time. Understanding this domain requires multiple perspectives on the nature of the system. The decision model is to create probes to make the patterns more visible, sense the patterns and stabilize desirable patterns and respond accordingly.

The “un-ordered domain: chaos” has no cause and effect relationships. It maps onto Cronjé’s Immersion quadrant. One enters the chaos domain to open up new possibilities and create the conditions for innovation. The decision model here is to act quickly and decisively, reduce turbulence and to sense immediately the reaction to the intervention so that one can respond accordingly.

The “domain of disorder” is in the middle of the four quadrants (Kurtz and Snowden, 2003) and is essential for conflict resolution as it enables looking at a situation from
different angles. Conflict influences knowledge exchange and decision-making. People interpret the central space differently based on their preferences: those most comfortable with stable order want to create or enforce rules, while experts will conduct research and accumulate data. The politically minded build their networks, and the dictators grab the opportunity to gain absolute control of a chaotic situation. People try to pull the situation towards the domain which best matches their individual capabilities and perspectives, and in which they are most likely to be empowered. The challenge is to reduce the central domain by establishing a consensual act of collaboration for all parties involved, and to enhance knowledge sharing and more effective workplace learning.

The role of the information resource in acquiring knowledge


The Digital Doorway is a gateway to the internet and to information processors (such as word processors, databases and spreadsheets). Since it is deployed as a resource rather than a tutor it is unlikely to produce learning per se.

Sievänen (2004) states that the information designer's conception of learning influences the implementation and use of a learning environment. In other words, these conceptions affect the way in which the learners learn with the help of the learning environment. According to Webber in Ruttenbur et al. (2000), to keep up to speed with change, students must be taught, with the help of technology, the skills to harness the vast and often raw array of information that technology itself has helped to generate. The Digital Doorway does not have teaching as a key function, but relies upon learning by serendipitous discovery and peer tutoring. It is a resource rather than an instructor. Information needs to be retrieved appropriately in a given context for learning to take place. Fresen (2004) shows the relationship between learning and information resources in an ingenious adaptation of Ingwersen's (1996) cognitive model of information retrieval and interaction.

From Figure 4 it can be seen that Fresen (2004) sees the computer with Internet access (i.e. the Digital Doorway) as the intermediary, while the Web-based content forms the information objects, and the infrastructure provided by the Digital Doorway form the information retrieval system. Students and lecturers are the users of the information. On to this adaptation of Ingwersen's model she maps a number of factors that contribute to the success or failure of the process. Technology factors relate to the extent to which the interface is usable, while institutional factors determine the accessibility of the information retrieval system. Instructional design and pedagogical factors will determine the usefulness of the learning products, while student and learner factors shape the cognitive space of the individual learner. Finally, institutional factors and exogenous factors (such as the weather, the physical and social environment in which the learning
resource is placed, the level of traffic, etc.), as well as the underlying assumptions about
the value of the resource, are dominant in the social and organizational environment.

**Conceptual framework**

Backed up by Kurtz and Snowden's (2003) Cynefin framework, Cronjé's (2006) four-
quadrant model forms the framework for this research. Taking cognisance of Fresen's
(2004) explanation of the relationship between information, knowledge resources and
learning, six of Reeves and Harmon's (1994) pedagogical dimensions were selected to
form categories on each axis of Cronjé's model. These were epistemology, pedagogical
philosophy, underlying psychology, teacher role, value of errors and cooperative
learning. It is argued that if each of the six dimensions is plotted at right angles on an
objectivist, constructivist matrix, it should be possible to develop a “footprint” of a given
learning intervention.

**Previous Digital Doorway research**

The research reported here is a direct continuation of work done by Grobler (2004), who
observed people using the Digital Doorway kiosk in Mamelodi. She analysed the CSIR's
closed-circuit television footage of participants at the computer in the kiosk over a period
of six weeks. The video was transcribed and both the visual document and the transcripts
were subjected to classical analysis to arrive at the “story” of what happened. Essentially
the research question was: “How do computer-illiterate people interact with a previously
unknown technology that is made available for free.” The recording started the day the
kiosk was installed, 6 December 2003. The time frame for the observation was between
10:00 and 16:00, seven days a week for the period 6 December 2003 to 15 January 2004.
No sound, screen captures or keystrokes were available from the available data streams.
Such information would have contributed towards the richness of her study.

The participants ranged between 10 years and 65 years in age. Very few had minimal PC
knowledge, but most had not worked on a PC before. They were almost always male.
Women and girls were seldom noted. After a six-week period the participants used the
computer in the kiosk with greater assurance. They were all very enthusiastic and the
room was seldom filled with fewer than four people. The most common users were
children in groups of four to ten. These groups normally used the computer for a period
of one hour at a time. Adults also used the computer, but more often during the early
mornings and late afternoons. Grobler (2004) concluded that both objectivist learning
took place in the form of direct instruction by peers, and even by the security guard,
while constructivist learning took place in the form of exploration, both individually and
in groups. She reported that as time progressed, as the learners became more familiar
with the resource and gained self-confidence, the interaction between the learners and the
resource became more structured. People were more likely to go directly to what they
wanted, ask for direct help and build onto previously acquired knowledge.
Research method

Research objective

The objective of our research was to plot occurrences of interaction with the Digital Doorway on Cronjé's (2000, 2006) four quadrants of teaching and learning, using the six pedagogical dimensions. In essence we wanted to evaluate the feasibility of a model that plots objectivist and constructivist elements at right angles, and we wanted to know how the Digital Doorway functioned as an educational information resource that facilitates learning in each quadrant.

The initial research question can be refined: “To what extent does the Digital Doorway accommodate teaching and learning from an objectivist or constructivist perspective?” Or, put more simply, “In which quadrant(s) does the Digital Doorway project function?”

Development of the instrument

An initial instrument designed by Basson (1998) to analyze a learning event using Cronjé's (2000) four quadrants was used as a point of departure. Literature concerning information processing (Smith and Ragan, 1999; Fresen, 2004), knowledge (Kurtz and Snowden, 2003), learning (Cronjé, 2000, 2006), pedagogy (Reeves and Harmon, 1994) was synthesized to isolate six of Reeves and Harmon's dimensions. Two constructs were generated for each dimension. The following example shows how. On the constructivist axis, for the dimension of “Value of errors”, questions were posed such as: “Was the learner allowed to make any mistakes and rectify them?” “Did the learners learn from their mistakes?” On the constructivist axis, for the same dimension, questions were asked such as: “Did the teacher correct errors for the learner?” The final instrument consisted of 24 questions to which respondents could reply “yes definitely, yes to some extent, no not really, and definitely not”.

Analysis

Grobler's (2004) findings, edited videos and transcripts were given to three evaluators who were asked to apply the instrument described above in order to analyse and evaluate the interaction between the users and the information resource. The evaluators were all final-year M.Ed students in Computer-Integrated Education of the University of Pretoria. They were asked to watch Grobler's (2004) video and then to complete the questionnaire. They evaluated the information independently of one another and they were allowed to go back and re-examine the material if they had any doubts about a specific answer. A possible source of error could have been the potential bias of the researchers and lack of rigour in analysis. Using three different observers to study Grobler's (2004) results was an attempt at avoiding this.
Findings

Analysis

Applying the evaluation instrument to analyze the video material gleaned by Grobler (2004) showed that most of what happened in the kiosk took place in Cronjé's quadrants of immersion and integration. The results of the evaluation are plotted in the Figure 5.

The plotting of the results of the three evaluators on the matrix supports Grobler's observation that the learners initially used the information resource in an unstructured/disorganized, sometimes even chaotic manner, and that later they followed a more integrative approach. The contribution of the security guard as self-appointed instructor can also be seen in the injection quadrant.

The results of the questionnaires are summarized in Table IV. In this table each evaluator's results are mapped against one of the six previously identified dimensions and against Cronjé's (2006) quadrants.

Epistemology (nature of knowledge) – The results of two evaluators indicate that the learners used a combination of strategies to make sense of the information presented to them by the information resource. Some learners asked the security guard for help (i.e. instruction), while others used a combination of integration, peer instruction and construction to categorize information (Fresen, 2004; Ingwersen, 1996) into meaningful chunks of knowledge (Kurtz and Snowden, 2003) for learning (Cronjé, 2000, 2006) to take place. The third evaluator was neutral, indicating that the learners were in the domain of disorder (Kurtz and Snowden, 2003). This domain is critical to understanding conflict amongst people in an organization, looking at the same situation from different angles.

Pedagogical philosophy – all three evaluators placed the resource in the immersion quadrant for this dimension. This would indicate that the pedagogical philosophy underpinning the Digital Doorway was neither overtly instructivist, nor overtly constructivist. This rating is in keeping with the concept of “minimally invasive education” which does not supply overt scaffolding, as constructivists do, nor clear instruction as objectivists do. All three evaluators recognized that learning would be mainly serendipitous.

Kurtz and Snowden (2003) state that the chaos domain (which maps onto the immersion quadrant) is the one where one can enter consciously, to open up new possibilities and to create the conditions for innovation. This is evident in the fact that individual learners were given the opportunity to “take” from this information resource what they wanted and make it their own.

Underlying psychology – two evaluators indicated that the information resource had a combination of immersion/chaotic and instructional (injection) qualities. The third
evaluator indicated that the chaos quadrant was more evident. Knowledge thus moved from Kurtz and Snowden's unknown domain to the known domain. Learners built mental models, which according to Reeves (1997), is very important, as models are the basis for problem-solving abilities.

*Teacher role* – according to Reeves (1997) some information resources are designed to place teachers in the role of a facilitator. Other information resources are designed to support the more traditional didactic role of an instructor as the teacher.

All three evaluators concurred that this information resource was in the immersion quadrant as described by Cronjé (2000, 2006). This is because no teacher was present at the information resource to fill one of Reeves' teacher roles for an information resource. Not surprisingly the evaluators rated the teacher role as zero, both on the objectivist and constructivist scale.

*Value of errors* – while experiential learning might be highly valued because it affords the learner the opportunity to “learn from his/her mistakes”, there are instances where it could be dangerous and inefficient (Reeves, 1997).

**Table IV** shows that only one evaluator rated this learning resource in the immersion quadrant of learning in terms of the value of errors. The other two evaluators remained neutral, which again places the use of the resource in the domain of disorder (Kurtz and Snowden, 2003). This could be because learners were unfamiliar with the interface (Fresen, 2004). The fact that users were initially “scared” of the interface/computer, but as time progressed some of them felt more comfortable using it, corresponds with the technology factors affecting quality web-based learning, according to Fresen (2004).

*Cooperative learning* – according to Johnson and Johnson (1987) and Slavin (1990), learners benefit both instructionally and socially from working together.

**Table IV** indicates that two evaluators placed the use of this information resource on the border of Cronjé's construction/integration quadrants, while evaluator A placed the information resource in the integration quadrant.

As the participants formed informal groups, it was clear that they used various strategies (Smith and Ragan, 1999) to receive information (Fresen, 2004). This information was then individually organised into meaningful chunks of knowledge (Smith and Ragan, 1999; Kurtz and Snowden, 2003; Fresen, 2004) and exchanged (Kurtz and Snowden, 2003) between peers, as indicated by Grobler (2004).

**Conclusions**

Three closely related questions were asked in this article. The conclusions will deal with them one by one.
In which quadrant(s) does the Digital Doorway project resort?

A visual inspection of the plotting on the matrix shows that a line could be drawn through the middle of the two quadrants, as is shown in Figure 6.

The line shows that the Digital Doorway project resides in the quadrants of integration, immersion and injection. No construction was observed in the research.

To what extent does the Digital Doorway project accommodate teaching and learning from an objectivist or constructivist perspective?

The evaluators found that the Digital Doorway functioned primarily in the chaos and immersion area, as well as the integration/knowable area (Cronjé, 2000, 2006; Kurtz and Snowden, 2003). From the plotting on the matrix it would seem that while the pedagogical philosophy was one of immersion, the epistemological mapping was integrative. This may well have been as a result of the growth in confidence. The juxtaposition of a high integration score for cooperative learning with a zero rating for the teacher's role supports the concept of minimally invasive education where learners learn by working it out for themselves, and from their peers. The high value of errors can also be explained in that in the absence of teachers and peers, learners have to learn from their mistakes. The Digital Doorway, therefore, can be shown to accommodate teaching from both perspectives.

To what extent can objectivism and constructivism be integrated into one information resource?

This single case study is hardly sufficient evidence to provide a generalized answer to the main question, but these results would seem to resonate with Muuren's (2003) conclusions that integrating high levels of objectivism and constructivism can lead to increased effectiveness and efficiency in a learning event. Thus, what may be true for a learning event may also be true for a learning resource.

Recommendations

The results of this investigation may lead to some recommendations for policy and practice, as well as some recommendations for further research and development.
Policy and practice

The fact that learners gained confidence and shifted from immersion to integration, with the help of their peers would suggest that minimally invasive education holds some possibility for communities where formally trained instructors are scarce. However, the fact that they asked the security guard for direct assistance would suggest that it is worthwhile training the guard to act as a facilitator. Although this may reduce the minimalism of the educational intervention, it may well speed up the learning process.

Further research

Researching the instrument and model

Further research is required to refine the research instrument. With only three evaluators having used the instrument it is hard to say why, although some of their assessments fall in the same quadrant, they are still quite far apart. This may be due to the wording of the instrument, or due to a wide interpretation of the concepts, and poor calibration of the raters. A statistical validation of the instrument would be useful. Nevertheless the research shows support for Cronjé's four-quadrant model.

Researching the Digital Doorway

Grobler's (2004) research into The Digital Doorway isolated patterns of use. This paper describes the pedagogical functioning of the resource. Research is required, however, to determine what users of the kiosk have actually learned. Obtaining screen captures and user tracking in conjunction with the video will probably be the best route.

Further development

From the results above it can be seen that no construction took place. This implies that, although people used the Digital Doorway to become computer literate, they did not use it to do productive work. A process should be developed whereby the Digital Doorway could be used productively.

In terms of the four-quadrant model, more research could be done on the “line” that was identified across the three quadrants. Regression analyses with larger data sets may prove useful.
**Figure 1** The Gartner hype cycle on e-learning

![Gartner hype cycle diagram](image)

Source: De Azevedo Filho and Lundy (2004)

**Plate 1** The Digital Doorway information kiosk

![Digital Doorway information kiosk](image)

Source: CSIR
Plate 2 The kiosk from the street. A man can be seen working on the computer inside

Source: CSIR

Figure 2 Four quadrants of teaching and learning

Source: Cronjé (2006)
**Figure 3** The Cynefin framework

<table>
<thead>
<tr>
<th>COMPLEX</th>
<th>KNOWABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause and effect are only coherent in retrospect and do not repeat</td>
<td>Cause and effect separated over time and space</td>
</tr>
<tr>
<td>Pattern management</td>
<td>Analytical/Reductionist</td>
</tr>
<tr>
<td>Perspective filters</td>
<td>Scenario planning</td>
</tr>
<tr>
<td>Complex adaptive systems</td>
<td>Systems thinking</td>
</tr>
<tr>
<td>Probe-Sense-Respond</td>
<td>Sense-Analyze-Respond</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAOS</th>
<th>KNOWN</th>
</tr>
</thead>
<tbody>
<tr>
<td>No cause and effect relationships perceivable</td>
<td>Cause and effect relations repeatable, perceivable and predictable</td>
</tr>
<tr>
<td>Stability-focused intervention</td>
<td>Legitimate best practice</td>
</tr>
<tr>
<td>Enactment tools</td>
<td>Standard operating procedures</td>
</tr>
<tr>
<td>Crisis management</td>
<td>Process reengineering</td>
</tr>
<tr>
<td>Act-Sense-Respond</td>
<td>Sense-Categorize-Respond</td>
</tr>
</tbody>
</table>

*Source: Kurtz and Snowden (2003, p. 468)*

**Figure 4** The relationship between the Digital Doorway and information retrieval and interaction

*Source: Fresen (2004)*
Figure 5 Evaluators’ results plotted on Cronjé’s matrix

Figure 6 Three quadrants of the Digital Doorway
Table I Contrasting views of objectivism and constructivism

<table>
<thead>
<tr>
<th>Category</th>
<th>Objectivism</th>
<th>Constructivism</th>
</tr>
</thead>
<tbody>
<tr>
<td>The real world ...</td>
<td>Has entities that can be categorized on the basis of their properties and relations</td>
<td>Is structured by our individual minds on the basis of our interactions (this limits what we can know about the real world)</td>
</tr>
<tr>
<td>Reality is ...</td>
<td>Fully and explicitly structured in a way that is shared by all who perceive it. Because of this commonality, reality can be modeled and shared with others.</td>
<td>Local (personal) to ourselves in a universe of multiple realities. Our realities are modeled by the way in which we personally construct them.</td>
</tr>
<tr>
<td>Symbols are ...</td>
<td>Representations of reality, and are only meaningful to the degree that they correspond to reality</td>
<td>Products of culture that are used to construct reality</td>
</tr>
<tr>
<td>The human mind ...</td>
<td>Processes abstract symbols and fashions them so that they mirror nature.</td>
<td>Perceives and interprets the world by creating symbols.</td>
</tr>
<tr>
<td>Human thought is ...</td>
<td>Symbol-manipulation and is independent of the human organism.</td>
<td>Is imaginative, and develops out of perception, sensory experiences, and social interaction.</td>
</tr>
<tr>
<td>Meaning ...</td>
<td>Exists objectively and independently of the human mind – and is external to the knower.</td>
<td>Is a construction that is the end result of an interpretive process that depends on the experience and understanding of the knower.</td>
</tr>
</tbody>
</table>

Sources: Compiled from Cobb (1994); Jonassen (1991); Lakoff (1987); Philips (1995); Reigeluth (1996); Vrasidas (2000)

Table II Pedagogical dimensions

<table>
<thead>
<tr>
<th>Category</th>
<th>Extremes on the continuum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epistemology&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Objectivism</td>
</tr>
<tr>
<td>Pedagogical philosophy&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Instructivist</td>
</tr>
<tr>
<td>Underlying psychology&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Behavioral</td>
</tr>
<tr>
<td>Instructional sequencing</td>
<td>Reductionist</td>
</tr>
<tr>
<td>Goal orientation</td>
<td>Sharply focused</td>
</tr>
<tr>
<td>Role of teacher/instructor&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Authoritarian/didactic</td>
</tr>
<tr>
<td>Experiential value</td>
<td>Abstract</td>
</tr>
<tr>
<td>Program flexibility</td>
<td>Teacher-proof</td>
</tr>
<tr>
<td>Value of errors&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Errorless learning</td>
</tr>
<tr>
<td>Motivation</td>
<td>Extrinsic</td>
</tr>
<tr>
<td>Structure</td>
<td>High</td>
</tr>
<tr>
<td>Learner control</td>
<td>Non-existent</td>
</tr>
<tr>
<td>User-activity</td>
<td>Mathemagenic</td>
</tr>
<tr>
<td>Accommodation of individual differences</td>
<td>Non-existent</td>
</tr>
<tr>
<td>Co-operative learning&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Unsupported</td>
</tr>
<tr>
<td>Cultural sensitivity</td>
<td>Non-existent</td>
</tr>
</tbody>
</table>

Note: <sup>a</sup>Indicates dimensions explored in this study

Source: Synthesized from Reeves (1997); Reeves and Harmon (1994)

Table II Pedagogical dimensions
Table III: Generative and supplantive learning events

<table>
<thead>
<tr>
<th>Generative event</th>
<th>Supplantive event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activate attention to lesson</td>
<td>Gain attention to lesson</td>
</tr>
<tr>
<td>Establish purpose</td>
<td>Inform learner of instructional purpose</td>
</tr>
<tr>
<td>Arouse interest and motivation</td>
<td>Stimulate learner's attention and motivation</td>
</tr>
<tr>
<td>Preview learning activity</td>
<td>Provide overview</td>
</tr>
<tr>
<td>Recall relevant prior knowledge</td>
<td>Stimulate recall of prior knowledge</td>
</tr>
<tr>
<td>Process information and examples</td>
<td>Present information and examples</td>
</tr>
<tr>
<td>Focus attention</td>
<td>Gain and direct attention</td>
</tr>
<tr>
<td>Employ learning strategies</td>
<td>Guide or prompt use of learning strategies</td>
</tr>
<tr>
<td>Practice</td>
<td>Provide for and guide practice</td>
</tr>
<tr>
<td>Evaluate feedback</td>
<td>Provide feedback</td>
</tr>
<tr>
<td>Summarise and review</td>
<td>Provide summary and review</td>
</tr>
<tr>
<td>Transfer learning</td>
<td>Enhance transfer</td>
</tr>
<tr>
<td>Re-motivate and close</td>
<td>Provide re-motivation and closure</td>
</tr>
<tr>
<td>Assess learning</td>
<td>Conduct assessment</td>
</tr>
<tr>
<td>Evaluate feedback</td>
<td>Provide feedback and remediation</td>
</tr>
</tbody>
</table>

Source: Smith and Ragan (1999)

Table IV: Summary of overall ratings for the information resource by evaluators, against Reeves' dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Evaluator A</th>
<th>Evaluator B</th>
<th>Evaluator C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of overall ratings</td>
<td>Injection/integration</td>
<td>Injection/integration</td>
<td>Neutral</td>
</tr>
<tr>
<td>epistemology</td>
<td>Immersion</td>
<td>Immersion</td>
<td>Immersion</td>
</tr>
<tr>
<td>Pedagogical philosophy</td>
<td>Immersion</td>
<td>Immersion /injection</td>
<td>Immersion</td>
</tr>
<tr>
<td>Underlying psychology</td>
<td>Immersion</td>
<td>Immersion</td>
<td>Immersion</td>
</tr>
<tr>
<td>Teacher role</td>
<td>Immersion</td>
<td>Immersion</td>
<td>Immersion</td>
</tr>
<tr>
<td>Value of errors</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Immersion</td>
</tr>
<tr>
<td>Cooperative learning</td>
<td>Integration</td>
<td>Construction/integration</td>
<td>Construction/integration</td>
</tr>
</tbody>
</table>

References


Reeves, T.C. (1997), "Learning with software: pedagogies and practices", Evaluating What Really Matters in Computer-Based Education, University of Georgia, Athens, GA.


**Corresponding author**

Johannes C. Cronjé can be contacted at: jcronje@up.ac.za