Teachers, technology and types of media: Teaching with ICTs in South Africa

Nokulunga Sithabile Ndlovu* and Ian Moll

University of the Witwatersrand, 27 St. Andrews Road, Parktown, 2193, Johannesburg, South Africa.

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ABSTRACT

This paper intends to provide an understanding of pedagogical integration of ICTs to facilitate ICT teacher preparation that promotes productive use of these digital technologies in the classroom. A qualitative multi-case study of three school teachers selected for their successful ICT pedagogical integration into their teaching was conducted in three South African township secondary schools. In the findings, teachers created rich learning environments enhanced by their purposeful and proficient integration of ICTs into their teaching. In addition, there was consistency between the teachers’ espoused and enacted practices as both digital (ICTs) and non-digital media augmented each other in the teaching process.

Key words: ICT pedagogical integration, media forms, ICT affordances, enhancement of teaching and learning.

*Corresponding author. E-mail: Nokulunga.Ndlovu@wits.ac.za.

INTRODUCTION

Efforts to introduce pedagogical integration of ICTs in South Africa have focused on provision of infrastructure, hardware and software. It has also concentrated on offering basic computer skills to teachers. This has proven insufficient to prepare teachers for effective integration of digital technology at their disposal in order to enhance their teaching practice (Blignaut et al., 2010; Mofokeng and Mji, 2010; Gudmundsdottir, 2010; Du Plessis and Webb, 2012). According to Bialobrzeska and Cohen (2005:13), “however good the ICT infrastructure in a school may be and however wide the range of software the school has, these are only as good as the teacher using them. ICT teacher training should therefore go beyond exposing teachers to technology as has been the case, but transcend to how the actual teaching (good or bad) is enhanced by its use”.

The extent to which teaching is enhanced by the use of ICTs depends on the teachers’ pedagogical beliefs about their subject, teaching, learner needs and perceptions about ICT capabilities (Fulton and Torney-Purta, 1999; Ertmer, 1999). These beliefs help expose the role and the value ICTs have in the pedagogical integration process that teachers orchestrate. This study investigates this exposure which has facilitated a description of this process. The research question guiding the study is: What contribution do the practices of three South African township secondary school teachers make to an understanding of ICT pedagogical integration?

ICTs as media for learning and teaching

An ICT tool can offer a wide range of multimodal texts and media forms in a given teaching and learning environment. This makes them more versatile than other teaching resources. Laurillard (2002) has categorised these tools into the following: Narrative, Interactive, Communicative, Adaptive and Productive media. These media are grouped based on their affordances, or what they can do to improve a learning experience. A clear articulation of these affordances is needed to understand how ICTs “can be most effectively used to support learning and teaching” (Conole and Dyke, 2004:113).

Media forms

Narrative media forms are non-interactive and often used
Pedagogy refers to “guidance-to-learn: learning in the context of teaching, and teaching that has learning as its goal” (Beetham and Sharpe, 2013:2). Teaching is therefore that which makes learning happen. In her Conversational Framework, Laurillard (2002) demonstrates how this happens through teacher-learner interaction. The interaction begins when the teacher presents a new concept and carries on until the learner shares more or less the same understanding. In her introduction of teacher pedagogical content knowledge, Shulman (1986) gives insight into how complex this process is as different aspects of pedagogy are brought into play during the act of teaching. Dron (2012) extends this understanding by describing pedagogy as an orchestration of ‘all’ that happens in the classroom that makes possible the achievement of educational goals. Pedagogy is therefore the integration of teaching methods, strategies, conversations and teaching resources. ICTs are included in this amalgamation.

Williams in Wang and Woo (2007:149) define ICT pedagogical integration as “a process of using any ICT to enhance student learning”. The idea that it is a process associated with and contributing to the learning experience suggests it is not stagnant; neither does it occur on its own but within that which makes learning possible. It is therefore important that ICTs in this context are considered as part of teaching and not as add-ons. ICT pedagogical integration consequently entails infusion of ICTs so that what the teacher has already been doing effectively is enhanced.

**METHODOLOGY**

This qualitative multi-case study investigates teacher practices of three selected teachers from three South African township secondary schools. The study interprets teacher espoused and enacted practices in order to understand what ICT pedagogical integration entails. As a multi-case study, the interpretation of each teacher’s case is used to identify similarities and explore differences within and between cases (Yin, 2003). Each subject teacher is a case that contributes to the formation of a “collective understanding” of the phenomenon under investigation (Stake, 1995:4). This type of study is recommended by Miles and Huberman (1994) for its potential to develop a generic theory, which in this case is the ICT teacher training framework to be developed later. Purposive sampling was used to identify cases where most could be gained on the phenomenon under study (Merriam, 2009). The selected teachers self-declared that their ICT use had pedagogical value. Semi-structured interviews were conducted with each teacher and were audio-recorded. Thereafter, one lesson observation per teacher was video recorded. Captured data was transcribed to facilitate a robust interpretation and coding of the data using the research analytical tool.

**Analytical tool**

The analytical tool (Table 1) based on Laurillard (2002) media forms and ICT affordances by Conole and Dyke was developed and used to interpret teachers’ interviews and observations. Media forms are used as themes to group possible ICT roles in the learning experience anticipated. The specific affordance described or observed is recorded in the next column. It responds to the question, what is the technology able to do in that particular theme or media form? What the media can do might vary depending on the description of the activity or learning outcome. The evidence is the activity or the description of what is observable as the ICT is integrated into the teaching and learning experience that can be used as the indicator showing that the ICT affordance is playing a particular role. Finally, the question, ‘what pedagogical value does it add?’ makes explicit what benefit the usage brings to the teaching and learning process. The identified value is an indication that there is effective integration in the use of the digital or and non-digital medium.

**RESULTS**

The findings concur with literature that claim teacher pedagogical beliefs influence their enacted ICT integration (Ertmer, 1999; Fulton and Torney-Purta, 1999). Each teacher in this study has his or her pedagogical belief or understanding of ICT integration, and that influences their enacted practice. ICTs are valued by teachers for their ability to present concept structure and that is consistent in all teacher practices. Through conversation, teachers interact with learners as they try and interpret the meaning of the structure. That gives teachers feedback which help them determine the direction the lesson should take or what teaching
resources or methods to engage as they amend misconceptions and concretise theory.

Each teacher’s role in the integration process is characterised and is a reflection of the individual teacher perception about the pedagogical benefits of the ICT affordance they use to enhance teaching and learning. The benefits relate to subject needs, teaching needs and learning needs.

Mpetha

Mpetha is a teacher whose pseudonym is a Zulu word and it means expert. The teacher is considered an expert because of his ability to maximise his advanced ICT technical skills to enrich his teaching of mathematics. Mpetha believes it is important that he makes explicit the process of solving problems in his subject. He states:

"The ICT helps with the procedure, because without procedure, you cannot do anything...but this one helps them to see how we can solve the problem...Like in Maths now the animation on the slides shows the movement from one point or the other, to show what is happening."

Mpetha’s programming skills make it possible to achieve this goal in his teaching. He believes the quality of digital materials determine the effectiveness of their use. This links with his aspiration to make visible problem solving processes. Mpetha does not only rely on his materials design, but engages other teaching strategies to make explicit the structure presented by the technology.

There is consistency in what the teacher articulates about how he integrates ICTs in his actual teaching. He is able to create a rich learning experience by utilising the five media forms that he integrates with various components of the pedagogical ensemble. In his use of 6 slides, Mpetha is not limited to the use of technology but he incorporates role play, examples, and explanations, links concepts from other subjects, gestures and prior knowledge to interpret and make explicit the symbols that make up the concept taught. This is a clear demonstration of the complexity of integrating not only the media but all that the teacher can lay his hands on to help make learners understand new knowledge as revealed below.

In the narrative, structural clues on the slides seem to play a significant role in helping establish the concept structure and connections between steps and ideas. The interactive media form drives the pace and direction of the lesson as determined by the feedback the teacher gets from learners in each step or activity. If the feedback is affirmative, the teacher moves to the next step. If it is negative, he moves away from ICT engagement and solicits the use of other teaching strategies that connect learners to their everyday experiences in and outside the classroom. Once learners grasp the idea, Mpetha moves to the next phase in the concept structure that is available on a different slide. This move helps learners concretise the theoretical aspect that he would have presented before the ICT engagement. The communicative and productive media are reflected in the whole class teaching and the group work. Re-descriptions are made as learners collaborate to find solutions to problems.

In his presentation, Mpetha draws from his repertoire of teaching methods and strategies to help learners follow the development of the concept structure, processes and connections. Table 2 makes explicit how he manages to integrate all these aspects.

The role of the ICT is to present the content structure and to illustrate how different representations (tables, graphs, animations, and formulas) contribute to the development of calculating cumulative frequency.

Mlingani

Mlingani is a Zulu name that means partner. It is used in this study as the name of the teacher who collaborates with digital technology (video) to help expose township learners to mathematical language and different problem solving methods.

Although the teacher uses the video as a narrative form, he is aware of the limitations it has in making the content accessible to his learners. He therefore slots it in to establish components of the content structure in the standard subject language which he interprets at the level of learners’ understanding without compromising it as follows:

"It is an integer and it represents a revolution. Do you get it? Why that one is positive is because it is moving anticlockwise. Ixesha musi likamba kanje (Xhosa to

<table>
<thead>
<tr>
<th>Media forms</th>
<th>Affordances</th>
<th>Evidence</th>
<th>What pedagogical value does it add</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrative</td>
<td>Non-linear</td>
<td>Multimodality</td>
<td>Apprehending structure/connections</td>
</tr>
<tr>
<td>Interactive</td>
<td>Immediacy</td>
<td>Immediate feedback</td>
<td>Exploration: misconceptions amended</td>
</tr>
<tr>
<td>Communicative</td>
<td>Collaboration</td>
<td>Discussion: class/ group</td>
<td>Re-descriptions of concepts</td>
</tr>
<tr>
<td>Adaptive</td>
<td>Diversity</td>
<td>Reproduction: experimental/role play</td>
<td>Concretising theory: practice</td>
</tr>
<tr>
<td>Productive</td>
<td>Articulation</td>
<td>Product: animation/ model</td>
<td>Knowledge construction</td>
</tr>
</tbody>
</table>

Source: Ndlovu (2015:100)
Table 2. The 14 teacher activity interchanges.

<table>
<thead>
<tr>
<th>Duration in minutes and seconds</th>
<th>Teaching strategy</th>
<th>Digital technology used with explanations of text</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:40</td>
<td>Question and answer (together with explanations are used throughout the interchange)</td>
<td>Slide with definition</td>
</tr>
<tr>
<td>03:15</td>
<td>Role play</td>
<td></td>
</tr>
<tr>
<td>01:08</td>
<td></td>
<td>Graph</td>
</tr>
<tr>
<td>00:25</td>
<td>Analogy</td>
<td></td>
</tr>
<tr>
<td>00:37</td>
<td></td>
<td>Graph</td>
</tr>
<tr>
<td>00:13</td>
<td>Role play</td>
<td></td>
</tr>
<tr>
<td>00:11</td>
<td></td>
<td>Graph</td>
</tr>
<tr>
<td>02:10</td>
<td></td>
<td>Table</td>
</tr>
<tr>
<td>00:21</td>
<td></td>
<td>Graph</td>
</tr>
<tr>
<td>00:27</td>
<td></td>
<td>Table</td>
</tr>
<tr>
<td>00:16</td>
<td></td>
<td>Graph</td>
</tr>
<tr>
<td>00:38</td>
<td>Reference to prior knowledge/ other subject</td>
<td></td>
</tr>
<tr>
<td>02:05</td>
<td>Object</td>
<td></td>
</tr>
<tr>
<td>00:54</td>
<td></td>
<td>Graph</td>
</tr>
</tbody>
</table>


mean, time moves this way), ne? (Afrikaans to mean, isn’t it?) [the teacher shows with his index finger how the clock hand moves clockwise]. Immediately *sithi* (Xhosa to mean, we say) *anti* (Greek word used as slang to mean, move in the opposite direction).

The conversation is adapted so learners have clear understandings of concrete aspects needed to apprehend what an integer represents. Interaction is between teacher and technology and teacher and learner as the concept is developed. The former is collaborative at teaching level and when confirmation is received from the technology after the teacher and the class have carried out the calculations. Although the video method of calculation is shorter, this gives the class a different problem solving technique. There is collaboration between the teacher and the expert in the video, with each playing his or her role. The teacher as the driver of this teaching experience occupies 69.62% of the period time and the video takes 29.31% of it. Learners participate in the development of the lesson as follows:

Teacher: So it can be what? It can be Sin -1352 equals?
Teacher: What will be the outcome, applying (points at the previous writing) the Thetas, do you get it?
Learners: Yes.
Teacher: What will be the outcome?
Learners: -Sin.
Teacher: What will be the outcome? What will be the Theta in this case?
Learners: 1352.
(Teacher writes –Sin (1352) = -Sin 1352)
Teacher: Are we together?
Learners: Yes (Ndlovu, 2015:187)

Learners are brought into the classroom conversation as the teacher demonstrates how calculations should be carried out. Although this type of collaboration (one-to-many) is not ideal (Laurillard, 2002), learner responses indicate that they are working together with the teacher.

While the teacher admits that the ICT he uses has helped to enhance learning (based on incremental increase in his matriculation results over the last 2 years), the technology seems to have had an influence on his teaching. This is exhibited in the teacher’s enacted practice where he uses storytelling to introduce the trigonometry lesson. When the video is played, the presenter uses the same teaching method. This type of collaboration does not disrupt the pedagogical flow, but enhances it as the concept taught is developed.

**Bambisana**

Bambisana is a Zulu name given to this teacher and it means *collaborate*. This teacher believes that for learners to grasp geographical concepts, they need to visualise them. She says:

> Always, in every lesson I use them to teach the learners especially when it comes to visuals. Because when you teach the learners, my subject needs a lot of visuals because some of the things happen where they have never been.

These visuals are presented with both digital and non-digital media. The affordance of each media form has benefits in showing a particular representation that serves a specific purpose as demonstrated in Table 3.

Slides containing a description of the content on a word document with 3 dimensional features are used. In her
Table 3. Frequency of resources used.

<table>
<thead>
<tr>
<th>Media</th>
<th>Total number used</th>
<th>Detailed distribution of usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICT</td>
<td>17</td>
<td>11/17 – 2D and 3D images</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2/17 – task display</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4/17 – response to questions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 – written text</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 - drawing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4/5 - explanations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/5 – response to questions</td>
</tr>
<tr>
<td>Whiteboard (drawing and writing)</td>
<td>10</td>
<td>3/4 - explanations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/4 - response to questions</td>
</tr>
<tr>
<td>Paper</td>
<td>4</td>
<td>Explanation</td>
</tr>
<tr>
<td>Object (in the classroom)</td>
<td>2</td>
<td>Definition read</td>
</tr>
<tr>
<td>Books – learner resource</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td></td>
</tr>
</tbody>
</table>


use of visuals as a narrative form, she uses an approach
that is non-linear as she engages different media forms to
try and make clear the structure and the process land
forms adopt at different stages of their development. The
feedback she gets from learners as she integrates the ‘visuals’ helps illuminate misconceptions and this prompts
questions she responds to by using different forms of
representation. As she does so, learners’ theoretical
understandings are concretised.

Both Bambisana’s espoused and enacted teaching
practices are driven by her subject’s demands. She
emphasises that learners should be able to identify
geographical features in different forms. The
geographical features are presented in picture, drawing,
3 dimensional colour (slide) and in 2 dimensional black
and white representation.

In this case both, digital and non-digital technologies
support each other as they are integrated into classroom
conversation to enhance learner understanding. It is
evident that while the teacher is aware of the value ICTs
bring to her teaching, she upholds her conventional
teaching and uses technology to augment it.

Teacher practice consistencies

In this study, the consistencies are not an indication of an
isolated use of ICTs but an integration of pedagogical
components that incorporate ICTs as the teacher guides
the learning process.

In general, the espoused practices do not reveal much
of what the role of the teacher is in the integration
process. Teacher enacted practices appear to be an
elaboration of what teachers espouse and a display of
how they put into action what their pedagogical beliefs
are, about ICT integration. The role of the teacher and
that of the ICT become explicit as the pedagogical blend
takes place. During interviews, Bambisana and Mlingani
did not show awareness of the significance of their
communicative role in the integration process. This
emerged in the actual teaching. Teacher communication
augments weaknesses of different media forms as he or
she mediates the concept development. Each teacher
has his or her individual pedagogical belief or
understanding about ICT integration, and that influences
their role in the integration process which is to use
different media forms to make learning happen.

The three teachers value ICTs for their ability to
present concept structure. While digital technology plays
this role, teachers interact with their learners through
conversation in different ways as teachers try and
interpret the meaning of structure.

DISCUSSION

This study sought to analyse three teachers’ practices to
make explicit what ICT pedagogical integration means by
describing their espoused and enacted performances.
The teachers’ desire to enhance learning and teaching
evident in their respective integration methods
contributed to the emerging description of what the
concept entails. The concept of integration appears to go
beyond the infusion of ICTs and extends to the
integration of teachers’ repertoire of pedagogical
resources, including non-digital resources as displayed in
the reviewed version in the next section.

ICT pedagogical integration reviewed

It is evident that there is a need for teachers to drive the
integration process by managing the augmentation as
each medium plays its role in the act of ‘making learning
CONCLUSION

Pedagogy as a process that leads to learning in all cases in this study was guided by the teacher who eagerly drove it in a way that its constructs collaborated as he or she ensured they augment his or her teaching. It is the description of this activity that has revealed what actually happens when ICTs are integrated into teaching.

The purpose of this study was to understand what pedagogical integration entails to help develop a generic ICT teacher training framework. Focus on the positive pedagogical integration experiences has helped provide an 'ideal' understanding of the concept. It is hoped that this study can help ICT teacher trainers identify effective and ineffective ICT pedagogical integration. That should help design modules that give trainees knowledge, skills and attitudes that promote good teaching practices with ICTs.

REFERENCES


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