UNIVERSITEIT VAN PRETORIA
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YUNIBESITHI YA PRETORIA

The integration of interactive whiteboards into classrooms at a well-resourced high school in South Africa

A dissertation of limited scope by

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submitted in partial fulfilment of the requirements for the degree

Magister Educationis
in
Computer-Integrated Education

Department of Science, Mathematics and Technology Education
Faculty of Education
University of Pretoria

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Dedication

This dissertation is dedicated to my late father.

This is the true joy of life… being used for a purpose recognised by yourself as a mighty one…being a force of Nature, instead of a feverish little clod of ailments and grievances complaining that the world will not devote itself to making you happy...

I am of the opinion that my life belongs to the whole community and, as long as I live, it is my privilege to do for it whatever I can. I want to be thoroughly used up when I die. For the harder I work, the more I live. I rejoice in life for its own sake.

Life is no brief candle to me. It's a sort of splendid torch, which I've got to hold up for a moment, and I want to make it burn as brightly as possible, before handing it on to future generations.

George Bernard Shaw

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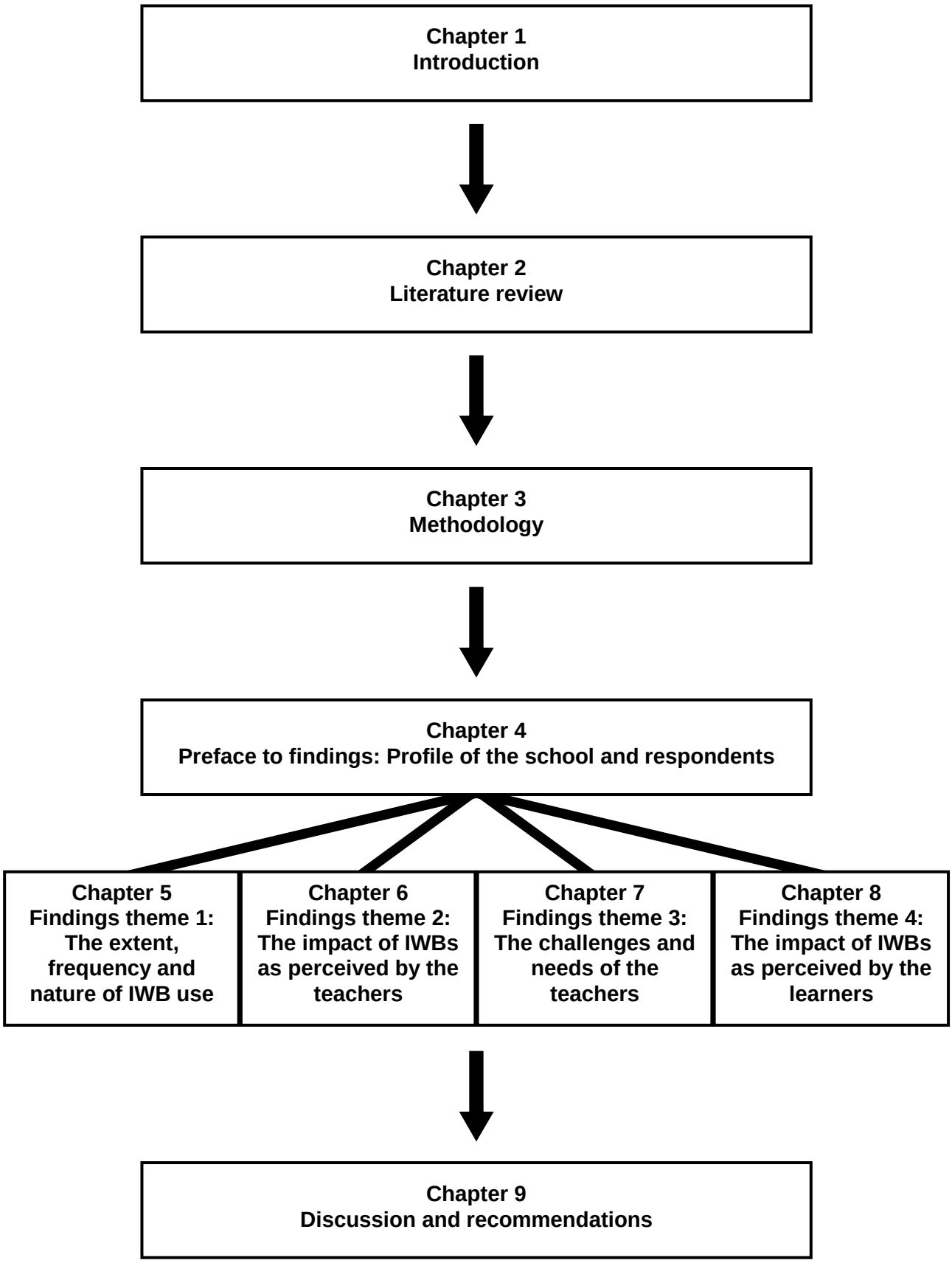

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- Peter and Heather, for their friendship, support, input and words of wisdom
- Patsy... strength and honour!

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Ethical clearance certificate

UNIVERSITY OF PRETORIA

FACULTY OF EDUCATION

RESEARCH ETHICS COMMITTEE

CLEARANCE CERTIFICATE	**CLEARANCE NUMBER :** CS08/07/02
DEGREE AND PROJECT	M.Ed Curriculum studies The Integration of interactive whiteboards into classrooms at a well-resourced high school in South Africa
INVESTIGATOR(S)	Andrew Lewis
DEPARTMENT	Curriculum Studies
DATE CONSIDERED	19 March 2009
DECISION OF THE COMMITTEE	APPROVED

This ethical clearance is valid for 3 *years and may be renewed upon application*

CHAIRPERSON OF ETHICS COMMITTEE Dr S Human-Vogel

DATE 19 March 2009

CC Dr P A Miller
Ms Jeannie Beukes

This ethical clearance certificate is issued subject to the following conditions:

1. A signed personal declaration of responsibility
2. If the research question changes significantly so as to alter the nature of the study, a new application for ethical clearance must be submitted
3. It remains the students' responsibility to ensure that all the necessary forms for informed consent are kept for future queries.

Please quote the clearance number in all enquiries.

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Summary

The integration of interactive whiteboards into classrooms at a well-resourced high school in South Africa

by
Andrew Christopher Lewis

Supervisor: Dr Pamela Ann Miller
Faculty: Education
Department: Department of Science, Mathematics and Technology Education
Degree: Magister Educationis in Computer-Integrated Education

This report describes a case study, in which the researcher investigated the integration of electronic interactive whiteboards (IWBs) into classrooms at a well-resourced South African high school. Consistent with the findings of other studies conducted to date, learners and teachers at the school generally believe that IWB technology enhances various aspects of the teaching-learning process. The frequency and nature of IWB use across the school was found to vary greatly between subject departments and from one user to the next within subject departments. In comparison to IWB use in schools overseas, as reported in the literature, general IWB utilisation was found to be relatively infrequent and superficial in nature, with only the basic features and capabilities being widely utilised. In terms of the progression models that have been proposed for IWB integration, it appears that, overall, this school has not advanced beyond the initial stage of integration described in each of the respective models.

This study attempted to determine why such a well-resourced school has not progressed further with the integration of IWBs in the five years that have passed since IWB technology was first introduced there, in spite of the fact that the teachers appear to recognise the value of the technology and express the desire to improve their use of the IWB. Results suggest that the major factors responsible for retarding progress are inadequate training and the lack of time available for teachers to explore the potential of IWB technology and build up a bank of useful resources. These issues appear to be linked to inadequate research and strategic planning on the part of the school management team.

In conclusion, this report proposes a strategy for the integration of information and communications technology (ICT) into South African high schools, with a view to promoting the integration of IWBs in the long term. The essence of the proposal is that teachers should make use of a data projector, which projects its image on to a conventional whiteboard writing surface. This approach would allow teachers to take advantage of the visual features of ICT they most readily recognise as beneficial when they first use IWB technology. The aim of this strategy would be to encourage teachers to improve their ICT skills and grow in confidence in the use of ICT in their lessons, while minimising the cost involved in allowing them to do so.

List of keywords

- Education
- Funding ICT integration
- ICT integration strategy
- Information and communications technology
- Interactive whiteboards
- Interactivity
- IWB integration model
- South African high schools
- Teacher confidence
- Teacher training

List of abbreviations

- **ICT:** Information and communications technology / technologies
- **IWB:** Interactive whiteboard
- **IWBs:** Interactive whiteboards
- **UK:** United Kingdom
- **WCED:** Western Cape Education Department
- **TPB:** Theory of Planned Behaviour

Terminology

- The word "**learner**" is used in preference to "pupil" or "student".
- The word "**teacher**" is used in preference to "educator".

Software cited

- Autograph – Eastmond Publishing
- Casio Calculator Emulator – Casio
- Class Performance System – eInstruction
- Inspiration – Inspiration Software
- MS Excel – Microsoft Corporation
- MS PowerPoint – Microsoft Corporation
- MS Word – Microsoft Corporation
- Multimedia Science School – RM and PLATO Learning
- Open Office Calc – OpenOffice.org
- Open Office Writer – OpenOffice.org
- The Geometer's Sketchpad – Key Curriculum Press
- VLC Media Player – VideoLAN Free Software

CHAPTER 1
INTRODUCTION

Research questions

Theme 1
The extent, frequency and nature of IWB use in classrooms

1.1 How are IWBs distributed across the school, and how frequently do learners encounter them?

1.2 How frequently are the existing IWBs being used by the teachers and what factors influence their frequency of use?

1.3 What features of IWBs are being used by the teachers, and how frequently?

1.4 What resources and equipment do teachers use in combination with IWBs?

1.5 How frequently are the existing IWBs being used by the learners and what features are they using?

Theme 2
The impact of IWBs on teaching and learning as perceived by teachers

2.1 What is the general attitude of teachers towards IWBs?

2.2 What attitude do teachers perceive the learners to have with regard to the IWB?

2.3 What impact do teachers perceive IWB use to have on learners' behaviour, attentiveness, motivation and productivity?

2.4 What impact do teachers perceive IWB use to have on the learning process, specifically with regard to their effect on learners' understanding, retention and performance?

2.5 What impact do teachers perceive the IWB to have on lesson planning, preparation and resource development?

2.6 What impact do teachers perceive the IWB to have on presentation, teaching styles and classroom management?

continued/...

.../continued

Theme 3
The challenges and needs of teachers with regard to IWB use

3.1 How competent do teachers using IWBs perceive themselves to be in their use of the IWBs, and how do they believe the learners perceive their use of the IWB?

3.2 What factors do teachers believe influence the effectiveness of their use of IWBs?

3.3 What formal training did teachers receive in the use of IWBs, and how effective was this training perceived to be?

3.4 Do teachers feel the need to improve their use of IWBs and, if so, how do they believe they could best achieve this?

3.5 What perceptions do teachers have of the resources available for use with IWBs?

3.6 How do teachers feel about integrating ICT in the form of the IWB into their teaching, as opposed to using a data projector alone, or making use of computers in a dedicated computer laboratory?

3.7 What limitations, technical or otherwise, do teachers perceive to be preventing them from using IWBs more effectively?

Theme 4
The impact of IWBs as perceived by learners

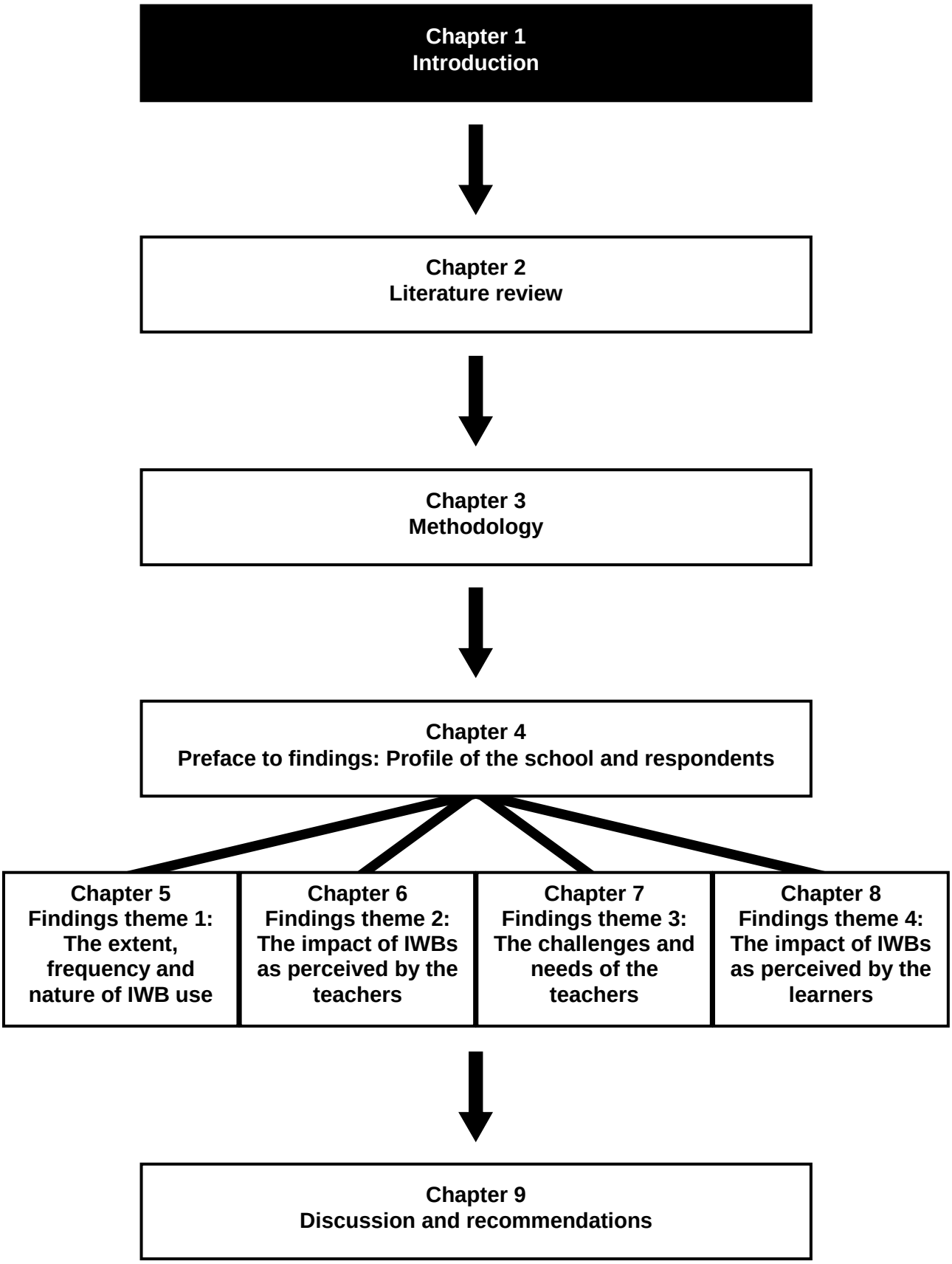
4.1 What is the learners' perception of the level of competency in IWB use amongst teachers?

4.2 What impact do learners perceive the IWB to have on their teachers and the manner in which they facilitate lessons, specifically with regard to the pace of lessons, the teacher's ability to capture and hold their attention, and the presentation and aesthetic appeal of the teacher's audiovisual aids?

4.3 What impact do learners perceive use of the IWB to have on the learning process, specifically on their understanding, retention and productivity?

4.4 What impact do learners perceive use of the IWB to have on their personal behaviour, attentiveness and motivation, and the behaviour of their fellow learners?

Outline of dissertation



Chapter 1: Introduction

"Our world is changing, and information and communication technology is central to this change. Digital media [have] revolutionised the information society. [Advances] in ICT have dramatically changed the learning and teaching process, and have expanded new learning opportunities and access to education resources beyond those traditionally available."

Professor Kader Asmal, MP
(Department of Education, 2003, p.3)

"A global revolution is taking place in education and training. It is driven by the nature of work, the realities of the information age, new global partnerships and an awareness of the need for equal distribution of educational opportunities."

Department of Education (2004, p. 8)

"Information and communication technologies are becoming more and more integral to the lives of South Africa's citizens. To prepare them for their adult working lives, but also to enhance their education, learners are being given access to computers and other digital resources as an integral part of their preparation for the National Senior Certificate."

WCED (2007, p. 4)

1.1 Introduction

One of the major changes that have taken place in South Africa since 1994 has been the revision of the national school curriculum. A key objective of the revised curriculum is to improve competence in the use of information and communication technologies (ICT) amongst learners and teachers. The importance of ICT has been recognised and highlighted by the South African Department of Education, which has formulated detailed policies and guidelines for the integration of ICT into schools (Department of Education, 2003).

The integration of ICT into the curriculum thus far has not been consistent throughout the country and the "disparities reflected in South African society [...] find expression in ICT integration into education" (Department of Education, 2004, p. 12). Schools in Gauteng, the Western Cape and the Northern Cape generally have significantly more advanced ICT infrastructure than schools in the Eastern Cape and Limpopo (Department of Education, 2003). On average the infrastructure in the Free State, KwaZulu-Natal, Mpumalanga and North West lies between the two extremes. As part of the conscious effort to advance the integration of ICT into teaching and learning, several education departments across the country have considered investing in electronic interactive whiteboards (IWBs), following the recent trends in more developed countries around the world (Slay, Siebörger and Hodgkinson-Williams, 2008b).

Over the last decade there has been a strong move in the United Kingdom (UK) to introduce electronic interactive whiteboards (IWBs) into classrooms on a vast scale, most notably in England

(Higgins, Beauchamp and Miller, 2007; Smith, Higgins, Wall and Miller, 2005). Vast sums of money have been invested in interactive whiteboard (IWB) technology (Hennessy, as cited in Schroeder, 2007, p. 65; Parkinson, as cited in Schroeder, 2007, p. 65), in the belief that it will lead to enhanced learning and improved learner performance. This has led to a marked increase in research into the use of ICT, and more specifically IWBs, in teaching, at primary and secondary schools (Higgins et al., 2007; Schroeder, 2007; Smith et al., 2005). When IWBs were first introduced, it was thought that what would make them unique amongst other ICT tools was the potential they held for facilitating effective learning by promoting more extensive interaction amongst learners, and between learners and the teacher, through physical interaction with the board (Smith, *et al*., 2005). While initial research findings generally suggested that both learners and teachers regarded IWBs favourably, the literature was largely descriptive (Higgins et al., 2007) and there has been little empirical evidence to support the claim that IWBs have an effect on learner performance (Smith et al., 2005). And while the majority of research reports show that IWBs are having an impact within the classroom, studies that have attempted to quantify the impact in terms of a resultant improvement in learner performance report results that are "wide ranging" (Smith, Hardman and Higgins, 2006).

As IWB use has become more widespread over the last ten years, various questions have arisen. Is the interactive whiteboard proving to be the revolutionary tool its promoters promised originally? Given the significant financial investment which a properly functioning IWB-setup represents, can the cost be justified, in all educational contexts? What impact has the introduction of IWBs had in South African schools thus far? What should teachers, researchers and investors who wish to improve the teaching-learning experience in this country bear in mind as they consider investing in IWB technology? What training and technical support is necessary in order to ensure that IWB technology is successfully integrated into the classroom? What distinguishes successful integration of IWB technology in the classroom from failed attempts?

This first chapter of the dissertation provides an overview of this study, outlining the background to the study, the motivation for the study and the rationale behind it. Consideration is given to both international and local perspectives. The research problem is defined and then the aim of the research is described in more detail. A description of the research plan follows, and this includes a discussion of the structure of this study and an outline of the approach adopted by the researcher. The measures taken to ensure sound reliability, validity and credibility in this study are described briefly, together with an outline of the methodology, the research design, the data collection methods and the ethical considerations associated with this study. Towards the end of this chapter brief consideration is given to related studies, which are discussed in greater depth in the literature review. Mention is made of the limitations of this study and the research contribution which the researcher hoped this work may provide.

1.2 Background

Towards the end of 2005, the researcher was involved in a discussion on the topic of interactive whiteboards (IWBs) and their potential introduction into South African schools. At the time, the Western Cape Education Department was inviting the distributors of the various brands of interactive whiteboard (IWB) to market their wares. Since the beginning of 2006, several South African schools have invested a considerable amount of money in the acquisition and installation of these whiteboards, following in the footsteps of schools around the world, perhaps most notably in the United Kingdom (Schroeder, 2007). In England, in particular, the government has endorsed the technology and commissioned extensive programmes involving the installation of IWB's in schools throughout London (Higgins et al., 2007; Moss et al., 2007).

After doing some research, the researcher decided to invest in an IWB personally, and purchased a SMARTboard IWB in March 2006. By the end of 2006, he had reached the point where he was reasonably competent in the use of its basic features, and readily used it in virtually every lesson, on a daily basis, in preference to a normal whiteboard. However, he believed that he was far from exploiting its full potential. In spite of this, within the school where he was teaching, he was widely regarded as one of the most competent IWB users.

1.2.1 Motivation for the study

The importance of the role ICT is playing in the global work environment, and its impact on society at large, are becoming ever more apparent. The fact that ICT is such an integral part of everyday life has been recognised by the South African Department of Education. In revising the national curriculum and formulating the National Curriculum Statement, the Department has recognised that it needs to prepare the country's learners for their adult working lives by educating them in the use of computers and other digital resources (WCED, 2007). In order to achieve this, the teachers need to be equipped with the skills required to integrate ICT into their teaching, so that they may assist the learners directly by improving their ICT skill levels, or indirectly, by exposing them to the use of ICT in the learning process.

The school where the researcher taught from July 2006 to March 2009, and which is the subject of this study, is financially well-resourced and prides itself in being at the cutting edge of South African education and providing its learners with access to top class facilities, including up-to-date ICT resources. After a trial period which began towards the end of 2004, during which two IWBs were purchased and made available for use by staff, several IWBs were installed at the beginning of 2006 and over the next three years further boards were installed. By the time this study commenced in the middle of 2008, several teachers had thus had a significant period in which to become accustomed to the IWBs and explore their possible uses. Others, who had gained access

to an IWB more recently, were apparently yet to become acquainted with the full range of IWB features available for use in the classroom, in spite of the fact that some initial training had been offered at the time the IWBs were installed. The researcher was under the impression that little in the way of formal training had been offered to teachers at the school, and most teachers appeared to have acquired their skills informally. Although the school is very well-resourced, there appeared to be little on offer to teachers in the way of general ICT training, and it appeared that the ICT support team had (perhaps by necessity) focussed on resolving technical issues and hardware problems in recent years.

Various questions relating to IWB use arose during the researcher's discussions with colleagues, some of whom were strongly in favour of the use of IWBs, while others appeared to be strongly opposed to their use, for various reasons. The researcher suspected that, in general, the IWBs in the school were being underutilised, largely as a result of a lack of training and ongoing technical and developmental support. He believed that, if this was indeed the case, it would be worthwhile to determine why a more structured integration policy was not instituted when the IWB installation programme began. He also hoped to determine the current needs of the teachers with regard to IWB use and support, and possibly propose a strategy to facilitate improved utilisation of IWBs throughout the school.

In October 2006 the school embarked on a "learning styles programme", the aim of which was to create greater awareness of the fact that learners have differing learning styles. This philosophy promotes the idea that new information should be presented to learners through auditory and visual media, as well as through interactive media (allowing for kinaesthetic learning), where learners have the opportunity to engage interactively with the material and with each other (Dunn, Griggs, Gorman and Olson, 1995). Promoters of IWBs advocate them as ideal learning tools for promoting the incorporation of different presentation and teaching styles in the learning process, and thus accommodating different learning styles. Thus it seemed as though improving the use of IWBs by the teachers could form an integral part of the school's plan to integrate the learning styles programme in the classroom. This seemed like a good opportunity to improve IWBs use for the sake of achieving an important educational goal, rather than simply for the sake of increasing the use of ICT in the classroom.

1.2.2 Rationale

The aim of this study was to determine the extent to which IWBs had been integrated into the school. Taking into consideration the studies of IWB use and integration which had been conducted in the decade preceding this study, the researcher identified key themes in the research and trends which had been reported. Informed by current trends and recent research, and in order to operationalise the research aim, various aspects of the IWB integration programme at the school

were considered. These were divided into four main areas of consideration, which led to the formulation of the four main research questions. The aspects of IWB integration which were chosen for consideration are listed below.

- The extent, frequency and nature of IWB use in the classrooms
- The impact of IWBs on teaching and learning as perceived by teachers
- The challenges and needs of teachers with regard to IWB use
- The impact of IWBs as perceived by the learners

The researcher decided to collect data through questionnaires and interviews, for various reasons. Given the nature of the school environment and the implicit pressure which teachers appeared to be under, it was felt that observation of lessons may be too intrusive. It was also the intention of the researcher to avoid collecting data on specific teachers from the learners. The aim of the research was rather to determine the global trends in the school, with a view to providing the school management team and the teachers with recommendations for a strategy that would allow more effective use of IWB technology around the school.

The literature review informed the research proposal, which took into account the specific characteristics of the school and its staff, including internal politics. It was hoped that the collection and analysis of the data from within the school would give the staff and learners some sense of ownership of the study, and that they would thus be more receptive when presented with the recommendations of the study, than if the findings of studies conducted elsewhere were presented to them. It was hoped that this study may be the first step in the process of evaluation and reflection, followed by the revision of strategies and the possible implementation of new ideas, which could lead to a spiralling cycle of evaluation, reflection and improvement over the next few years. It was also hoped that this research may assist other South African schools, and possibly provincial education departments who are introducing ICT, and specifically IWB technology, into classrooms or instituting policies relating to the integration of ICT into classrooms.

It was the intention of the researcher that, at the very least, this research project may provide insight into how a group of South African learners and teachers perceive the use of IWB technology in the high school environment in which they find themselves. It was hoped that data collected from the participants would provide an indication of the extent to which the IWB technology is enhancing the teaching-learning process for both teachers and learners. Depending on the outcomes of the study, there was the possibility that careful consideration of the findings could assist in the process of improving the effectiveness of IWB integration initiatives undertaken by other schools and education departments in the future.

It was the researcher's hope that the findings of this research project may add to the general understanding of how teachers integrate ICT and specifically IWB technology into their classrooms, and what factors determine the degree to which IWB technology is successfully integrated. The researcher hoped to determine what lessons could be learnt in the context of this particular school environment and possibly applied in other South African schools where financial and other restrictions have delayed the adoption and integration of ICT, and specifically IWBs, in the classroom over the last few years. He believed that lessons learnt in the context of the school may help to streamline the adoption of ICT, or at least the integration of IWBs, in other schools. He was aware of the fact that an outcome of the study may indeed be to advise against the installation of IWBs in classrooms in South African schools.

Rudd (2007) suggests that researchers investigating the use and effectiveness of IWBs have reached the point where they are no longer considering simply whether IWBs are good or bad. The issue of IWB use has now become more complex, and Rudd suggests that the aim of current and future research should be to determine the optimum conditions for effective use of IWBs, and identify the factors that will support effective use of IWBs. He suggests that it is vital for researchers to consider what is likely to influence future developments in the field of IWB use, and to determine what evidence is required to support the implementation of changes that will enhance IWB use.

1.3 Research Problem

The aim of this research was to investigate the integration of IWBs in classrooms at a well-resourced South African high school, with a view to determining what lessons learnt in the context of the particular school could prove valuable in the wider context of South African high school education. The overarching research question was thus "What impact has the introduction of IWBs had on the teaching-learning process at a well-resourced South African high school?" This question was operationalised and given greater definition through its expansion into four major research themes, each of which is directly related to the primary aim of the research. The four research themes were as follows.

- The extent, frequency and nature of IWB use in the classrooms
- The impact of IWBs on teaching and learning as perceived by teachers
- The challenges and needs of teachers with regard to IWB use
- The impact of IWBs as perceived by the learners

The exploration of each of these themes involved the formulation of further research questions, which gave each theme greater definition. The research questions associated with each research theme are presented in **Table 1**, which follows.

Table 1: Research themes and associated research questions

	Research themes		Research questions
1	The extent, nature and frequency of IWB use in classrooms	1.1	How are IWBs distributed across the school, and how frequently do learners encounter them?
		1.2	How frequently are the existing IWBs being used by the teachers and what influences their frequency of use?
		1.3	What features of IWBs are being used by the teachers, and how frequently?
		1.4	What resources and equipment do teachers use in combination with IWBs?
		1.5	How frequently are the existing IWBs being used by the learners and what features are they using?
2	The impact of IWBs on teaching and learning as perceived by teachers	2.1	What is the general attitude of teachers towards IWBs in teaching?
		2.2	What attitude do teachers perceive the learners to have with regard to the IWB and its impact on lessons?
		2.3	What impact do teachers perceive the IWBs to have on learners' behaviour, attentiveness, motivation and productivity during lessons?
		2.4	What impact do teachers perceive IWBs to have on the learning process, specifically with regard to their effect on learners' understanding, retention and productivity?
		2.5	What impact do teachers perceive IWBs to have on teaching, specifically with regard to lesson planning, preparation and resource development?
		2.6	What impact do teachers perceive the IWB to have on teaching, specifically with regard to lesson facilitation, presentation, teaching styles, classroom management, interactivity and accommodating different learning styles?
3	The challenges and needs of teachers with regard to IWB use	3.1	How competent do teachers using IWBs perceive themselves to be in their use of the IWBs, and how do they believe the learners perceive their use of the IWB?
		3.2	What factors do teachers believe influence the effectiveness of their use of IWBs?
		3.3	What formal training did teachers receive in the use of IWBs, and how effective was this training perceived to be?
		3.4	Do teachers feel the need to improve their use of IWBs and, if so, how do they believe they could best achieve this?
		3.5	What perceptions do teachers have of the resources available for use with IWBs?
		3.6	How do teachers feel about integrating ICT in the form of the IWB into their teaching, as opposed to using a data projector alone, or making use of computers in a dedicated computer laboratory?
		3.7	What limitations and stumbling blocks, technical and otherwise, do teachers perceive to be preventing them from using IWBs more effectively?
4	The impact of IWBs as perceived by the learners	4.1	What is the learners' perception of the level of competency in IWB use amongst teachers?
		4.2	What impact do learners perceive the IWB to have on their teachers and the manner in which they facilitate lessons, specifically with regard to the pace of lessons, the teacher's ability to capture and hold their attention, and the presentation and aesthetic appeal of the teacher's audiovisual aids?
		4.3	What impact do learners perceive use of the IWB to have on the learning process, specifically on their understanding, retention and productivity?
		4.4	What impact do learners perceive use of the IWB have on their personal behaviour, attentiveness and motivation, and the behaviour of their fellow learners?

1.4 Aims of the research

The aim of this research project was to investigate the integration of electronic IWBs into classrooms at a well-resourced South African high school. From data captured in questionnaires and interviews the researcher hoped to determine, firstly, the extent to which existing IWBs were being used at the school. The "*extent* of IWB use" was taken to include the *frequency* with which IWBs were being used, and the *nature* of the use. It was intended that consideration would be given to the features and capabilities of IWBs that were being utilised by teachers and learners, as well as the resources and equipment that were being used in combination with the IWBs. Data was to be gathered from both learners and teachers in order to explore these issues.

Another key interest of this study was the impact teachers perceived the IWBs to have on teaching and learning. Where teaching was concerned, teachers were asked to consider any impact the IWB was having on their lesson planning, preparation and resource development, as well as their style of teaching. The researcher hoped to determine whether or not use of the IWB has changed teaching practice at the school in any way. Where learning was concerned, teachers were asked to consider the impact of IWBs on issues such as learner behaviour, attentiveness and motivation, as well as the learning process, and learners' understanding, retention and performance.

Another purpose of this study was to investigate the perceived challenges and the needs of the teachers that were using IWBs, in the hope of gaining some insight into the general attitude of teachers towards this technology, and the challenges and fears they face as they consider using IWBs. The researcher hoped to ascertain the level of competence and confidence amongst teachers that are using IWBs and determine their perceptions of the processes involved in the introduction of IWBs into the school, and the subsequent management and evaluation of the implementation process. This study also sought to determine what the teachers believed may help them to improve their use of the technology and realise its full potential. In order to gain a wider perspective of teachers' perceptions of IWBs, a group of teachers who had access to a data projector, but no IWB were also included in the study.

This study also sought to ascertain what impact (if any) the learners perceived IWBs to have on teaching and learning. Learners were asked to give consideration to any effect IWBs may have on their behaviour, attentiveness and motivation, as well as their understanding, retention and performance. They were asked to consider their perceptions of teachers' use of IWBs in the school.

It was hoped that this investigation would reveal the extent to which teachers at this school have integrated the IWB into the planning and execution of lessons, and how well they are utilising the capabilities of the IWB relevant to teaching and learning at secondary school level.

It was hypothesised that the IWBs in the school were being underutilised, largely as a result of a lack of training and ongoing technical and developmental support. If this was found to be the case, it was hoped that insight could be gained into the reasons why a more structured integration policy was not instituted when the IWB installation programme began.

The researcher hoped to determine what lessons could be learnt in the context of this school and applied in other schools, where financial and other restrictions have delayed the adoption and integration of ICT in the classroom over the last few years. It was hoped that lessons learnt in the context of this school may help to streamline ICT, or at least IWB, integration in other South African schools.

The findings of this research are compared to what is reported in the literature (mainly from research at schools in the United Kingdom). The relevance of the findings in the South African context is discussed, with particular reference to possible implications for IWB funding and ICT integration policies in South African schools over the next few years.

1.5 Research design and methodology

This study began in 2007, with the researcher recognising that there was a need for IWB use to be evaluated and reviewed at the school where he was working. Once the researcher had identified this need, he approached the Head of Information Technology and the Director of Academic Studies to determine whether they recognised the need for such a study and also to establish whether they would see value in the findings resulting from this investigation. They were supportive of the idea and believed it would be a valuable exercise. After conducting a substantial review of the literature available on studies of the use of IWBs, the researcher set about determining how best to structure the study and began designing the study.

Based on previous studies described in the literature, and informal observations within the context of the school, the researcher identified key issues that needed to be addressed in the study. These issues led to the formulation of a provisional list of research questions which the study would attempt to answer. The needs of the school and the teachers were discussed in greater detail with the Head of Information technology, and this led to the research questions being refined in an attempt to give the study clearer focus.

1.5.1 Structure of this research report

The report on this study is divided into nine chapters. **Table 2** provides a summary of the structure of the report, including a brief description of the contents of each chapter.

Table 2: Overview of research report

Ch.	Main heading	Summary of content
1	**Introduction**	• Statement of the research problem • Background to the study • Aims and motivation for the study • Outline of design and methodology • Related studies and potential research contribution
2	**Literature review**	• Synthesis of literature published in the last decade • Description of IWB technology • Overview of existing models for ICT and IWB integration in schools • Discussion of existing literature on IWB distribution and the nature of use in schools • Discussion of existing literature on the impact of IWBs as perceived by teachers • Discussion of existing literature on the challenges and needs of teachers • Discussion of existing literature on the impact of IWBs as perceived by learners • Summary of studies of IWB use in South Africa
3	**Methodology**	• Description of methodology underpinning the study • Overview of data collection and analysis • Discussion of measures taken to maximise reliability and validity • Discussion of ethical considerations
4	**Preface to findings** Profile of school and respondents	• Description of the school • Profile of learners • Profile of staff
5	**Findings theme 1:** The extent, nature and frequency of IWB use	• Findings related to IWB distribution • Findings related to the frequency and nature of IWB use by staff and learners
6	**Findings theme 2:** The impact of IWBs as perceived by the teachers	• Findings related to teachers' perceptions of the impact of IWBs on the learners and the learning process • Findings related to teachers' perceptions of the impact of IWBs on teaching
7	**Findings theme 3:** The challenges and needs of the teachers	• Findings related to teachers' perceptions of their own competence and confidence • Findings related to teachers' perceptions of training and technical support • Findings related to problems and needs identified by teachers
8	**Findings theme 4:** The impact of IWBs as perceived by the learners	• Findings related to learners' perceptions of the impact of IWBs on the learning process • Findings related to learners' perceptions of the impact of IWBs on their teachers and the teaching process • Comparison of learners' responses with teachers' responses
9	**Discussion and recommendations**	• Discussion of the findings and how they relate to existing literature • Recommendations for future policy making and further research • Proposed strategy for ICT integration aimed at promoting future IWB integration

Table 2 provides a summary of the contents of each of the nine chapters included in this research report. Following this introductory chapter, is a review of relevant literature, most of which was

published within the last decade. The methodology adopted in this study is then discussed and this is followed by five chapters in which the findings of this study are presented. The research report ends by discussing the findings of this study, the conclusions arising from the findings, and a possible ICT adoption strategy that may lead to the successful integration of IWBs in the future. What follows immediately is a discussion of the approach adopted by the researcher in this study.

1.5.2 Research approach

This study is essentially a case study, which strives "to contribute to action and intervention" (Cohen, Manion and Morrison, 2005, p. 79). It considers a particular school as a single case, within the South African context. It strives to incorporate the defining characteristics of a case study as it attempts to portray the use of IWB technology within the school. The study attempts an in-depth analysis of the situation, drawing on input from numerous learners and teachers. It represents a sincere effort by the researcher to "present and represent reality" (p. 79) with integrity, incorporating elements of reflective teaching.

This study draws on a wide range of data, both qualitative and quantitative in nature. Teachers and learners completed comprehensive questionnaires, and the data from the questionnaires was enriched by data collected during interviews. This study endeavours to determine what can be learnt from this particular case, in an effort to allow policy makers in other contexts to make more informed decisions with regard to the integration of technology within the context of high school education in South Africa.

1.5.3 The researcher

The researcher in this study is a high school teacher, with eight years of teaching experience. Although his academic background is in the Natural Sciences, most of his teaching has been in the subject of Mathematics. Since beginning his teaching career, the researcher has endeavoured to explore ways of making lessons more interesting for learners and for himself. He began his teaching career competent in the use of computer technology, and has built on that foundation, investing in ICT equipment for use in his own classroom, as part of his exploration of the potential which technology offers in the teaching-learning environment. He purchased a data projector in 2005 and then an IWB in 2006. By the time the researcher commenced this study, he had been using an IWB regularly, in virtually every lesson, for over two years, and he was thus confident and competent in the use of the basic features of the equipment. The researcher's aim in this study was to determine how effectively IWB technology was being used throughout the school, with a view to providing the platform for further advances in the use of this and similar technology in the future.

1.5.4 The participants

The participants in this study were learners and teachers at a South African high school. Seventeen teachers and approximately two hundred and twenty learners participated in the study. The group of learners consisted of approximately equal numbers of learners from each of the grades 8, 9, 10, 11 and 12, most of whom were selected from two of the boarding houses at the school. These learners completed a questionnaire. With regard to their exposure to IWB use by teachers, the method of selecting learners was effectively random. The teachers who participated in this study were selected based on their access to ICT, and specifically a data projector (without an IWB) or a data projector together with an IWB. These teachers were from a variety of subject departments and they were asked to complete a questionnaire. A small group of teachers, each of whom had fulltime access to an IWB, were invited to participate in an interview. Ultimately five teachers were interviewed.

1.5.5 Data collection methods

Prior to the commencement of this study, and periodically once it was under way, the researcher reviewed relevant literature. The literature formed the foundation of this study. In order to investigate the use of IWB technology at the school, data was collected from teachers and learners, using a combination of questionnaires and interviews. **Table 3** provides a brief description of the data collection instruments and how they were administered.

Table 3: Data collection instruments

	Instrument	Brief description
1	Literature review	Text resources including books and journal articles, both electronic and in print, formed the basis of the literature review. Most of the literature reviewed was published in the five years preceding this study.
2	Questionnaires	Learners completed a paper-based questionnaire, consisting largely of questions requiring responses based on Likert items. Provision was made for additional comments.
		Teachers with permanent access to an IWB completed a paper-based questionnaire. The questionnaire included a combination of open-ended questions and questions requiring responses based on Likert items.
		Teachers with permanent access to a data projector, but no IWB, completed a paper-based questionnaire, consisting largely of questions requiring responses based on Likert items.
3	Interviews	Teachers with permanent access to an IWB were interviewed. The researcher followed a structured interview schedule while conducting the interview. The schedule consisted of open-ended questions.

The data collection instruments described in **Table 3** provided the data used to address each of the research themes presented in this research report. The main research themes, together with the corresponding data collection methods, are presented in **Table 4**. The researcher combined the data collected from the participants with the findings presented in the literature to answer the research questions.

Table 4: Research themes and corresponding data collection instruments

	Research theme	Literature review	Questionnaires	Interview
1	The extent, nature and frequency of IWB use in schools	✓	✓	✓
2	The impact of IWBs as perceived by teachers	✓	✓	✓
3	The challenges and needs of teachers	✓	✓	✓
4	The impact of IWBs as perceived by learners	✓	✓	–

As **Table 4** indicates, it was only the fourth research theme, pertaining to the learners' perceptions, which was not intended to be addressed directly by all three of the different types of data collection instruments. As may have been expected, comments made by the interviewees did ultimately provide insight into the learners' perceptions of IWB use by the teachers.

1.5.6 Validity, reliability and credibility

In an effort to maximise the validity of this research, during the planning phases of this research project the researcher bore in mind that the depth and scope of the data gathered would be critical (Cohen et al., 2005). Through thorough, careful planning of the manner in which the data would be collected, the researcher sought to ensure that the data would be rich, drawing together both qualitative and quantitative data, in an attempt to present the case study as honestly as possible.

Furthermore, the researcher attempted to involve a large number of respondents, within the context of the school, which was the focus of this study. All teachers who had regular access to an IWB, and all except one of the teachers with permanent access to a data projector (but not an IWB) were invited to participate in the study. Fifteen of the twenty-one teachers with frequent access to an IWB, and all of the teachers with data projectors only, who were invited to participate in the study, completed questionnaires. The respondents included members from all except one of the subject departments in which an IWB was present. The head of the IT department, which was not represented by a respondent in the questionnaire, did participate in an interview. Ultimately data was collected from teachers in ten of the fifteen subject departments, either through one or both of the two questionnaires and / or the interviews. The five subject departments which were not represented in the study did not have a data projector (and hence no IWB) installed at the time this study commenced.

With regard to the learners, the researcher attempted to collected data from a broad, representative sample of the learners across all grades, of varying academic ability, and with a variety of subject choices. The learners were selected based on the boarding establishment in which they resided. Learners from two boarding houses were invited to participate in the study.

As far as this study is concerned, the allocation of learners to boarding houses is effectively random, and thus the sampling is effectively random. In addition to this, learners whose academic tutors had regular or permanent access to an IWB were also invited to complete the questionnaire. Approximately 40% of the learner population ultimately participated in the study, by completing the learner questionnaire. Each of the grades was well-represented amongst the respondents, with participant numbers per grade ranging from 36 (from the grade 11 group) to 50 (from the grade 8 group). With regard to subject choice, each of the subject departments was fairly represented by the learners, with differences in representation related to the number of IWBs present in each department, rather than any bias in sampling.

In order to address the issues of reliability and validity, an attempt was made to implement the principles of triangulation (Cohen et al., 2005) by making use a combination of different data collection instruments (questionnaires and interviews), which yielded a combination of both quantitative data and quantitative data. In so doing the researcher attempted to employ the principle of methodological triangulation. The researcher hoped that there would be a strong correlation between the data gathered in the questionnaires and the data gathered in the interviews, and that a satisfactory level of concurrent validity would thus be demonstrated. The principles of data triangulation were also implemented through the collection of data from three different groups of respondents within the school, teachers with an IWB, teachers with a data projector but no IWB, and the learners. It was hoped that by collecting data in this manner the validity would be improved.

In order to address the issue of reliability with regard to the data collection instruments, the construction of the questionnaires and interview schedules was modelled on instruments that had reportedly been used successfully in previous studies of IWB use. The researcher addressed the issue of reliability in the interviews by conducting structured interviews, using the format and sequence of questions presented in the interview schedules, which are included in the appendices. The researcher attempted to ensure that the questions asked were not leading, or misleading, and consciously attempted to prevent personal views from influencing the responses of the interviewees. The researcher ensured that the data collected during the interviews was dependable by allowing interviewees the opportunity to review the transcripts prior to the inclusion of the data in the final research report.

1.6 Ethical considerations

Throughout this study the researcher endeavoured to ensure that no participants were harmed in any way, and that their privacy was protected. Given that the researcher was conducting the research within his work environment, and that the participants consisted of his colleagues and

learners in his care, it was clearly in his best interest to ensure that involvement in this study was a positive experience for all participants, in the hope that he would maintain good relationships with them. The researcher ensured that he complied with all the requirements of the University of Pretoria's Ethics Committee.

The school within which this study was conducted was a private school. The study was conducted with the permission of the Headmaster of the school (who gave permission on behalf of the school's Board of Governors), the Director of Academics and the head of the Information Technology Department. It was made clear to the teachers and learners, who were invited to participate in the study, that participation was voluntary and that any participant could terminate his / her involvement in the study at any time, even if he / she had agreed to participate initially. Teachers and learners were asked to sign a form indicating that they consented voluntarily to participate in the study. The identities of the participants were protected, with none of their names being used in the research report. All information gathered during the study was held in the strictest confidence.

As a result of the nature of this study and its interest in the use of technology, there was the possibility that some of the participating teachers may experience a sense of failure or inferiority when comparing themselves to each other. For example, there was the likelihood that certain teachers may consider their use of the IWB to be inferior to that of other colleagues. The researcher was sensitive to such issues, and endeavoured to ensure that no participants perceived their involvement as a negative experience. Teachers who completed the questionnaire or participated in the interview were assured that the aim of the study was not to scrutinise individual use of the IWBs, in order to determine who makes best (or worst) use of the technology, but rather to determine how all IWB users (irrespective of their current level of use) may improve their use of the technology so that it may enrich their teaching.

With regard to the interviewing of teachers, the interviewees were given the opportunity to read through the transcriptions of their interviews and indicate whether or not they believed the transcription to be a true reflection of their answers. They were invited to amend any of the answers they had originally given. They were offered access to a copy of the final report.

As far as the learners were concerned, the questions being asked in the questionnaire were not intrusive, and so it was hoped that they would not feel threatened, and that they were happy to answer honestly. It was made clear to them that they were not being asked to evaluate individual teachers.

1.7 Limitations of this study

By virtue of the fact that this study is a case study, one of the limitations is that the data was collected from a particular school environment, which happens to be quite unique within the South African context. Given the nature of the school, and the section of the population from which its learners are drawn, it is not a typical example of a South African high school. The socio-economic backgrounds of the learners are not representative of the South African population as a whole. The demographic composition of both the learner body and the staff is not representative of the South Africa population. The experience, expertise, subject knowledge and computer literacy of the staff are not necessarily typical of most South African schools, and neither are the financial resources nor the infrastructure of the school.

The researcher is of the opinion that the abovementioned limitations of the study will certainly not render the findings irrelevant within the South African context. One of the hypotheses of the researcher is that the school in question has achieved only limited success in its attempt at the integration of IWB technology into teaching. If this is indeed the case, then this study will recommend that very careful consideration be given to similar programmes in schools more typical in terms of their financial and human resources.

This study is limited in its investigation of classroom practice. The researcher elected not to observe nor make video recordings of lessons. Based on the general attitude which the researcher perceived amongst the staff, he believed that teachers would find this too intrusive. The researcher is of the opinion that an observation-based study may be a suitable follow up to this study. This study does not profess to provide an in depth description or evaluation of *individual* use of IWB technology, but rather it seeks to describe the *general* trends of IWB use and the perceptions of teachers and learners.

1.8 Related studies

The majority of research into the use of IWBs in schools appears to have been conducted in the United Kingdom (Schroeder, 2007), where several research teams are involved in ongoing projects (e.g. Moss et al., 2007). Various projects similar in nature to this study are discussed in the review of current literature on the topic. Several authors have published findings relating to various aspects of IWB use. A selection of these papers is reviewed in the second chapter of this research report.

Perhaps one of the most extensive studies conducted to date was that published by Moss et al. (2007), whose aim it was to evaluate the effectiveness of a major IWB integration project in secondary schools in London. This findings published by Moss et al. are discussed in the literature

review and were used by the researcher to inform the planning of this case study and the formulation of the data collection instruments.

At the time this study was conducted, there did not appear to be much evidence of similar studies having been conducted in South Africa. The most prominent local IWB-specific research appeared to be that conducted in the Eastern Cape Province by Slay, Siebörger and Hodgkinson-Williams (2007, 2008a, 2008b, 2008c) who conducted research as part of a feasibility study, and investigated the use of IWB technology by five teachers in three different schools, two of which were secondary schools. The findings published by these researchers are discussed in the literature review.

The literature published by South African research teams who have investigated the more general integration of ICT into teaching is more prolific and mention is made of relevant studies, such as the research conducted by Miller, Naidoo and Van Belle (2006) in the Western Cape Province, in the literature review.

1.9 Research contribution

It is hoped that the findings of this research project may assist South African high school teachers who are considering investing in IWB technology. Given the current economic climate in the country and the cost of an IWB, it is critical that, if a school chooses to invest in the technology, its full potential should be realised. It is also intended that the results of this study may be useful to teachers who already have IWBs installed in their classes, and are looking to harness the full potential of the boards. Furthermore, the recommendations may be of use to national and regional policymakers in planning future technological advances in South African classrooms.

1.10 Chapter one in summary

This chapter has provided an overview of the study, describing the aims of the study and the manner in which it was carried out. It provides a brief description of the motivation for the study, the research design, ethical considerations, its limitations and the potential contribution it may offer to the growing body of research on the use of ICT and specifically IWBs in teaching. The chapter which follows presents a synthesis of the literature that has arisen from studies of IWB use, conducted over the last eight years. It attempts to present a summary of the current thinking on the impact of IWBs on teaching and learning, the general pattern of IWB integration in schools, what constitutes effective use of the IWB and how to foster effective IWB use amongst staff. It

discusses a selection of studies similar in nature to this study and, more specifically, related studies which have been carried out in South Africa.

CHAPTER 2
LITERATURE REVIEW

Research questions

Theme 1
The extent, frequency and nature of IWB use in classrooms

1.1 How are IWBs distributed across the school, and how frequently do learners encounter them?

1.2 How frequently are the existing IWBs being used by the teachers and what factors influence their frequency of use?

1.3 What features of IWBs are being used by the teachers, and how frequently?

1.4 What resources and equipment do teachers use in combination with IWBs?

1.5 How frequently are the existing IWBs being used by the learners and what features are they using?

Theme 2
The impact of IWBs on teaching and learning as perceived by teachers

2.1 What is the general attitude of teachers towards IWBs?

2.2 What attitude do teachers perceive the learners to have with regard to the IWB?

2.3 What impact do teachers perceive IWB use to have on learners' behaviour, attentiveness, motivation and productivity?

2.4 What impact do teachers perceive IWB use to have on the learning process, specifically with regard to their effect on learners' understanding, retention and performance?

2.5 What impact do teachers perceive the IWB to have on lesson planning, preparation and resource development?

2.6 What impact do teachers perceive the IWB to have on presentation, teaching styles and classroom management?

continued/...

.../continued

Theme 3
The challenges and needs of teachers with regard to IWB use

3.1 How competent do teachers using IWBs perceive themselves to be in their use of the IWBs, and how do they believe the learners perceive their use of the IWB?

3.2 What factors do teachers believe influence the effectiveness of their use of IWBs?

3.3 What formal training did teachers receive in the use of IWBs, and how effective was this training perceived to be?

3.4 Do teachers feel the need to improve their use of IWBs and, if so, how do they believe they could best achieve this?

3.5 What perceptions do teachers have of the resources available for use with IWBs?

3.6 How do teachers feel about integrating ICT in the form of the IWB into their teaching, as opposed to using a data projector alone, or making use of computers in a dedicated computer laboratory?

3.7 What limitations, technical or otherwise, do teachers perceive to be preventing them from using IWBs more effectively?

Theme 4
The impact of IWBs as perceived by learners

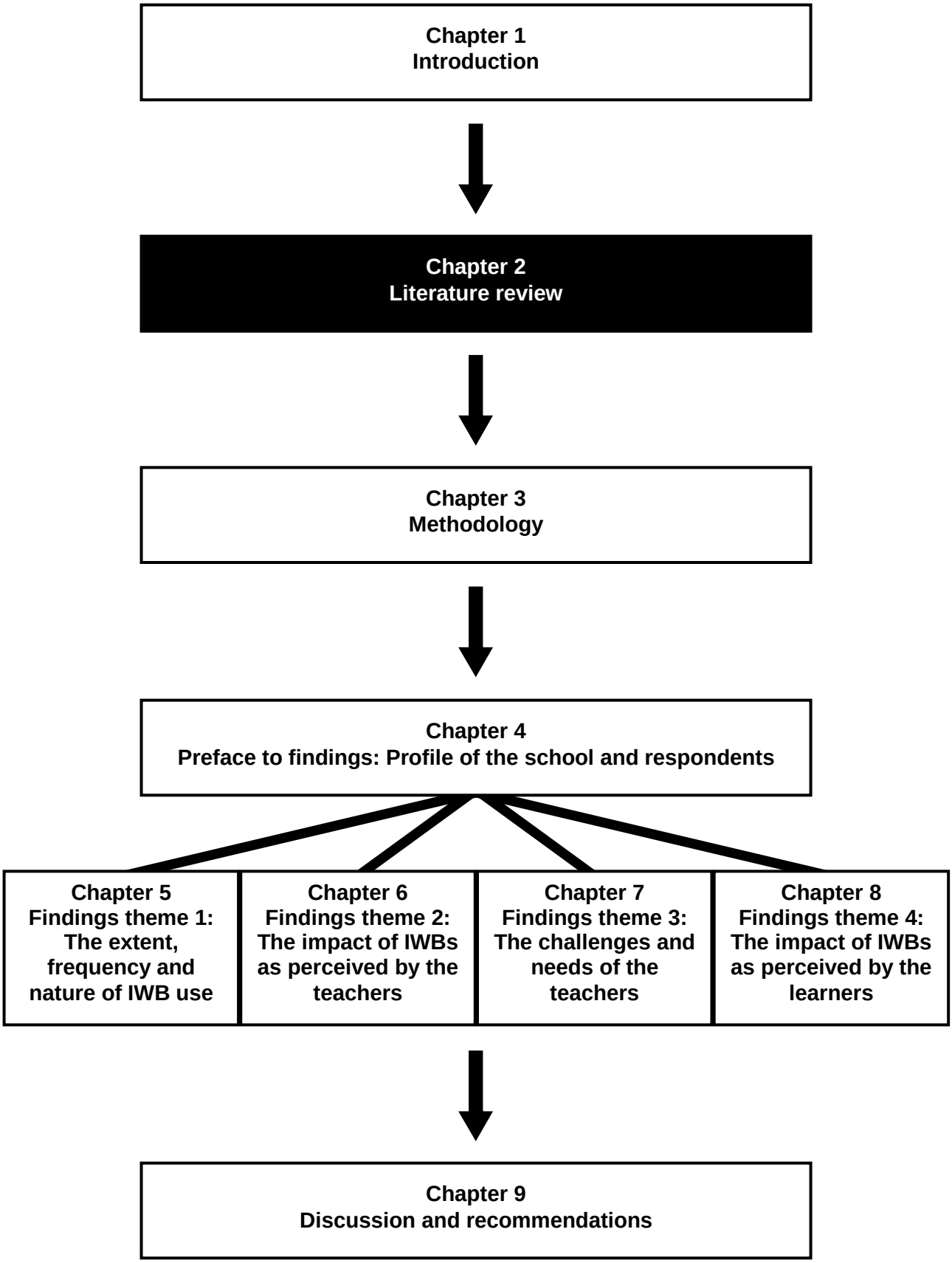
4.1 What is the learners' perception of the level of competency in IWB use amongst teachers?

4.2 What impact do learners perceive the IWB to have on their teachers and the manner in which they facilitate lessons, specifically with regard to the pace of lessons, the teacher's ability to capture and hold their attention, and the presentation and aesthetic appeal of the teacher's audiovisual aids?

4.3 What impact do learners perceive use of the IWB to have on the learning process, specifically on their understanding, retention and productivity?

4.4 What impact do learners perceive use of the IWB to have on their personal behaviour, attentiveness and motivation, and the behaviour of their fellow learners?

Outline of dissertation



Chapter 2: Literature review

2.1 Introduction

The previous chapter provided an outline of this study and the research questions it attempted to answer. This chapter attempts to address the research themes from the perspective of the existing literature, which describes previous studies of the use of interactive whiteboards (IWBs), most of which have been conducted in the United Kingdom. In a later chapter the findings of this study will be presented and then compared to what is reported in the literature. The relevance of the findings of this study, especially in the context of the South African education system, will be discussed, with particular reference to possible implications for IWB funding policies and installation and integration policies in South African schools over the next few years.

The aim of this research project was to investigate the integration of IWBs into classrooms at a well-resourced high school in South Africa. The participants in the study consisted of a group of teachers and a group of learners. The group of teachers invited to participate in the study included a group with access to IWBs, and a group with access to a data projector, but no IWB. The group of learners was randomly selected from each year group in the school. Information was gathered from the learners by means of a questionnaire. Information was gathered from teachers largely by means of questionnaires. A small number of teachers were invited to participate in a structured interview. The set of data captured in the questionnaires and interviews was used to investigate the extent to which existing IWBs were being used at the school, and the impact teachers and learners perceived them to have on teaching and learning. This chapter presents a synthesis of existing literature, with a view to addressing the following themes.

- IWB technology and its potential impact on teaching
- The role of management in the integration of IWB technology into schools
- Current models for the integration of IWBs into teaching
- The extent, nature and frequency of IWB use in classrooms
- The impact of IWBs on teaching and learning as perceived by teachers
- The challenges and needs of teachers with regard to IWB use
- The impact of IWBs as perceived by learners
- IWB technology in the South African context

2.2 The interactive whiteboard (IWB) described

An interactive whiteboard (IWB) consists of a large screen on to which an image is projected by a data projector, which is connected to a computer (refer to **Figure 1**). The projected image is the

same as that which is visible on the computer monitor, magnified so that it is visible to an audience (such as a class of learners), rather than just a single user in front of a personal computer screen. The projection surface (the IWB) is also connected to the computer and is touch sensitive, detecting changes in an electromagnetic field, which occur in response to contact with the surface. It translates contact with the surface of the IWB into a mouse event, which is transferred to the computer and processed (Slay et al., 2007). The IWB thus serves as an interface between the user and the computer.

To quote one of the interviewees in this study, an IWB is "sort of like a giant mouse pad that you would have on a laptop, actually. It allows you to control the computer from the projected surface, [i.e. the] projected image. It has a dual functionality: the one is just controlling the computer and the other is taking it one step further and [allowing you] to actually write on the surface and use what you have written there and so on." **Figure 1** depicts a schematic representation of the IWB setup and the flow of data which takes place.

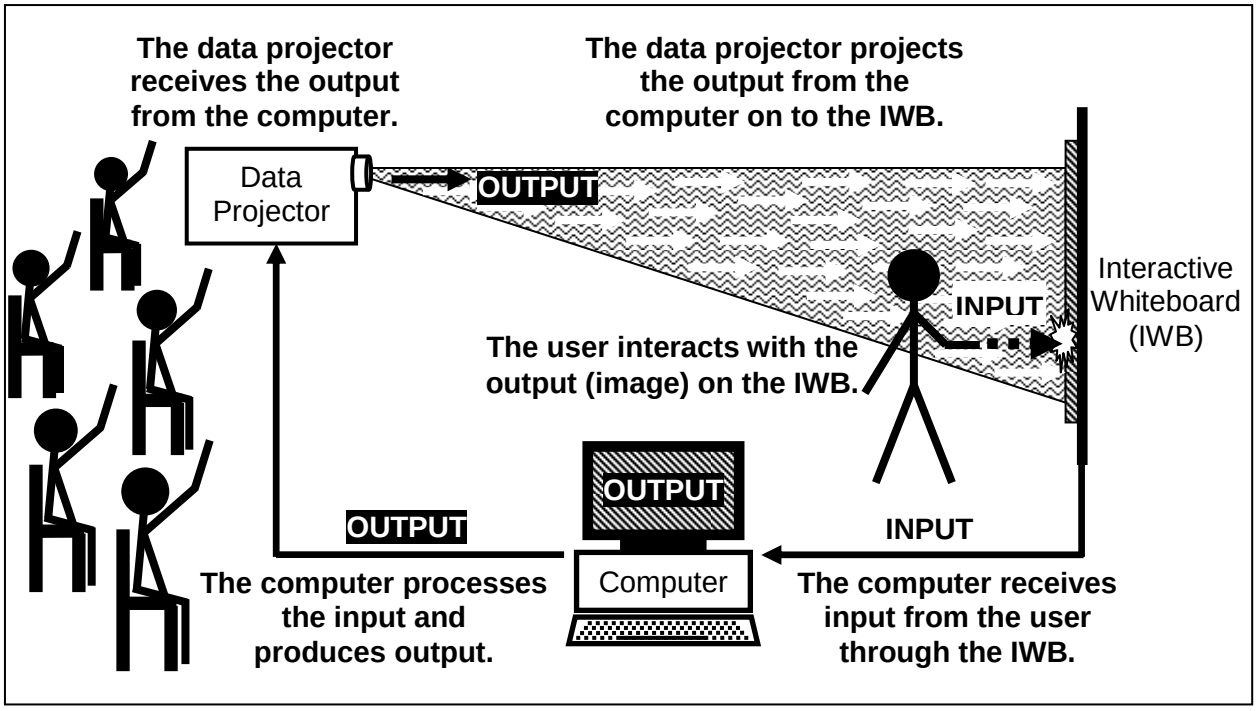


Figure 1: Diagrammatic representation of the typical IWB setup

As **Figure 1** indicates, input from the user is captured by the IWB and transferred to the computer, which processes the input and produces output, which is projected on to the IWB by the data projector. A variation of the concept involves the projection of the image on to any flat surface, with no electronic board present, but rather a radio receiver placed on the edge of the projection area. The receiver receives input from radio-wave emitting pens which are used within the projection area. When a pen is pressed against a hard surface it emits a radio wave, which is detected by the receiver and translated into a mouse event. In this literature review, it is appropriate to use the abbreviation "IWB" and the term "IWB technology" to refer to both setups. Where necessary, a distinction will be made between the two.

Thus, in effect, an IWB (or the equivalent, sans the actual board) serves as an input device which allows the user to control applications while delivering a presentation or facilitating a lesson. It allows the presenter to stand in front of an audience (such as a class of learners) and interact with them and the material being presented, rather than being seated behind a personal computer. Higgins et al. (2007) suggest that a more accurate term for IWBs would be "electronic whiteboards" or "digital whiteboards", but they do point out that the term "interactive whiteboard" has been popularised in the literature over the last ten years and it is the phrase now most commonly found in Internet searches on the topic.

2.3 The IWB: tool for pedagogical change or political quick-fix?

"…technology by itself does not change practice – people do."
(Burden, 2002, p. 6)

"IWBs will not provide some technological fix in order to bring about fundamental change in the underlying pedagogy of whole class teaching."
(Smith et al., 2006, p. 456)

"Good teaching remains good teaching, with or without the technology; the technology might enhance the pedagogy only if the teachers and pupils [engage with it and understand] its potential in such a way that the technology is not seen as an end in itself, but as another pedagogical means to achieve teaching and learning goals."
(Higgins et al., 2007, p. 217)

Over the last decade there has been a strong move to introduce IWBs into classrooms throughout the United Kingdom, most notably in England (Higgins et al., 2007; Smith et al., 2005). Millions of pounds have been invested in IWB technology (Hennessy, as cited in Schroeder, 2007, p. 65; Parkinson, as cited in Schroeder, 2007, p. 65), as part of an initiative to modernise schools, in the belief that this investment will lead to enhanced learning and improved learner performance. This has led to a marked increase in research into the use of ICT, and more specifically IWBs, in teaching, at primary and secondary schools (Higgins et al., 2007; Schroeder, 2007; Smith et al., 2005).

When IWBs were first introduced, it was thought that what would make them unique amongst other ICT tools was the potential they held for facilitating effective learning by promoting more extensive interaction amongst learners, and between learners and the teacher, through physical interaction with the board (Smith, *et al*., 2005). While initial research generally suggested that both learners and teachers regarded IWBs favourably, the literature was largely descriptive (Higgins et al., 2007) and there has been little empirical evidence to support the claim that IWBs have an effect on learner performance (Smith et al., 2005). Smith et al. (2006) concluded from their research that IWBs are having an impact within the classroom, but they indicated that their results are "wide

ranging". Some early studies found that use of the IWB resulted in an improvement in learner behaviour, and more significantly, learner performance (Thompson and Flecknoe, 2003). The suggestion that IWBs may improve learner performance obviously holds great appeal for developing countries, who are seeking to improve education standards and raise the level of learner performance. In the last few years countries such as South Africa have shown an interest in IWB technology. The Western Cape Education Department has installed IWBs in several schools in the Western Cape Province, as part of a pilot project (Walker, as cited in Slay, et al., 2008b, p. 1322).

Slay et al. (2008b) suggest that education departments in developing countries, such as South Africa, should guard against installing IWBs with the purpose of shortcutting the development of ICT skills amongst teachers. In their study of the use of IWB technology in schools in the Eastern Cape, they found that the IWB does provide the opportunity for interactivity, but issues relating to a lack of technical skills and the cost of the IWB, as well as safekeeping and security, detract from the benefits it offers. They conclude that basic ICT equipment in the form of laptops and data projectors should be offered to teachers as a first step along the path towards ICT integration.

Slay et al. indicate that technology should fall in line with pedagogical strategies, rather than dictate them, and suggest that teachers should be allowed to request the technology *they* believe will assist them in their attempts to achieve their pedagogical aims. They emphasise the importance of providing teachers with ongoing training and support. The authors suggest that if IWB technology is to be effectively integrated into classrooms, then an "evolution of ICT related pedagogy is necessary" (p. 1338). They recommend that interactive technology should be *offered* to teachers, rather than *imposed* upon them (*ibid.*).

2.4 Integrating IWB technology in schools: models of progression

Moss et al. (2007, p. 6) report that research into the integration of new technologies, such as IWB technology, into the classroom suggests that "new technologies initially support, then extend and finally transform pedagogy as teachers gradually find out what the technology can do." As early as 2001, Kennewell (2001) recognised three levels of application in the use of IWBs. The first level of application involves simply using the IWB as a projection surface. The teacher does not employ the capabilities and features of the IWB, apart from touching it (or using an electronic pen) instead of using a mouse to point and click.

The second level of application is characterised by the teacher using a finger to point or drag or click for pedagogical purposes. Kennewell indicates that this action may be applied in two ways. Firstly, through interaction with the IWB, a teacher may demonstrate how to use a software

application prior to the learners engaging with it themselves. Secondly, the teacher may interact with the IWB while facilitating a class discussion, responding to and incorporating verbal contributions from the learners (*ibid.*).

At the third level of application the teacher makes use of new pedagogical tools through the IWB. Kennewell (2001) distinguishes between two main types of tools: generic software associated with an IWB and software designed to incorporate IWB features as it addresses specific sections of the curriculum.

Various models have been proposed to describe the process through which new technology is integrated within an educational context. As part of the process of evaluating the integration of IWBs into teaching practice at the school at the centre of this study, it was deemed useful to determine some benchmarks for comparison, based on the research conducted in other educational settings. With this in mind, consideration was given to the models that have been proposed to date to describe the adoption of technology, and specifically IWBs, in schools. These models serve as a useful means of evaluating the progress of a school thus far, and they provide an indication of what the teachers should be striving to achieve as they consider taking another step along the path towards fully integrating IWBs into their teaching. What follows is a description of three such models or frameworks, each of which models the process of IWB integration from a slightly different perspective.

2.4.1 An early three-stage model for the progression of IWB use

Burden (2002) proposed a three-stage process to model the adoption of IWB use, based on a model developed by Gibson (as cited in Burden, 2002, p. 5), originally proposed to describe the stages of development through which a school moves as it acquires and uses new technologies. Burden proposed the model as a means of considering how IWB use may develop in the years which followed, at a stage when IWB technology was still relatively new to schools. The three stages distinguished in this model are “infusion”, “integration” and “transformation”.

For each stage Burden suggests a set of features typical of a school in that stage of development. The features he proposes take into consideration the strategy involved in the acquisition and deployment of IWBs in a school, the general usage patterns of the IWBs, the ICT devices that may be used in conjunction with the IWB and the key characteristics of teaching and learning with the IWB. A schematic representation of Burden’s model is given in **Figure 2**, which also highlights the key features of IWB use associated with each stage of the progression.

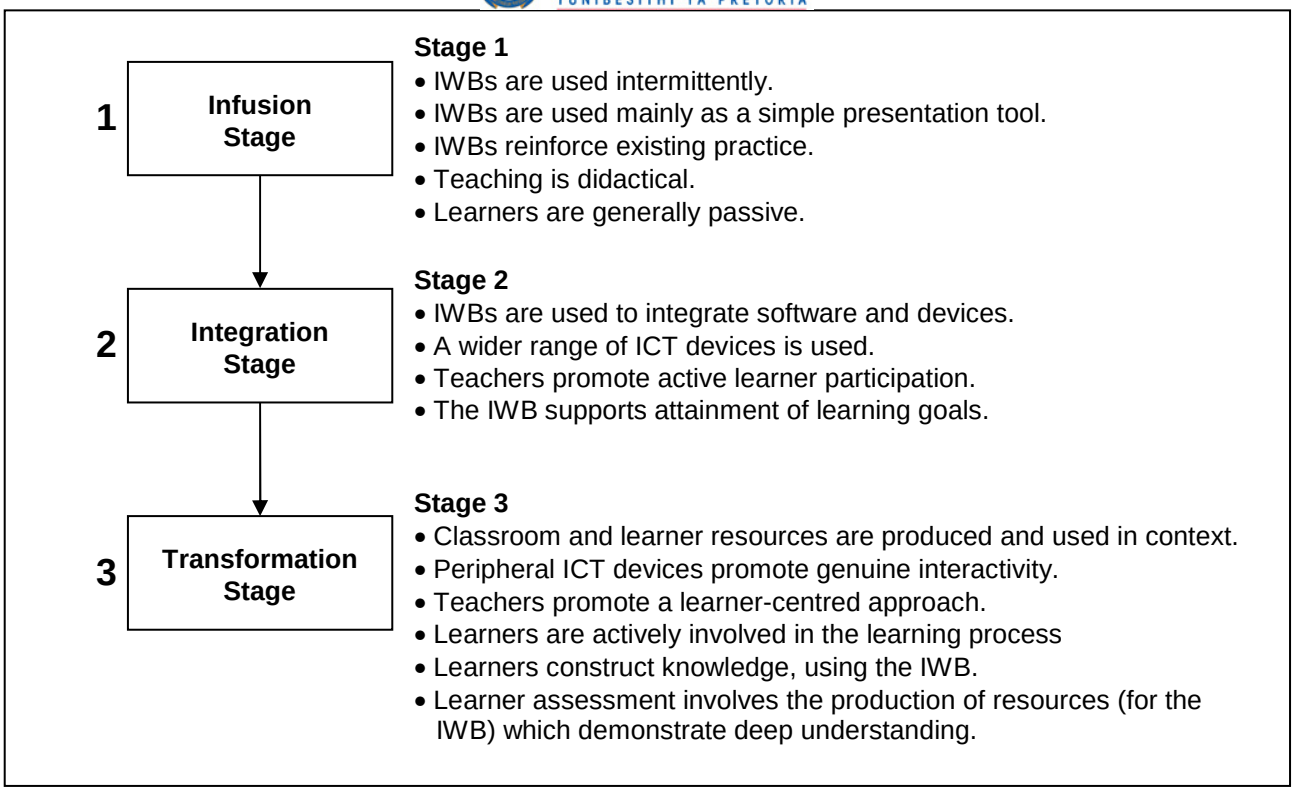


Figure 2: Burden's (2002) model for the integration of IWB use

During the Infusion Stage, the school's main concern is equipping classrooms with the hardware under consideration and, to a lesser extent, applicable software. A school working in the Infusion Stage of development is characterised by the fact that IWBs are generally "purchased in isolation from their intended use" (Burden, 2002, p. 8) and very little consideration is given to how the IWBs will be deployed through the curriculum. The IWBs are frequently installed in ICT rooms, with the intention of reinforcing the use of existing software, and they are used intermittently by teachers, who generally use them as a simple presentational tool. The IWB typically serves mainly as a didactic tool and reinforces existing practice: a teaching style that is didactical or presentational. Lessons involving the IWB are characterised by very little or no interaction with the learners, who generally remain passive. Burden (2002) indicates the mere presence of new technology will not necessarily lead to changes in teaching practice, and it is vital that this stage of infusion is not viewed as an end in itself, but rather as an initial transitory phase in the process of integrating technology into teaching practice.

During the second phase of development, the Integration Stage, greater consideration is given to the ways in which the IWB may be used to support a particular subject, or the attainment of particular learning goals. Teachers consider the manner in which the technology which has been acquired may be integrated into classroom practice. More emphasis is placed on promoting the active participation of learners in the use of the IWB (Burden, 2002). Rudd (2007) suggests that during this stage of IWB use the technology becomes "embedded within the school and the curriculum" (p. 5).

A school at the Integration Stage of development is characterised by strategic deployment of IWBs, with consideration being given to integrating IWB throughout the school. The IWB is recognised as "a curriculum tool and not just another piece of hardware used in isolation from the learning process" (Burden, 2002, p. 8). IWBs are no longer confined to ICT rooms, but are installed throughout various curriculum areas. IWBs are used to integrate the use of existing software and peripheral devices into classroom practice, and the variety of tools and devices used in conjunction with the IWBs increases. Teachers use the IWBs to encourage increased learner participation in lessons.

IWB use is still generally restricted to doing things "more effectively" rather than "doing things differently" (p. 8), but consideration is given to how the technology may be used to enhance the learning process. The emphasis is thus on improved efficiency, rather than changing approaches or paradigms. So an IWB may be used to mimic previous practice (e.g. the use of flashcards), but possibly more effectively, with greater efficiency, and with improved motivation amongst learners, as a result of superficial improvements, such as clearer, more colourful presentation of material. Burden (2002) suggests that some IWB users do not progress beyond this stage.

During the third stage of development, the Transformation Stage, teachers strive to realise the full potential of the IWB technology, and they allow it to transform their approach to teaching, as they re-evaluate the role of ICT (and specifically IWB technology) in the learning process, and the potential it holds. There is a significant shift from the use of the IWB as a presentation tool, to its use as an interactive tool, used to increase the involvement of the learners in the learning process. Learners become more actively involved in the use of the technology and the IWB "is used to 'add value' to the whole learning process" (Rudd, 2007, p. 5). Teachers are able to work more freely and creatively to generate resources which promote a learner-centred approach, with the emphasis on enquiry, and thus they provide opportunities for the learners to actively and creatively construct knowledge and understanding through their interaction with the technology (Burden, 2002).

In a school which has reached the third stage of development, IWB use is characterised by a greater variety of genuine multimedia resources integrated through a single device, namely the IWB. Teachers produce resources for their own use, as well as the use of the learners, to achieve specific outcomes in the context of their subjects. There is the opportunity for genuine interaction between the teacher and the learners through peripheral devices such as slates, and through diverse learning activities. There is a move away from learning as knowledge accumulation and emphasis is placed on using the IWB technology in knowledge construction. Learners are actively involved in the creation of resources which provide evidence of their understanding. There is the creation of interdisciplinary classrooms where IWBs become constructionist tools which are used in cross-curricular projects, combining different subjects.

2.4.2 A five-stage model for the adoption of IWB use

Beauchamp (2004), proposed a five-stage scale or framework to model the development and progression of a teacher's use of the IWB. For each stage he classified the features characterising the teacher's IWB use under the headings of operating system use and file management, mechanical skills, program variables and classroom management and pedagogy. The framework is outlined in **Figure 3**, together with a brief description of the characteristics of each stage.

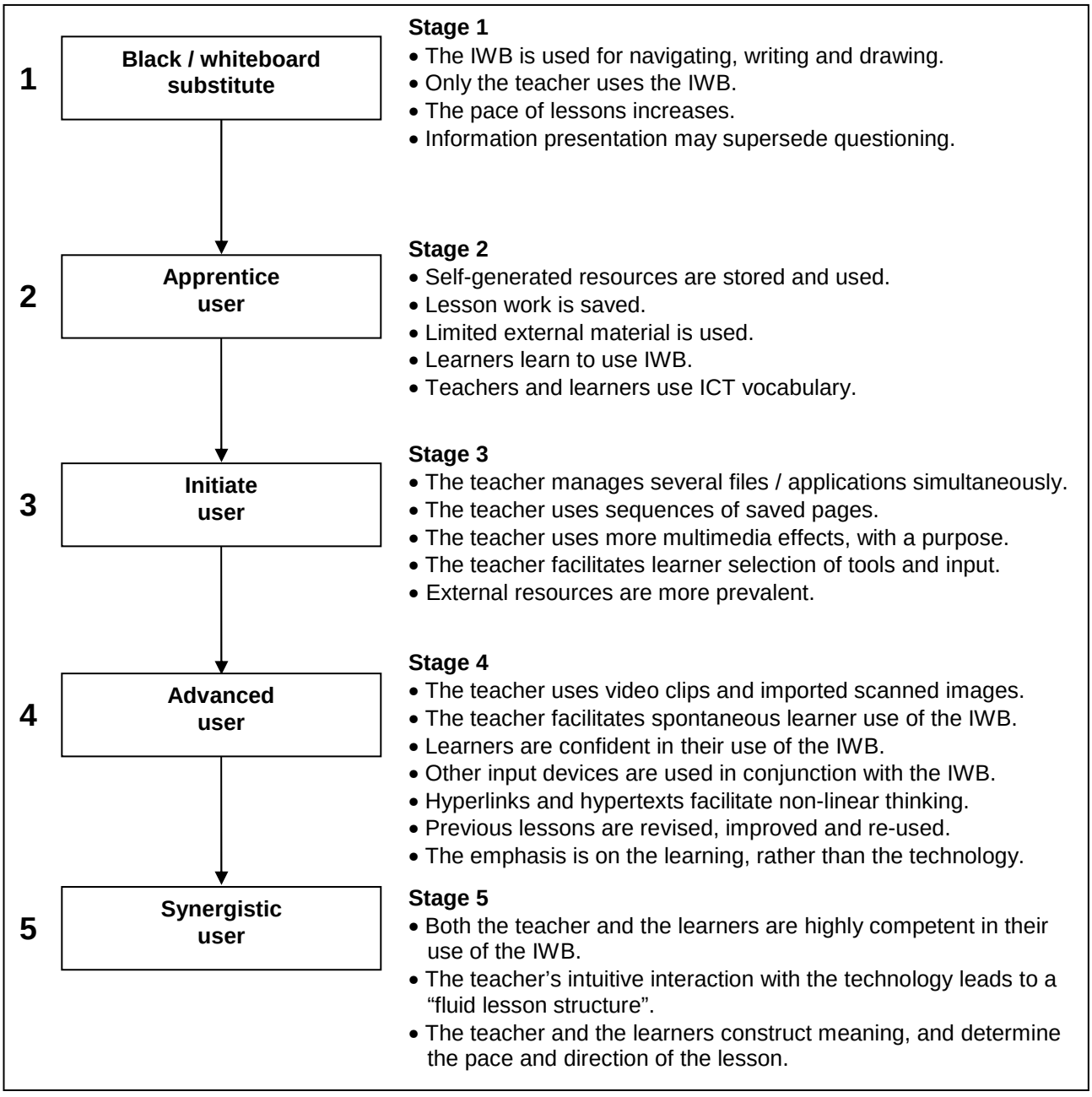


Figure 3: Beauchamp's (2004) five-stage model for the progression of IWB use

In the first stage of use, a teacher masters the basic techniques of IWB use and needs to become confident in dealing with basic technical issues like board-projector alignment or orientation. This phase of IWB is characterised by minimal interactivity, and the teacher maintains control of the

board, using it predominantly for navigating, writing and drawing. The teacher may annotate word processing files, but rarely saves the annotated files. The pace of the lesson increases as a result of the teacher's ability to quickly and easily access prepared resources. Beauchamp (2004) observed that the IWB allowed teachers to maintain eye contact for longer periods as a result of not having to actually write on the board, because they could display content simply by tapping the board. He also suggests that having prepared material readily available frees the teacher to focus more on facilitating the lesson and managing the learners. Beauchamp warns against the danger of allowing the IWB to become simply an information presentation platform, incorporating minimal interactivity. The presentation of information may dominate the lesson and there may be a resulting decrease in questioning and interactivity.

The second stage of use is characterised by the generation of materials by the teacher. The resources are stored and used during lessons. Work done on the IWB during a lesson is generally saved. A limited amount of externally produced material is introduced into lessons. The teacher plans for learners to use the IWB and the learners learn to use the IWB. Microsoft PowerPoint may be used in lessons. Teachers and learners use appropriate ICT vocabulary when discussing use of the IWB.

The third stage of use is characterised by greater realisation and use of the IWB capabilities. The teacher is able to manage several applications at once and moves between several files which are open simultaneously. The teacher makes use of sequences of saved pages in applications such as the IWB software. External resources are more prevalent and there is evidence of organisation and management of external resources such as Internet sites, which may be placed in a Favourites folder. The teacher promotes more active involvement from the learners, who select learning tools and provide input through the IWB. The teacher makes use of a wider range of applications, and employs a wider range of multimedia effects, including sound and graphics, for a pedagogical purpose, rather than simply to enhance the appearance of the material.

A teacher in the fourth stage of IWB use uses imported scanned images during lessons. The teacher facilitates spontaneous learner use of the IWB and learners in the class are confident in their use of the IWB. The teacher makes use of other input devices such as voting pads or slates in conjunction with the IWB. Previous lessons are revised, improved and re-used. There is increased use of multimedia resources such as video clips. There is evidence of non-linear thinking in the use of hyperlinks and hypertexts within and between programmes. The emphasis of the lessons is now on the learning, rather than the technology.

In the final stage of use, the teacher and learners are highly competent in their use of the IWB. The teacher's intuitive interaction with the technology leads to a smoothly flowing lesson. The teacher

and learners cooperate in the construction of knowledge and understanding, and together they determine the pace and direction of the lesson.

Beauchamp (2004) indicates that the fundamental requirement for integration of IWB technology into teaching is a willingness to adopt an interactive teaching style, in conjunction with the acquisition of particular ICT skills. He suggests that training is essential, both before and after the introduction of an IWB. This training needs to address technical and pedagogical issues. He also highlights the need for ongoing reflection and self-evaluation, if teachers are to progress to higher levels of competency in their use of IWBs.

2.4.3 A more recent three-stage model for the adoption of IWB use

Following their work with language teachers and Mathematics teachers, each of whom had been working with IWBs for between three months and three years, Glover, Miller, Averis and Door (2005) described three developmental stages through which the teachers had progressed in their use of IWBs. The authors named the three stages "supported didactic stage", the "interactive stage" and the "enhanced interactivity stage". They describe the key features which characterise each phase, with regard to teaching and learning with the IWB. The key characteristics of each stage are summarised in the schematic representation of the developmental process, which is depicted in **Figure 4**.

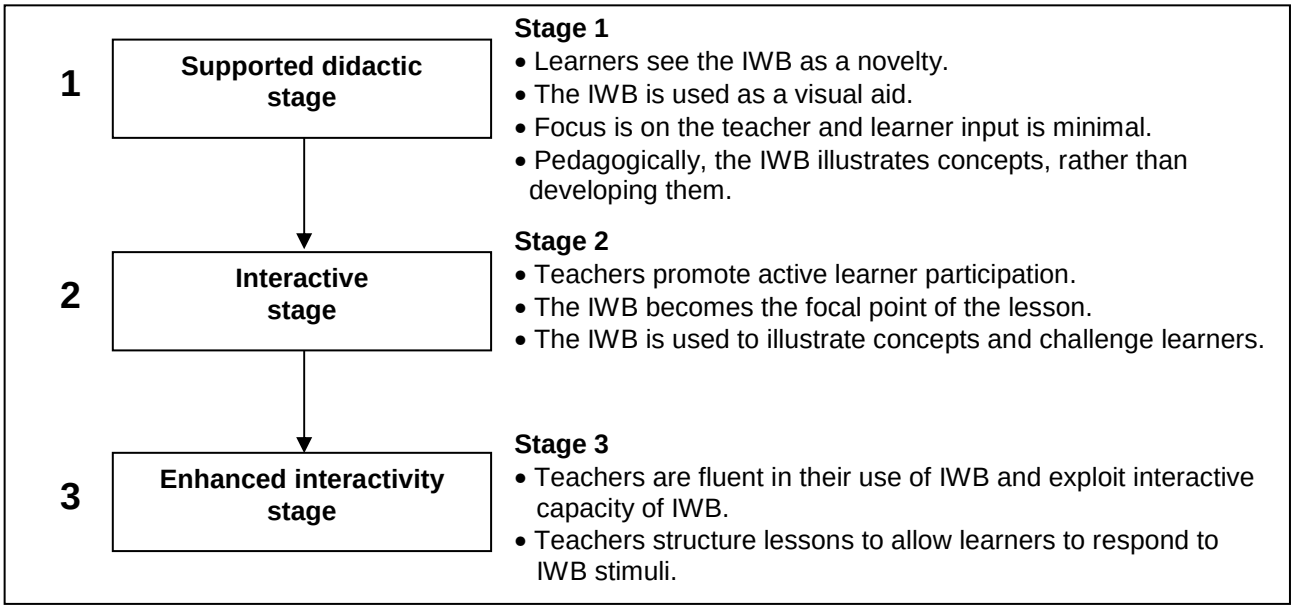


Figure 4: Three-stage IWB integration process proposed by Glover et al. (2005)

During the first stage, the supported didactic stage, teachers make some use of the IWB, but only as a visual aid, which supports the lesson. The teacher does not exploit the capabilities of the IWB to develop concepts, but may use it to illustrate concepts. The learning process is teacher-centred, and learner input is restricted to answering the teacher's questions and completing written

tasks (Glover, et al., 2005). Miller, Glover and Averis (2005) found that most of the teachers in their study of secondary mathematics lessons were at the supported didactic stage of IWB use. Teachers who had been using an IWB consistently for at least a year appeared to have moved beyond the supported didactic stage, to the point where they used the manipulations afforded by the IWB to promote interactivity, rather than simply enhance the presentation of material.

Teachers progress to the interactive stage when they exploit the capabilities of the IWB more effectively and use it to incorporate unique elements of the technology, such as verbal, visual and aesthetic stimuli into the lesson. During this stage the IWB becomes the focal point of lessons, instrumental in challenging learners to think, and in illustrating, developing and testing concepts. The novelty of the IWB has worn off by the time the teacher progresses to this stage, but the teacher is not yet utilising it to its full potential. Teachers who have reached this stage are inclined to consider new approaches. They also collaborate with other teachers and show a willingness to learn from each other.

Miller et al. (2005) reported that secondary school mathematics teachers, whose lessons fitted the enhanced interactivity profile, were employing strategies which placed the emphasis on the IWB and learner-centred learning. They employed various IWB-related techniques and a combination of self-generated material and externally produced material. Their lessons were characterised by faster pace and use of the IWB as the focus for all activity.

Teachers reach the final stage, the enhanced interactivity stage, when they seek to employ the IWB as an integral part of most lessons, and strive to exploit the interactive capacity of the technology in the learning process. Teachers who have reached this stage are fluent in their use of the IWB, and have great awareness of its capabilities. They structure lessons to allow learners to respond to IWB stimuli. They display a thorough understanding of the learning process and consider various ways in which technology can support and enhance the learning process. They are also creative in their development of material for use on the IWB, designing it to meet the needs of their learners. Teachers who have progressed to this stage also strive to exploit the IWB features which enhance kinaesthetic learning. They create opportunities for learners to come up and use the IWB, and they make use of movement and animation on the board.

2.4.4 A five-stage synthesis of these three models

In **Table 5**, which follows, a synthesis of the three models described in this chapter is presented for consideration. The table incorporates the different perspective each of the models offers on the process of IWB integration into a five-stage model.

Table 5: A five-stage synthesis of the three models for IWB integration

	Features characterising each stage in a synthesis of the three existing models described in this chapter			Comparison of equivalent stages in the three models described in this chapter		
Stage	**Lesson facilitation and pedagogy**	**Features of IWB use**	**Learner involvement**	**Burden (2002)**	**Beauchamp (2004)**	**Glover et al. (2005)**
1	•IWB reinforces existing practice •Focus is on the teacher •Little interaction with learners •Teaching didactical •Lesson pace increases	•IWB serves as a visual aid •IWB is used for navigating, writing and drawing •Only the teacher uses the IWB •IWB illustrates concepts, rather than developing them	•Learners generally passive •Learners see the IWB as a novelty	Infusion stage	Blackboard / whiteboard substitute stage	Supported didactic stage
2	•IWB is the focal point •Learner participation increases •Teacher encourages learners to use the IWB	•Teacher uses self-generated resources •Work is saved •Limited external material is used	•Learners begin using the IWB	Integration stage	Apprentice user stage	Interactive stage
3	•IWB supports attainment of learning goals •Teachers are fluent in their use of the IWB •Teachers exploit interactive capacity of IWB	•Sequences of saved pages are used •Purposeful use of multimedia resources increases •External material is more prevalent •Wider range of software and hardware devices used	•Teachers actively promote learner use of the IWB		Initiate user stage	Enhanced interactivity stage
4	•Emphasis is on learning, no longer technology •Non-linear thinking is evident, facilitated by technology	•IWB brings together a wide range of multimedia resources •Use of other input devices •Previous lessons are improved and re-used	•Learners use the IWB with confidence •Use of IWBs by learners is spontaneous	Transformation stage	Advanced user stage	
5	•A learner-centred approach is evident •Learners and teachers collaborate in the construction of meaning •Lesson flows smoothly and adaptability is evident •IWB technology is incidental	•Teachers are highly competent in their use of the IWB •Resources are developed specific to context •Use of peripheral devices facilitates genuine interactivity	•Learners actively participate in the construction of knowledge and meaning •Learners are assessed through their creation of resources for the IWB		Synergistic user stage	

Table 5 indicates one way in which the different stages of each model may be aligned with each other in mapping out the process involved in the integration of IWB use. It highlights the features characterising each stage in regard to lesson facilitation and pedagogy, as well as the features of IWB use and learner involvement.

The model proposed by Glover et al. (2005) described IWB integration that had already taken place amongst teachers using IWBs, and at that stage it did not give serious consideration to further development in IWB use amongst the teachers in the future. Hence in **Table 5** it is suggested that the third stage of the model proposed by Glover et al. does not necessarily consider the most advanced stages of development proposed by Beauchamp (2004). Burden's (2002) model appears to be broader in its consideration of IWB integration and so it is suggested that the third stage of development in this model may be aligned with the most advanced developmental stages as proposed by Beauchamp.

2.5 Research theme one: The extent, frequency and nature of IWB use

This section of the literature review gives consideration to the first research theme, bearing in mind the following research questions.

- How are IWBs distributed within schools, and how frequently do learners encounter them?
- How frequently are existing IWBs being used by teachers and what factors influence their frequency of use?
- What features of IWBs are being used by teachers, and how frequently?
- What resources and equipment do teachers use in combination with IWBs?
- How frequently are existing IWBs being used by learners and what features are they using?

2.5.1 The pattern of IWB distribution within schools

In their study of the integration of IWBs into secondary schools in London in the United Kingdom, Moss et al. (2007) focussed on the use of IWBs in the three core subject departments, namely the English, Mathematics and Science departments. They found that, in allocating funding for IWBs, preference was given to Mathematics and Science departments. Their data implied that some Mathematics and Science departments were equipped with IWBs in every classroom and that, of the three core subject departments, English was the least well equipped. The authors found that, across the schools involved in the study, 25% of the IWBs in use were in Science departments, 22% of the IWBs in use were in Mathematics departments and 15% of the IWBs in use were in English departments. Their research revealed that the majority of the remaining IWBs (38% of all IWBs) were in use in ICT, and Design and Technology departments.

In the schools where there was at least one IWB in the respective subject departments, Moss et al. (2007) reported that in the Science departments the mean number of IWBs was 5,8, while in the Mathematics departments the mean number of IWBs was 5,3 and in the English departments the mean number of IWBs was 3,8. In their study, schools tended to have more Science classrooms than Mathematics classrooms, and so they suggest that it may have been that the percentage of Science classrooms equipped with IWBs was in fact lower than the percentage of Mathematics classrooms equipped with IWBs. Other studies have reported that Mathematics departments have been given preference. For example, the Becta survey conducted in the UK reported that Mathematics departments have approximately 30% more IWBs than Science and English Departments (Becta, as cited in Moss et al., 2007, p.101).

Moss et al. (2007) reported that the most common reason indicated for a particular subject department receiving IWBs ahead of others was that the curriculum in that particular subject was most likely to benefit from the use of IWBs. The authors reported that the teachers managing the integration of IWBs in the schools tended to be of the opinion that IWBs are best suited to the Mathematics and Science curriculum, and that having IWBs was more important in Mathematics and Science, than in English. Moss et al. (2007) also reported that in certain schools preference was given to fully equipping a subject department that was already partially equipped, or that they wanted to enhance an already successful department. In some schools it was believed that staff in the subject that was given preference would make the best use of the IWBs, based on factors such as existing ICT skill levels.

2.5.2 The frequency of IWB use amongst teachers

In their study of IWB integration in London secondary schools, Moss et al. (2007) found that IWB technology was being embraced by teachers. They suggest that IWBs are easy to integrate into teaching and their research showed that very few teachers who had access to IWB technology were not using it. Considering the frequency of IWB use in English, Mathematics and Science, they found that many teachers were using the IWB is most or every lesson. The authors reported that the most frequent use of IWBs appeared to be in Science departments, the second most frequent use in Mathematics departments, and the least frequent use (of the three departments) in English departments. Moss et al. (2007) also asked learners to indicate the frequency of IWB use in each of the core subjects. The vast majority of learners (86%) reported that in Mathematics the IWBs are used in most lessons or in every lesson. In comparison, 67% reported similar frequency of use in Science and 50% in English. There appeared to be a discrepancy between the frequency of use reported by teachers and learners, and Moss et al. did indicate concern over whether or not the Science teachers who actually participated in their study were representative of Science teachers in the schools in general.

Moss et al. (2007) asked subject department heads to report the frequency of IWB use by teachers in their subject departments. A smaller sample of teachers also reported on their own use of IWBs. **Table 6**, which follows, shows the combined frequency of IWB use as reported by the subject department heads of the English, Mathematics and Science departments in Moss et al. (2007), as well as a selection of teachers in these subject departments.

Table 6: Frequency of IWB use as reported by Moss et al., 2007 (p. 130)

	Frequency of IWB use as reported by schools with IWBs				
	Never	**Hardly ever**	**In some lessons**	**In most lessons**	**In every lesson**
Subject department heads (n=451)	5%	6%	32%	35%	22%
Teachers (n=113)	4%	4%	25%	29%	38%

As **Table 6** indicates, the authors found that 22% of the subject heads reported that the IWBs in their respective departments were being used in every lesson, 35% reported use of IWBs in most lessons, 32% reported use of IWBs in some lessons, 6% reported use of IWBs hardly ever and 5% reported that the IWBs were never used. Moss et al. (2007) questioned the reliability of the data, suggesting that the subject department heads may not have observed a truly representative sample of lessons. In comparison, 38% of the teachers in the study indicated that they use the IWB in every lesson, 29% indicated that they use it in most lessons, 25% indicated that they use it in some lessons, 4% indicated that they hardly ever use it, and 4% indicated that they never use it.

2.5.3 The nature of IWB use amongst teachers

Moss et al. (2007) reported that IWB use amongst the majority of teachers in their study was characterised by the following features. Firstly, the IWB was being used as a data projection screen which allowed the teacher to navigate to multiple screens. Secondly, it was being used by the teacher as a surface to generate a dynamic rather than static form of display, and thirdly it was being used to enhance their presentation of material from the front of the class. Moss et al. (2007) suggest that the IWB may play a valuable role in each of these uses. They indicated that there is a need for teachers to consider how the technology may be used to fulfil each purpose, and which feature of the technology may best achieve their aim.

Levy (2002) found that the IWB was used to support four main aspects of whole-class teaching. Firstly, teachers were using the IWB to give software demonstrations, prior to learners using the applications themselves. Secondly, teachers made use of the IWB for presenting and discussing information and learning resources in a variety of formats. Thirdly, IWBs were used to facilitate the

explanation of concepts by teachers and learners and, finally, learners used the IWB to present their own work, and then received feedback from the teacher.

2.5.4 Resources and equipment used in combination with an IWB

Moss et al. (2007) found that most of the materials being used on IWBs by teachers were generated by the teachers themselves. Mathematics teachers were found to be making the most extensive use of subject specific software that was externally produced. The authors found that material designed by the teachers could not easily be used independent of the author, as a result of the fact that the teachers had not incorporated critical design principles into the design and creation of the materials.

Moss et al. (2007) found that teachers used very few peripheral devices in conjunction with IWBs. Their research suggested that peripherals could significantly enhance the use of IWBs and promote a more learner-centred approach. Appropriate use of peripheral devices could help teachers move away from the front of the class and provide them with the opportunity to allow learners greater control over the IWB, and therefore the learning process.

Moss et al. (2007) reported that the most popular features used by teachers were preloaded pages, the drag or hide feature, and also colour, shading and highlighting. Less popular, but also widely used, were downloaded images or sounds, the ability to annotate and save material, and the ability to revisit material. The authors found that the vast majority of teachers using IWBs had created their own IWB resources, and about two-thirds had used Internet websites to source material. Nearly half of the teachers had used resources created by a colleague, and a similar number had used commercial software. The authors suggest that their results indicate that, within subject departments, teachers' use of the IWB is generally taking place independently, and that there is not much in the way of collaboration and shared resource development. The authors go on to say that this was to be expected, given the stage of the IWB implementation cycle the schools had reached at the time they conducted their study.

With regard to ICT resources, Moss et al. (2007) reported that the Internet was the ICT resource most popular amongst teachers, with the vast majority of teachers reporting that they had used it. The school network was the next most popular, with about three quarters of the teachers reporting that they had used it, followed by audio speakers, which about two-thirds of the teachers reportedly used. These were followed by electronic pens, laptops and a printer. The use of voting pads, slates or tablets and learners laptops was reported by no more than 5% of the respondents.

2.6 Research theme two: The impact of IWBs as perceived by teachers

This section of the literature review gives consideration to the second research theme, bearing in mind the following research questions.

- What is the general attitude of teachers towards IWBs in teaching?
- What attitude do teachers perceive the learners to have with regard to the IWB and its impact on lessons?
- What impact do teachers perceive the IWBs to have on learners' behaviour, attentiveness, motivation and productivity during lessons?
- What impact do teachers perceive IWBs to have on the learning process, specifically with regard to learners' understanding, retention and performance?
- What impact do teachers perceive IWBs to have on teaching, specifically with regard to lesson planning, preparation and resource development?
- What impact do teachers perceive the IWB to have on teaching, specifically with regard to lesson facilitation, presentation, teaching styles, classroom management, interactivity and accommodating different learning styles?

2.6.1 The general attitude of teachers and learners towards IWBs

In their large-scale study of IWB use in London secondary schools, Moss et al. (2007) found that both teachers and learners were generally very positive about IWBs. The authors found that the features of IWB technology which teachers and learners regarded as beneficial were those which enhance the teacher's role at the front of the class. Teachers and learners were of the belief that the quality of the visual display afforded by the IWB can help clarify key teaching points, and indicated their belief that IWBs help bring teaching up to date. There was a strong belief amongst teachers that the use of an IWB would help them further their teaching careers in the future.

Glover and Miller (2002) distinguish between three different approaches or attitudes shown by teachers as they consider adopting IWB technology, and they suggest that teachers may be classified as "missioners", "tentatives" or "luddites". Missioners hold a very positive attitude towards IWBs and incorporate the new technology fully in their teaching. They seek to improve their own skills, while actively encouraging other teachers to use IWBs. Tentatives have some access to the IWBs, but are inhibited by the need for further training or fear of the time required for them to become fluent in the use of the IWB in the classroom. Luddites are teachers who are opposed to the use of the new technology, in spite of their exposure to it.

They suggest that head teachers may also be divided into three groups, based on attitude, and classified as "revolutionaries", "gradualists" or "reactionaries". Revolutionaries are convinced of the

value of the new technology. Gradualists are aware of the need for change and the introduction of technology, but use development planning as a shield against sudden change. Reactionaries are fearful of the new technology and use current or potential resource problems as an excuse for not embracing it (*ibid.)*.

2.6.2 The effect of IWBs on learner behaviour and motivation

Various authors have reported an improvement in learner motivation and behaviour when an IWB is used in lessons (Smith et al., 2005; Thompson and Flecknoe, 2003). Waite (2004) reported that teachers have found the greatest impact of ICT on teaching is the resulting increase in learner motivation.

Thompson and Flecknoe (2003) suggest that use of the IWB is most effective when its capacity for interaction is harnessed, especially when learners interact with it. They suggest that this increases learner motivation because it allows them greater control over their learning. They emphasise that the maximum benefits of IWB use are only gained when the IWBs are used by imaginative and innovative teachers, and reported that excessive use of the IWB simply as a presentation tool, without encouraging learner interaction, led to the learners losing interest and becoming disruptive.

Miller et al. (2005) suggest that the behaviour of learners improves when an IWB is used because the learners are caught up in the lesson as a result of the increase in pace, and the well-structured, sequenced learning. They highlight various features, which characterise a lesson where an IWB is used effectively by a teacher to encourage learning. These are the intrinsic stimulation of the material and the presentation, sustained focus amongst learners and stepped learning (*ibid.*).

In contrast to many earlier studies, Moss et al. (2007) found that, although learners were receptive to IWB technology, any apparent increase in motivation as a result of the novelty of IWB technology was temporary, and waned shortly after the introduction of the IWB. The authors found the learners to be fairly non-committal in their comments on the impact of IWBs on behaviour. Interestingly, they also reported that some learners were reluctant to use the board themselves, which is something that does not appear to have been reported in many other studies.

2.6.3 The impact of IWBs on learner performance

In their review of literature on IWB studies, Smith et al. (2005) report that there has been relatively little empirical evidence to support the claim that the use of IWBs in lessons actually improves learner performance. Moss et al. (2007) reported that their statistical analysis of results for approximately 9000 learners from 30 schools indicated that the increase in the number of IWBs in schools had no impact on the learners' performance in three core academic subjects, namely

Mathematics, Science and English. This study was conducted in the first year in which the subject departments were fully equipped with IWBs, and the authors indicate that the lack of impact may be expected, given the lack of uniformity in the use of IWBs amongst teachers in the study up to that point.

Thompson and Flecknoe (2003) reported that IWB-based teaching helped learners grasp ideas and concepts and led to rapid progress and improved performance amongst learners. The authors reported that the use of IWBs in primary school classes resulted in a significant improvement in the learners' performances in Mathematics, in comparison with levels predicted by the previous year's performance indicators. Within six months the group of learners had exceeded the progress projected for the entire year. They found that the proportional gain in attainment was greatest for learners of lower prior attainment. The results of their behaviour observations indicated that learner behaviour did improve during lessons where an IWB was employed. The authors acknowledge that the impact of the IWBs in their study may have been partly as a result of the novelty of the technology, but indicate that there was no indication that the learners' favourable disposition towards the board was lessening.

In this particular study, the teachers concerned were making use of various basic mathematical resources, together with online teaching activities, specifically designed to increase interactivity and learner involvement in lessons (Thompson and Flecknoe, 2003). The authors concluded that IWBs are effective tools, which can be used to help improve teaching standards, and also raise learner attainment. They state that, as may be expected, the benefits are gained when the IWBs are used by imaginative and innovative teachers. They suggest that IWBs will yield greater benefits in the future, as they become more prevalent in classrooms, and software for the boards becomes more readily available.

2.6.4 The impact of IWBs on teaching

Moss et al. (2007) suggest that the changes which technology brings about depend on what teachers think it is for. They report that there are three main themes currently prevalent in discussions on the topic of IWB-induced pedagogical change. The first is "increased pace of delivery", the second is "increased use of multimodal resources, incorporating image, sound and movement in new ways" and the third is "a more interactive style of whole-class teaching" (Moss et al., 2007; p6).

Smith et al. (2006) concluded from their research that IWBs are having an impact within the classroom, but they indicate that their results are "wide ranging". They found that the pace of a lesson where an IWB was used was generally faster than the pace of lessons without IWB use. Various authors have reported that when an IWB is used, the pace of the lesson increases as a

result of the teacher's ability to quickly and easily access prepared resources, and because information can be changed and manipulated quickly and easily (Beauchamp, 2004; Thompson and Flecknoe, 2003). Moss et al. (2007) reported that the correlation between speed of delivery of a lesson and the effectiveness of the teaching was weaker than previous studies have suggested.

Beauchamp (2004) observed that the IWB allowed teachers to maintain eye contact for longer periods as a result of not having to actually write on the board, because they could display content simply by tapping the board. He suggests that having prepared material readily available frees the teacher to focus more on facilitating the lesson and managing the learners. He also suggests that the IWB may free teachers, especially new teachers, from worrying about aspects of presentation such as their handwriting, because it allows them to present saved material, with the presentation may be improved through features such as text prepared using a word processor.

Miller et al. (2005) discuss various advantages that use of the IWB offers, and report that the IWB enhances the learning process through the presentational techniques and manipulations it affords the teacher. The presentational features they highlight include colour, shading and lighting, movement and animation. The range of manipulations the IWB allows provides the teacher with the opportunity to promote interactivity. Manipulation functions include drag-and-drop, hide-and-reveal and matching items. More experienced teachers use these features to foster interactivity, rather than simply improve presentations. The authors emphasise that the manipulations are most effective when used in conjunction with discussion between teacher and learner, based on focussed questioning and follow-up responses.

Thompson and Flecknoe (2003) indicated that one of the strengths of the IWB is its capacity to accommodate learners with different learning styles, as it incorporates kinaesthetic, audio and visual style learning paths. Learners in their study responded favourably to the colourful nature of the material presented on the IWB, and they displayed increased levels of interaction, becoming more involved in learning through active involvement in class discussions and the presentation of material.

As a result of the initial appeal of IWBs, the colourful dynamic display, and the novel features they provide, it is tempting to think that they will increase motivation, revolutionise traditional teaching and change whole class teaching patterns, but Smith et al. (2006) suggest this will not be the case. These authors suggest that the impact of IWBs on classroom interactions is not as extensive as reported by some advocates of IWBs, having found during their research that traditional teaching styles were prevalent in spite of the introduction of IWBs. In terms of changes in the classroom, they report that, in comparison to lessons where an IWB is not used, lessons incorporating significant use of an IWB were characterised by less group work and more whole class teaching.

These IWB-based lessons did contain more frequent interaction between the teacher and learners, and teachers were inclined to use more open-ended questions. They found that the teacher spent more time on evaluation of pupil answers. Pupils answered more frequently, but, although the frequency of answering was higher, the answers were briefer than those given in non-IWB lessons and therefore the percentage contribution of answers to the lesson, from learners, remained the same (*ibid.*).

Smith et al. (2006) found that use of an IWB encourages students to volunteer answers as a result of its strong visual and conceptual appeal, and that it improves motivation through its capacity for quality presentation, which, they suggest, satisfies the expectations of the modern learner, who is accustomed to high quality multimedia. Their findings thus support some of the claims being made for IWBs, but suggest that IWBs are not causing a fundamental change in teachers' underlying pedagogy. The authors propose that more research is required in order to determine ways in which teachers can improve teacher-learner interactions. They indicate that IWBs may have an important role to play in facilitating more active learner involvement, but suggest that, at this stage, it is unclear when and how IWBs should be used to good effect to achieve this.

Miller et al. (2005) reported finding that the learning process changes when the IWB becomes the focus of the lesson. A distinguishing characteristic of IWB-based lessons, which they discuss, is "stepped learning", achieved through constant challenges, combined with frequent assessment and feedback. One of the reported benefits of the use of an IWB is its ability to accommodate different learning styles. Evidence gathered in their study indicated that the IWB provides intrinsic stimulation through the combination of visual, kinaesthetic and auditory paths to learning, which it offers. Lessons observed during their study were characterised by sustained focus from the learners, as a result of the manner in which the teachers facilitated the lessons.

Moss et al. (2007) express their concern at the manner in which IWBs are being used and the potential the technology has for reinforcing a teacher-centred approach. The features of an IWB may allow a teacher to present more information at a faster pace during a lesson, which may free up more lesson time for group work, but there is the danger that this may actually reinforce transmission-style teaching, with the learners becoming increasingly passive. It is important that interactivity be considered broadly, in terms of the interactions between the teacher and the learners, and amongst the learners, and not simply as interaction with the IWB, which may also lead to a teacher-centred approach.

Moss et al. (2007) suggest that, because IWB technology has effectively adapted to existing pedagogy, it is only in time that researchers will be able to determine any distinctive contribution IWBs can make to the learning process. They indicate that researchers need to explore what IWB

technology can best be used for. They do suggest that IWBs may play a role in transforming pedagogy at a secondary school level, and suggest that transformation in teaching is dependent on familiarity, confidence and time. They indicate that teachers most advanced in their use of IWB technology are those who have used it for the longest period of time, or are most interested in exploring the potential of the technology, where they have the time and opportunity to experiment.

Moss et al. suggest that discussions amongst teachers should focus on pedagogic aims, so that IWB technology may be used to achieve goals that are set based on broader pedagogic purposes. They highlight the need for teachers to discuss critically the strengths and weaknesses of IWB technology and express concern over the fact that the lack of critical perspective on IWB technology amongst teachers may be problematic in promoting such discussion (*ibid.*).

2.6.5 The I in IWB: interactivity discussed

> **"…claims are also being made that IWBs facilitate more interactive lessons."**
> (Smith et al., 2005, p. 95)

One of the key issues that lie at the heart of the IWB debate is the issue of interactivity and interactive teaching. Smith et al. (2005, p. 99) suggest that the uniqueness of IWB technology lies in the potential it holds for providing an "intersection between technical and pedagogic interactivity." In other words, its strength lies in the potential it holds for facilitating effective learning through stimulating "dialogic interaction" amongst learners, and between learners and the teacher, and through physical interaction with the board. However, research conducted over the last five years suggests that the opportunity for physical interaction with the IWB by learners in the classroom is limited, and that IWBs do not promote interactivity any more than traditional whiteboards (Rudd, 2007).

There has been a move to redefine the concept of interactivity with respect to IWBs and the role that IWBs may play in promoting interactivity in the learning process. In considering the issue of interactivity, Smith et al. (2005) suggest that a distinction needs to be made between "technological interactivity" and "pedagogic interactivity". *Technological* interactivity refers to the unique ability which an IWB offers the user to physically interact with the learning materials by touching the IWB by hand or using an interactive pen. *Pedagogic* interactivity refers to the interactions which take place between the people involved in the learning process. Thus it incorporates interactions between the learners in the classroom, and between the teacher and the learners, such as asking and answering questions, sharing ideas and debating issues. Claims are being made that IWBs promote both technical and pedagogic interactivity (*ibid.*). Smith et al. (2006) highlight the need for more research to be conducted in order to determine whether interactive teaching styles that encourage more active learner involvement can actually *improve* learning.

Moss et al. (2007) describe three different categories of interactivity evident in use of IWB technology, namely "technical interactivity", "physical interactivity" and "conceptual interactivity". They appear to divide the concept of technological interactivity described by Smith et al. (2005) into *technical* interactivity, which is concerned with interaction with the technological facilities which the IWB offers, and *physical* interactivity, which relates to the actual physical interaction with the IWB surface, by teachers and learners. The authors' notion of *conceptual* interactivity involves engaging with curriculum concepts, and exploring and constructing ideas.

Some of the early studies reported that the *technical* interactivity which an IWB affords, allowing learners the opportunity to interactive physically with the material, is highly motivational (Becta, as cited in Smith et al., 2005, p. 94). But early researchers also reported problems with attempting to allow learners to use the board in whole-class teaching, indicating that it may slow down the lesson, resulting in boredom amongst the learners (Smith, as cited in Smith 2005, p. 95). Early research also indicated that teachers were not necessarily allowing learners the opportunity to interact with the board (Levy, 2002).

With regard to IWB use and *pedagogic* interactivity, Smith et al. (2005) suggest that care must be taken to determine whether any change in participation and interactivity is superficial or more profound, actually leading to higher quality interactions between the teacher and the learners, and amongst learners, in their search for meaning. In considering the impact of IWBs in the classroom and the idea that they may revolutionise traditional whole class teaching, Smith et al. (2006) question whether more interactive teaching styles which promote more active learner involvement in lessons actually lead to significant improvements in learning. They suggest that there is a need for further research in this area of interest. Their findings supported claims in favour of IWBs, but suggest that IWBs are not causing a fundamental change in teachers' underlying pedagogy. The authors suggest that further research is required to determine ways in which teachers can improve teacher-learner interactions, and they indicate that IWBs may have an important role to play in facilitating more active learner involvement in the learning process. They suggest that at this stage it is unclear when and how IWBs should be used to good effect to achieve this.

Smith et al. (2006) found that the level of learner use of the IWB reported during the first year following the installation of an IWB did not continue into the second year of use. It thus seems to be a short term benefit. Moss et al. (2007) reported that whether or not a teacher provided learners with opportunities to interact with the IWB was not critical in providing opportunities for learning. They indicate that by focussing on this "*technical* interactivity" teachers may place too much emphasis on mundane lower order activities, and they suggest that the learning process may be slowed down if a teacher places too much emphasis on providing learners with an opportunity to interact with the IWB.

Similarly, where the use of multimodal resources is concerned, Moss et al. (2007) indicate that the resources are most effective when they are regarded as an integral part of the learning process, and included as a result of their potential to enhance understanding, rather than simply to gain attention.

In considering the impact of IWBs in the classroom and the idea that they may revolutionise traditional whole class teaching, Smith et al. (2006) question whether more interactive teaching styles which promote more active learner involvement in lessons actually lead to significant improvements in learning and learner performance. They suggest that there is a need for further research in this area of interest.

2.7 Research theme three: The challenges and needs of teachers

"…there is much more to the effective use of [IWB] technology than simply ensuring that teachers have access to the equipment."
(Glover et al., 2005, p. 27)

This section of the literature review gives consideration to the third research theme, bearing in mind the following research questions.

- How competent do teachers using IWBs perceive themselves to be in their use of the IWBs, and how do they believe the learners perceive their use of the IWB?
- What factors do teachers believe influence the effectiveness of their use of IWBs?
- What formal training did teachers receive in the use of IWBs, and how effective was this training perceived to be?
- Do teachers feel the need to improve their use of IWBs and, if so, how do they believe they could best achieve this?
- What perceptions do teachers have of the resources available for use with IWBs?
- How do teachers feel about integrating ICT in the form of the IWB into their teaching, as opposed to using a data projector alone, or making use of computers in a dedicated computer laboratory?
- What limitations and stumbling blocks, technical and otherwise, do teachers perceive to be preventing them from using IWBs more effectively?

2.7.1 The role of school management in IWB integration

Glover and Miller (2002) concluded from their studies that the interplay between leadership and classroom teachers determines the pace, extent and impact of change, with respect to the introduction of new technology in a school. They found that, whatever the attitude of the head

teachers, if the number of *missioner* teachers increased, the pace of change quickened. They found that changes occurred more rapidly once it became apparent that results were improving as a result of greater learner involvement, increased motivation, higher interactivity and the use of a variety of learning styles. The authors reported that over the two years during which their study was conducted, learner results improved in all the schools except the one, where teacher resistance was most evident.

Glover et al. (2005) indicate that if IWB technology is to be fully integrated in the classroom, various factors are critical for ensuring the successful integration of IWBs into classrooms in a school. The school management team needs to develop an ICT resource management programme to facilitate the introduction and maintenance of equipment and ensure that equipment is available and functional, thus minimising frustration for teachers. It is vital that teachers and technicians receive the support and coaching they require in order to improve their knowledge of the technology. The management team should also implement a professional development programme which provides opportunities for individual and corporate development. This programme should also incorporate wider development across the school, addressing issues such as understanding of the learning process and learning styles, thus fostering a whole-school ethos which embraces the technology. There should be a focus on longitudinal action research aimed at evaluating the impact of the integration of IWB technology on learner performance. The findings of such research may form the basis of classroom practice and policy development. The school management team should also encourage teachers to foster amongst learners a greater awareness of how they learn, and how the IWB influences their learning.

2.7.2 The importance of teacher training

Glover et al. (2005) emphasise the importance of providing appropriate training for teachers as they consider adopting IWB technology in their classrooms. They identified four factors that influence developmental activity: encouragement from senior leaders, enhanced pedagogic understanding, availability of equipment and the development of technological and pedagogic skills. Support from senior management is essential if teachers are to receive the technological resources and professional development they require in order to improve their use of technology in their teaching. They deduced that decision making related to ICT implementation is influenced by resource issues inherent in the use of new technology, and pedagogic issues arising from awareness of the potential the technology holds for enhancing learning.

They suggest a strategy that should be implemented in order to ensure that teachers reach the stage where the potential of IWBs is realised. The strategy includes the development of a resource management programme, a support structure that answers teachers' questions, devising a

professional development programme, facilitating longitudinal action research and encouraging learners to evaluate their learning when the IWB is involved (*ibid.*).

Glover et al. (2005) found that teachers expressed the desire to deepen their understanding of the way in which learners learn, with particular reference to different learning styles. A deep understanding of the learning process is critical if a teacher wishes to take full advantage of the IWBs capacity to offer various pedagogic approaches. The authors found that learners and teachers who had become accustomed to the IWB as part of the normal classroom setup were keen to improve their use of it in their spare time, if it was readily available and they were not required to book it or arrange venue changes in order to access it. Networking and sharing ideas was a critical factor in improving use of the IWB.

Glover et al. (2005) suggest that as far as training is concerned, individual teachers benefit most when a coaching-based approach is used to improve their understanding of the technology, their awareness of its capabilities, and their competence and confidence in using it. Where groups of staff are involved, they suggest that learning is most effective if staff have some knowledge of different learning styles, and are then made aware of how the IWB offers different stimuli and learning paths, which may accommodate different learning styles.

Beauchamp (2004) indicates that the fundamental requirement for integration of IWB technology into teaching is a willingness to adopt an interactive teaching style, in conjunction with the acquisition of particular ICT skills. He suggests that training is essential, both before and after the introduction of an IWB. This training needs to address technical and pedagogical issues.

Beauchamp also indicates that there are several skills, necessary for successful use of the IWB, which may be acquired by the teacher prior to using the IWB in the classroom. These are essentially basic computer literacy skills, and they include the following. In terms of file management, a teacher needs to be able to navigate the operating system, save and open files and set up a well-organised management system. As far as basic computer operation skills are concerned, teachers need to be able to click and drag objects, and they should be able to minimise and maximise windows and switch between several programmes which are open simultaneously.

Furthermore, Beauchamp suggests that teachers should become competent in their integration of imported graphics, such as clipart, photographs and pictures, from within programs and from other sources, especially the Internet. They should be able to scan documents or images and import scanned images into their materials. With regard to the Internet, he recommends that teachers become competent in their use of a search engine on the World Wide Web, and that they should be able to organise Internet pages into Favourites folders. They should also become familiar with

the use of hyperlinks and hypertext to move within and between programmes. They should become competent in the use of hyperlinks to accomplish tasks such as accessing websites, moving between pages within a file and following hyperlinks from spelling lists and word banks (*ibid.*).

Miller et al. (2005) found that teachers' understanding of the presentational and pedagogical advantages offered by IWBs is improving. The authors indicated that in order to gain the maximum benefit offered by an IWB, teachers need time to develop their technological fluency and apply pedagogic principles to existing materials, or in the development of their own materials, in order to be able to incorporate the IWB "seamlessly" into their teaching.

Moss et al. (2007) suggest that it is critical for individual teachers to determine how best to incorporate IWB technology into their particular subject. In their study they found that the teachers who were making the most effective use of IWBs were consciously reflecting on how best to use the technology. They suggest that it is vital for pedagogical purpose to determine the manner in which technology is incorporated into learning, if the technology is to enhance it. If the use of particular technological tools is prioritised, and the pedagogical purpose is not clearly defined, the technology is unlikely to enhance learning significantly.

2.8 Research theme four: The impact of IWBs as perceived by learners

This section of the literature review gives consideration to the fourth research theme, bearing in mind the following research questions.

- What is the learners' perception of the level of competency in IWB use amongst teachers?
- What impact do learners perceive the IWB to have on their teachers and the manner in which they facilitate lessons, specifically with regard to the pace of lessons, the teacher's ability to capture and hold their attention, and the presentation and aesthetic appeal of the teacher's audiovisual aids?
- What impact do learners perceive use of the IWB to have on the learning process, specifically on their understanding, retention and productivity?
- What impact do learners perceive use of the IWB to have on their personal behaviour, attentiveness and motivation, and the behaviour of their fellow learners?

2.8.1 Learners' perceptions of the impact of IWBs on teachers and teaching

Various authors have reported that learners generally display a very positive attitude towards IWBs and comment favourably on the presence of an IWB in the classroom (Moss et al., 2007; Thomson and Flecknoe, 2003; Wall, Higgins and Smith, 2005). In their study of IWB use, Wall et al. (2005) found that the majority of learners displayed a positive attitude towards IWB technology, and expressed awareness of its potential. The learners recognised various advantages afforded by IWBs, including improved visibility, the ability to save work done on the board, the ability to use different programmes to explain things, and the variety of multimedia functions. Learners suggested that it helped their teachers to explain concepts, improved their teachers' motivation and led the teachers to be more innovative.

However, Wall et al. (2005) also reported that learners expressed the concern that use of the IWB resulted in their teachers moving through the lesson too quickly. The authors found that learners are sensitive to the positive and negative influences of IWBs on teachers, and they indicated awareness of certain teachers' lack of technical knowledge.

2.8.2 Learners' perceptions of the impact on IWBs on learners and learning

Wall et al. (2005) investigated learners' perceptions of how IWBs affect their learning. Their findings suggested that IWBs "can be effective tools for initiating and facilitating the learning process" and they highlighted the need for teachers and IWB manufacturers to be aware of the impact IWBs may have on learners' beliefs about their own learning and metacognition.

Wall et al. reported that learners believed that the presentation style afforded by IWBs, particularly the use of colour and movement, improved their motivation and concentration and thus helped them to be more attentive during lessons. The learners perceived the visual display of information and the use of different software, especially games, to have a positive impact on their learning. They reported feeling motivated to be involved by the prospect of being able to use the board themselves, or have their work displayed on the board. These authors also reported that learners felt that the visual nature of the IWB complemented the teacher's use of verbal cues and discussion to enhance the learning process. They felt more motivated to share their ideas during class discussions (*ibid.*).

Glover et al. (2005) and Miller et al. (2005) found that amongst learners, interest in the IWB may initially be attributed to the novelty of the technology. But over time this wanes and learners recognise the value of the technology, making specific reference to three aspects of IWB use. Firstly, they appreciate the enhanced presentation of material, indicating that it is brighter and clearer. Secondly, they value stepped learning, which the IWB facilitates, and its capacity for

saving and recalling material, which allows concepts to be revisited and for learning to be reinforced. Finally, they value the rapid responses and immediate feedback provided by interactive software, which also allows learning to be reinforced.

Moss et al. (2007) found that learners were receptive to IWB technology, but reported that any apparent increase in motivation as a result of the novelty of IWB technology was temporary, and waned shortly after the introduction of the IWB. The authors found the learners to be very cautious about the impact of IWBs on behaviour, and they also reported that some learners were reluctant to use the board themselves.

As far as criticisms of the IWB are concerned, Wall et al. (2005) found that the most common theme in the negative comments from learners was frustration when technical problems had a negative impact on use of the IWB. Learners from every school in their study alluded to their IWBs breaking down, and commented on the need to recalibrate the IWB during the course of the lesson. They also complained about having to wait for the board to be started up or shut down. Learners expressed the perception that IWBs are fragile and expensive. Wall et al. also reported that learners who wanted to use the IWB were frustrated by the fact that their teachers did not provide them with enough opportunities to use it. Learners also expressed concern about the negative effects the board may possibly have on their health, including headaches, sore eyes and epileptic fits.

2.9 The IWB in the South African classroom

"…the introduction of an IWB does not in and of itself transform existing pedagogies."

(Moss et al., 2007, p. 6)

It appears that the majority of the studies on IWB use have been conducted in developed countries and that research into the use of IWBs in developing countries has been minimal. This is perhaps not surprising, given that the financial investment which an IWB represents does restrict access to this technology in poorer communities. However, given the objectives of the South African Department of Education's Revised National Curriculum Statement, its recognition of the importance of technology in society and the emphasis that has been placed on the integration of ICT into teaching and learning, the use of IWB has become very relevant in this country, albeit simply because certain schools and certain provincial education departments have already invested in them.

2.9.1 First-world technology transforming third-world classrooms?

Based on research conducted in schools in the Western Cape Province, Miller et al. (2006, p. 100) identified "seven critical adoption factors", which their respondents reported to be "the most influential and important determinants of their ICT usage." The authors classify the adoption factors as either "school-level" or "teacher-level", based on the grouping proposed by Jones (2004), for barriers which prevent teachers from taking full advantage of ICT in their teaching. Independent of the work of Miller et al.(2006), Slay et al. (2007) identified seven "criteria for the successful integration of IWBs into teaching environments" (p. 7), based on current literature and their own work, involving research into the use of IWBs in schools in the Eastern Cape Province.

In **Table 7**, which follows, the seven criteria for the successful integration of IWBs, identified by Slay et al. (2007, p. 7) are listed, together with the critical ICT adoption factors identified by Miller et al. (2006, p. 101). It is interesting to note the similarities between the criteria and the factors identified by the respective research teams.

As **Table 7** indicates, the seven criteria recognised by Slay et al. (2007) as having an influence on the integration of IWBs into teaching environments, include the following. Teachers require a basic level of ICT literacy, because an IWB is essentially an extension of the computer. They require access to ICT facilities and exposure to ICT, as well as administrative support and technical support. The authors found that is was critical for teachers to be given time to experiment with new technologies, and finally, the factor they found to be *most critical* was a willingness to change their thinking and consider changes in their pedagogical practice.

Table 7: Criteria for successful IWB integration and critical ICT adoption factors

	Criteria for successful IWB integration (Slay et al. 2007, p. 7)		Critical ICT adoption factors (Miller et al., 2006, p. 101)	Grouping of adoption factors (Miller et al., 2006)
1	Technical support		Technical support	School-level critical adoption factors
2	Access to ICT facilities		Accessibility of ICT	
3	Exposure to ICT		Lack of resources	
4	Administrative support		Influence of educational leaders	
5	Time to experiment with technology		Time	Teacher-level critical adoption factors
6	ICT literacy		Adequate knowledge	
7	A change in pedagogical practice		Internal belief and motivation	

Table 7 also lists the seven critical factors which Miller et al. (2006) believe to be most influential in determining the extent to which an ICT integration programme succeeds. The school-level factors they identify are technical support, accessibility of ICT, lack of resources and influence of educational leaders. The teacher-level factors they highlight are internal belief and motivation, adequate knowledge and, finally, time. The authors highlighted three key themes underpinning the seven critical success factors they identified. Firstly, they found that teachers need to have a positive attitude towards the use of ICT in teaching. Secondly, they indicate that it is important that a culture of ICT use is promoted amongst teachers and that teachers believe that they are expected to integrate ICT into their teaching. The third theme they highlighted is the provision of skills, resources and support for teachers, in order to enable them to incorporate ICT into their teaching.

In his review of research on barriers to the uptake of ICT by teachers, Jones (2004) indicates that many authors distinguish between two types of barriers, external and internal, which he suggests may also be described as school-level and teacher-level barriers, respectively. He indicates that the relationships and the interactions between the various factors are complex, which means that it is unwise to think of the two groups of factors as being completely separate from each other. However, recognising the extent to which a particular barrier is predominantly teacher-dependent or school-dependent may be helpful in deciding how to address issues relating to the barrier.

In his review of literature on ICT integration in schools, Scrimshaw (2004) identified factors or “key enablers” which are most influential in determining the extent to which teachers are willing and able to incorporate ICT use into their teaching. These enablers include internal school-based strategies and external support bases.

According to Scrimshaw, within the school effective leadership plays a critical role in enabling teachers to experiment with innovative ideas. Proper planning, which incorporates the formulation of a vision statement, a comprehensive needs assessment and the formulation of a school development plan, is vital in ensuring successful ICT integration. Collaboration throughout the school is important, and this should incorporate the sharing of resources, as well as sensitivity to the actual needs of individuals, and the fact that these needs may change over time. Reliable technical support, that is well co-ordinated and effective, is vital (*ibid.*).

Collaboration between schools helps teachers to identify successful practice and provides them with the motivation to attempt new ideas. Co-operation with local communities is also important because it has the potential to allow teachers to provide more authentic, contextualised learning opportunities for the learners. Continuous professional development is preferable to intensive up-front training at the time ICT is introduced. It is vital that training is differentiated based on the

needs and expertise of teachers, so that it is deemed useful and beneficial by the teachers. Involvement in projects beyond the confines of the school, both locally and nationally, is recognised as being helpful in promoting the using of ICT. Scrimshaw also concludes that allowing for variation and innovation within a clearly defined overarching strategy is more effective than adopting a narrow, specific approach to ICT integration (*ibid.*).

2.9.2 The Eastern Cape Province: a case in point

Slay et al. (2007) performed a feasibility study in the Eastern Cape Province in an effort to determine the possible benefits and drawbacks of use of IWBs in South African schools. The authors compared IWB use by two teachers, one of whom was in a less favourable position as far as all the criteria, except willingness to change thinking, were concerned. In spite of the fact that the odds were effectively stacked against her, this teacher used the IWB more effectively. Slay et al. (2007) concluded that it is a willingness to change which is the critical factor in determining whether or not an IWB may be effectively integrated in a teacher's battery of teaching resources. The authors suggest that, unless teachers change their teaching, IWBs will not be successfully integrated into South African schools.

Slay et al. (2008c) reported that use of the IWB in the classroom created the opportunity for teachers and learners to actively construct knowledge by providing access to a range of digital resources. They reported that the IWB improved the teacher's ability to show content, and the learners' ability to visualise the content. Knowledge being created through activities such as brainstorming could easily be captured, and the IWB provided the opportunity for knowledge to be shared through group work and collaboration. They concluded that IWBs do have the potential to be useful in South African classrooms.

The teachers and learners in the study conducted by Slay et al. (2008c) had been using the IWB technology for a relatively short period of time: approximately four months. The authors found that the teachers retrieved content and materials quickly and with ease. The IWB provided teachers with easy access to different content and materials and allowed them to respond to changing dynamics during the lesson. Teachers did provide learners with the opportunity to be creators of knowledge and access different sources of information work collaboratively.

Within the context of their study, Slay et al. (2008c) discussed the role which the IWB played in the sharing of knowledge, through three types of communication. The first form of communication involved the teachers sharing knowledge with learners through prepared material. The visual aspects of the IWB made the teachers' explanations more effective, enhancing this form of communication during the learning process. The second form of communication involved learners sharing with each other through collaborative discussion. The authors indicated that, as reported

in previous studies (Levy, 2002), because the IWB allowed work to be presented more efficiently, more time became available during lessons for group work. Learners became more actively involved because they could explore answers to questions on the IWB immediately. The final form of communication involved learners sharing knowledge with the teacher. Slay et al. reported that learners appeared more motivated and enthusiastic during lessons, following the introduction of the IWBs. Interestingly, the teachers involved in the study commented on the excitement being linked to the novelty of the technology.

Slay et al. (2008b) reported that teachers and learners commented favourably on the visual display and the access to multimedia options provided by the IWB. These authors found that the majority of the benefits discussed by teachers and learners could be attributed to the use of a data projector in combination with a laptop. Most of the problems they encountered were associated with the use of the interactive pen technology.

Slay et al. (2008b) found that the most frequently mentioned advantage of the IWB technology amongst both teachers and learners was the clear visibility of the big screen. This particular feature is a property of the projector, rather than the IWB itself. This led to them questioning whether a data projector in combination with a computer would provide the teachers with all the facilities they needed. Similar studies (Wall et al., 2005) have also found that is the *visual* aspects of IWB technology that are most valued by learners. The value teachers and learners place on the large projected image suggests that a computer connected to a data projector is a worthwhile investment, and brings into question the necessity of an IWB.

Learners reported that because the teacher was able to prepare notes in advance, rather than having to write on the board during the lesson, s/he was able to spend more time interacting with them. The authors suggest that a teacher who is confident and competent in his/her use of the IWB technology, would be able to focus more on the learners, rather than the content s/he is delivering during the lesson. Slay et al. (2008b) indicate that it is important for teachers to be using and practicing ICT skills in order to maintain their level of competence.

Slay et al. (2008b) found that the teachers in their study incorporated several multimedia resources into their lessons. The benefits recognised by the teachers and learners related to the display, rather than the interactive nature of the technology. Again this could be achieved with a data projector linked to a computer, sans an IWB. There are various reasons why multimedia is popular. These include the vibrant colours, the ability to manipulate objects and zoom in or out, and the ability to display a wide variety of information. Multimedia resources also support a wide range of learning styles.

Slay et al. (2008b) also found that teachers commented on the value of using modern technology and the fact that the technology in the classroom brings teaching up to date with technological advances in other areas. They suggest that learners relate well to an IWB because it is technologically advanced. To a certain extent their enthusiasm and interest may be related to the novelty of the technology, but there have been reports of learners' motivation improving during the use of an IWB over a longer period of time (Weimer, 2001).

In their study, Slay et al. (2008b) found that certain teachers simply used the IWB as a replacement for a blackboard. They reported that most of the teachers in their study believed that the interactivity afforded by the IWB technology was the enhanced interactivity between the teacher and the learners during the learning process. One of the teachers in the study attributed these benefits to the laptop and projector, rather than the IWB. Slay et al. (2008b) found that the predominant benefit associated with the IWBs interactive capacity was the fact that the teacher could control the technology from the front of the class, maintaining the position of authority.

Negative issues relating to the IWB technology included concern over the cost of the technology and the ongoing training and maintenance required to ensure that the technology is functional. New technology will only be effective if it is in working order. Slay et al. (2008b) also expressed their concern about the poor ICT literacy levels evident amongst the teachers in their study. The authors found that the problem most frequently reported in connection with the use of IWB technology is the lack of ICT literacy and competency amongst teachers. They discuss the fact that insufficient ICT skills generally result in poor use of IWB technology, and they also point out that *knowledge* of ICT skills doesn't necessarily translate into *application* of the skills. They found that learners are acutely aware of teachers' shortcomings. They raise the issue of teachers with poor ICT skills attempting to use the technology and incorporate it into the learning, but as a result of the teacher's incompetence the technology ends up detracting from the learning experience.

It is important to distinguish between the IWB-associated benefits which may actually be achieved without an IWB, using only a computer and data projector, and the benefits which are dependent on the IWB technology. Moss et al. (2007) were not able to determine whether or not IWBs have more potential in the classroom than the use of data projectors with networked peripherals.

In their study, Slay et al. (2008b) found, perhaps surprisingly, that both the teacher and the learners in the class where the teacher had made the most successful use of the IWB technology were more in favour of the computer/projector combination (sans IWB) rather than the full IWB setup. Participants in the study suggested that teachers should first be given a laptop and projector and shown how to make effective use of the technology. Then, once this technology has been effectively integrated into their teaching practice, the IWB could be introduced.

Six months after their feasibility study was concluded, Slay et al. (2008b) interviewed three teachers who participated in the initial study and found that two of them still made prolific use of the laptop and data projector, with occasional use of the IWB technology. The third teacher was still using the IWB technology.

Slay et al. (2008b) concluded from their research in the Eastern Cape Province that the IWB *does* provide the opportunity for interactivity, but issues relating to a lack of technical skills and the cost of the IWB, as well as safekeeping and security, detract from the benefits it offers. They propose that basic ICT equipment in the form of laptops and data projectors should be offered to teachers as a first step along the path towards ICT integration. They emphasise the importance of providing teachers with ongoing training and support.

The authors indicate that technology should fall in line with pedagogical strategies, rather than dictate them, and they suggest that teachers should be allowed to select the technology they believe will be most beneficial to them in their attempts to achieve their pedagogical aims. They suggest that, if IWB technology is to be effectively integrated into classrooms, then an "evolution of ICT related pedagogy is necessary" (p. 1338). They recommend that interactive technology should be offered to teachers, rather than imposed upon them (*ibid.*).

2.10 Conclusion

In his analysis of research to date, and his consideration of the direction IWB research should be taking as we look to the future, Rudd (2007) suggests that researchers should be moving beyond simply considering whether IWBs are good or bad. The issue of IWB use has now become more complex, and consideration needs to be given to the complexities of IWB use that have been revealed by researchers. Rudd proposes that researchers should be striving to determine the optimum conditions for effective use of IWBs and that they need to identify the factors that influence and support effective use of IWBs. He suggests that it is vital for researchers to consider what is likely to influence future developments in the field of IWB use, and to determine what evidence is required to support the implementation of changes that will enhance IWB use.

2.11 Chapter two in summary

This chapter presents an overview of current perspectives of the use of IWBs in teaching, based on the studies described in literature published over the last decade. To date, the majority of the IWB-related studies appear to have been conducted in the United Kingdom. In this chapter, research themes, which this study will attempt to address within the context of a South African

school, have been considered from the perspective of the studies conducted overseas. The following chapter describes the methodology employed in this study in order to gather the information required to answer the research questions within the context of a well-resourced South African school. The underlying research methodology, the data collection instruments and the data collection strategies are described.

CHAPTER 3
METHODOLOGY

Research Questions

Theme 1
The extent, frequency and nature of IWB use in classrooms

1.1 How are IWBs distributed across the school, and how frequently do learners encounter them?

1.2 How frequently are the existing IWBs being used by the teachers and what factors influence their frequency of use?

1.3 What features of IWBs are being used by the teachers, and how frequently?

1.4 What resources and equipment do teachers use in combination with IWBs?

1.5 How frequently are the existing IWBs being used by the learners and what features are they using?

Theme 2
The impact of IWBs on teaching and learning as perceived by teachers

2.1 What is the general attitude of teachers towards IWBs?

2.2 What attitude do teachers perceive the learners to have with regard to the IWB?

2.3 What impact do teachers perceive IWB use to have on learners' behaviour, attentiveness, motivation and productivity?

2.4 What impact do teachers perceive IWB use to have on the learning process, specifically with regard to their effect on learners' understanding, retention and performance?

2.5 What impact do teachers perceive the IWB to have on lesson planning, preparation and resource development?

2.6 What impact do teachers perceive the IWB to have on presentation, teaching styles and classroom management?

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Theme 3
The challenges and needs of teachers with regard to IWB use

3.1 How competent do teachers using IWBs perceive themselves to be in their use of the IWBs, and how do they believe the learners perceive their use of the IWB?

3.2 What factors do teachers believe influence the effectiveness of their use of IWBs?

3.3 What formal training did teachers receive in the use of IWBs, and how effective was this training perceived to be?

3.4 Do teachers feel the need to improve their use of IWBs and, if so, how do they believe they could best achieve this?

3.5 What perceptions do teachers have of the resources available for use with IWBs?

3.6 How do teachers feel about integrating ICT in the form of the IWB into their teaching, as opposed to using a data projector alone, or making use of computers in a dedicated computer laboratory?

3.7 What limitations, technical or otherwise, do teachers perceive to be preventing them from using IWBs more effectively?

Theme 4
The impact of IWBs as perceived by learners

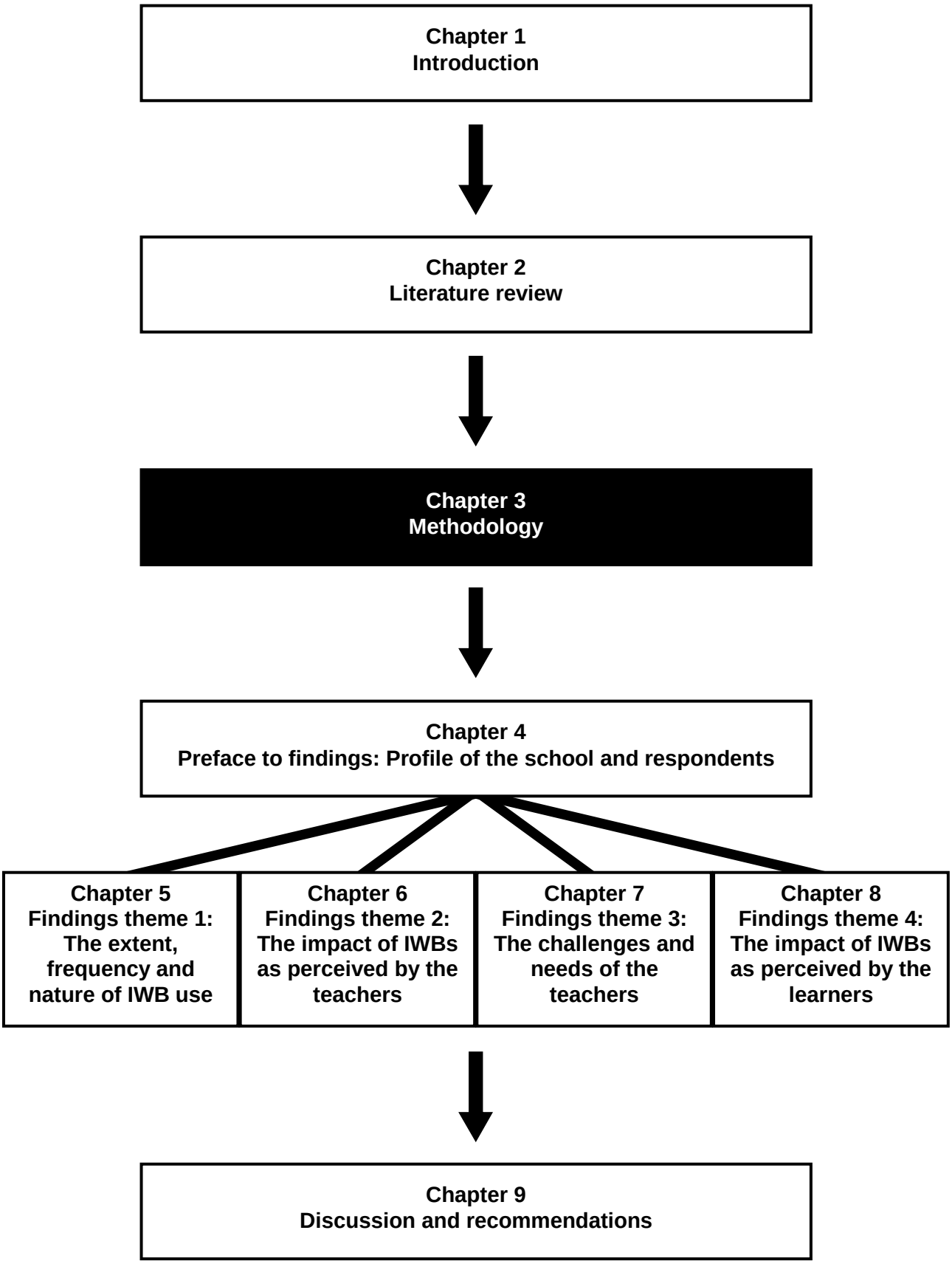
4.1 What is the learners' perception of the level of competency in IWB use amongst teachers?

4.2 What impact do learners perceive the IWB to have on their teachers and the manner in which they facilitate lessons, specifically with regard to the pace of lessons, the teacher's ability to capture and hold their attention, and the presentation and aesthetic appeal of the teacher's audiovisual aids?

4.3 What impact do learners perceive use of the IWB to have on the learning process, specifically on their understanding, retention and productivity?

4.4 What impact do learners perceive use of the IWB to have on their personal behaviour, attentiveness and motivation, and the behaviour of their fellow learners?

Outline of dissertation



Chapter 3: Methodology

3.1 Introduction

This study is perhaps best classified as a case study, incorporating a comprehensive survey and elements of reflective teaching. It represents an attempt by the researcher to investigate, in depth, the influence of an ICT-based educational tool in the context of an existing teaching environment, without influencing the situation during the course of the study, but with a view to possibly proposing interventions designed to improve the current use of ICT. The study was undertaken with the intention of providing readers with a useful, informative description of "real people in real situations" (Cohen et al., 2000, p. 181), from whom valuable lessons may be learnt in the ongoing effort to improve the education South Africa's youth.

Several of the characteristics of a typical case study (Cohen et al., 2000) are applicable to this research project. It focuses on various groups and sub-groups involved in the educational setting and it endeavours to understand the perceptions of these different groups. The researcher has attempted to provide rich, detailed descriptions and analyses, based on the data collected from the respondents. The data collected was a combination of quantitative and qualitative data, and hence a combination of analysis methods was required. Throughout the course of this research the researcher was acutely aware of the importance of striving to ensure the reliability, validity and credibility of the study. In order to address the issues of reliability and validity an attempt was made to implement the principles of triangulation (Cohen et al., 2000).

3.2 Data collection instruments

All of the data collection instruments used in this study were approved by the University of Pretoria Ethics Committee. They are listed below and included for consideration in the appendices of this research report.

- Questionnaire for learners (Appendix 4)
- Questionnaire for teachers with regular or permanent access to an IWB (Appendix 5)
- Questionnaire for teachers with access to a data projector, but no IWB (Appendix 6)
- Interview schedule for structured interviews with teachers using an IWB (Appendix 7)

The research questions which this study attempted to answer are presented in **Table 8** and **Table 9**, which follow, which give an indication of which data collection instruments were intended to yield answers to each question.

Table 8: Research questions and data collection instruments

Research Questions		Data collection instruments*			
		Questionnaires			Teacher interview
		For teachers with an IWB	For teachers with a data projector, but no IWB	For learners	
	Theme 1: The extent, frequency and nature of IWB use in classrooms				
1.1	How are IWBs distributed across the school, and how frequently do learners encounter them?	✓	✓	✓	
1.2	How frequently are the existing IWBs being used by the teachers and what influences their frequency of use?	✓		✓	✓
1.3	What features of IWBs are being used by the teachers, and how frequently?	✓			✓
1.4	What resources and equipment do teachers use in combination with IWBs?	✓			
1.5	How frequently are the existing IWBs being used by the learners and what features are they using?			✓	✓
	Theme 2: The impact of IWBs on teaching and learning as perceived by teachers				
2.1	What is the general attitude of teachers towards IWBs in teaching?	✓	✓		✓
2.2	What attitude do teachers perceive the learners to have with regard to the IWB and its impact on lessons?	✓			
2.3	What impact do teachers perceive the IWBs to have on learners' behaviour, attentiveness, motivation and productivity during lessons?	✓			
2.4	What impact do teachers perceive IWBs to have on the learning process, specifically, specifically with regard to their effect on learners' understanding, retention and performance?	✓			
2.5	What impact do teachers perceive IWBs to have on teaching, specifically with regard to lesson planning, preparation and resource development?	✓	✓		✓
2.6	What impact do teachers perceive the IWB to have on teaching, specifically with regard to lesson facilitation, presentation, teaching styles, classroom management, interactivity and accommodating different learning styles?	✓			✓

*In each case the data collection instrument(s) designed to answer the particular question is/are marked with a tick "✓".

Table 9: Research questions and data collection instruments continued

	Research Questions	Data collection instruments*			
		Questionnaires			Teacher interview
		For teachers with an IWB	For teachers with a data projector, but no IWB	For learners	
	Theme 3: The challenges and needs of the teachers with regard to IWB use				
3.1	How competent do teachers using IWBs perceive themselves to be in their use of the IWBs, and how do teachers believe the learners perceive their use of the IWB?	✓			✓
3.2	What factors do teachers believe influence the effectiveness of their use of IWBs?	✓			
3.3	What formal training did teachers receive in their use of IWBs, and how effective was this training perceived to be?	✓			
3.4	Do teachers feel the need to improve their use of IWBs, and if so, how do they believe they best achieve this?	✓			
3.5	What perceptions do teachers have of resources available for use with IWBs?	✓			
3.6	How do teachers feel about integrating ICT in the form of the IWB into their teaching, as opposed to using a data projector alone, or making use of computers in a dedicated computer laboratory?	✓	✓		✓
3.7	What limitations and stumbling blocks, technical and otherwise, do teachers perceive to be preventing them from using IWBs more effectively?	✓			✓
	Theme 4: The impact of IWBs as perceived by learners				
4.1	What is the learners' perception of the level of competency in IWB use amongst teachers?			✓	
4.2	What impact do learners perceive the IWB to have on their teachers and the manner in which they facilitate lessons, specifically with regard to the pace of lessons, the teacher's ability to capture and hold their attention, and the presentation and aesthetic appeal of the teacher's audiovisual aids?			✓	
4.3	What impact do learners perceive use of the IWB to have on the learning process, specifically on their understanding, retention and productivity?			✓	
4.4	What impact do learners perceive use of the IWB to have on their personal behaviour, attentiveness and motivation, and the behaviour of their fellow learners?			✓	

*In each case the data collection instrument(s) designed to answer the particular question is/are marked with a tick "✓".

Table 8 and **Table 9** indicate which data collection instruments were intended to yield answers to each of the research questions. In each case, the data collection instruments used to collect the data required for answering a particular question are marked with a tick "✓". The research

questions are grouped accorded to the four main research themes. As these tables indicate, the first three themes were addressed predominantly by the two questionnaires given to the teachers, as well as the interviews held with the teachers.

The main aim of the questionnaire given to the learners was to collect data that would be used to address the fourth research theme, dealing specifically with the learners' perspectives of particular aspects of IWB use. It was also intended that the data collected through this questionnaire would provide further insight into the first research theme, concerned with the extent, frequency and nature of IWB use by the teachers.

3.3 Administration of questionnaires and interviews

The researcher approached the headmaster, the director of academics (who was also the deputy head of the school) and the head of Information Technology and requested permission to conduct a study of the integration of IWB use in the school. All three staff members were happy for the study to take place, and expressed their hope that the school may benefit from the findings of the study. The participants in the study included teachers and learners at the school.

3.3.1 Questionnaire completed by teachers with access to an IWB

Twenty-one teachers who had access to an IWB at the time the study commenced were invited to participate in the study. These teachers either had IWBs installed in their classrooms, or had frequent access to an IWB in at least some of their lessons. One teacher who had limited access to an IWB, in certain lessons with certain classes was excluded from the study, because she has never used an IWB. The researcher emailed each staff member, personally, informing them that they study was going to take place and inviting them to participate in it. The email to the staff explained the aims of the study, and described what participation in the study would involve: the completion of a questionnaire (requiring approximately 30 minutes), and the possibility of participating in an interview (lasting approximately 30 minutes). Refer to the appendices for the email sent to staff.

The teachers were asked to inform the researcher as to whether or not they were willing to participate in the study. Most teachers indicated that they were willing to participate. None of the teachers indicated that they were not willing to participate. A hard copy of the questionnaire, together with a cover page, was placed in the pigeon hole of each staff member invited to participate in the study. Refer to the appendices for a copy of the questionnaire. Staff were reminded again that participation was voluntary and that they were welcome to end their

participation at any time. They were asked to sign a form indicating that they were voluntarily consenting to participate in the study.

The teachers were asked to complete the questionnaire and return it to the researcher within two weeks. At the end of the two-week period several questionnaires had been returned, and within a month a total of 13 questionnaires had been returned to the researcher. Staff who had not yet returned their questionnaires were encouraged to do so, if they still wished to participate in the study. This resulted in two more questionnaires being returned, and thus in total 15 of the original 21 questionnaires (71,4%) were returned.

3.3.2 Questionnaire completed by teachers with access to a data projector only

A second group of teachers, all of whom had a data projector, but no IWB installed in their classrooms, was also invited to participate in the study. The researcher emailed each staff member personally, informing them that the study was going to take place and inviting them to participate in it. The email to the staff explained the aims of the study, and indicated that participation in the study would involve the completion of a questionnaire, requiring approximately 15 minutes of their time. Refer to the appendices for the email sent to staff.

The teachers were asked to inform the researcher as to whether or not they were willing to participate in the study. All of the teachers indicated that they were willing to participate. None of the teachers indicated that they were not willing to participate. A hard copy of the questionnaire, together with a cover page, was placed in the pigeon hole of each staff member invited to participate in the study. Refer to the appendices for a copy of the questionnaire. Staff were reminded again that participation was voluntary and that they were welcome to end their participation at any time. They were asked to sign a form indicating that they were voluntarily consenting to participate in the study. The teachers were asked to complete the questionnaire and return it to the researcher within two weeks. All eight teachers returned their questionnaires within the two-week period.

3.3.3 Interviews

From the group of 21 teachers with frequent access to IWBs, seven were invited to participate in an interview. The researcher selected teachers from different subject departments, and emailed each of the participants, inviting them to participate in an interview and informing them that the interview would be captured on video, to allow the researcher to transcribe the interview. They were asked to indicate whether or not they were willing to participate and, if so, to give an indication of the most suitable time for the interview. Six of the teachers indicated that they were willing to participate in an interview, but circumstances prevented the sixth participant from being

interviewed and ultimately only five teaches were interviewed. The researcher arranged to the conduct each of the interviews at a time chosen by the interviewee.

The interviews were structured interviews, following the format outlined in the interview schedule, included in the appendices. At the beginning of each interview, the interviewee was presented with the interview schedule and given an opportunity to read through the questions, so that they could see that nothing intrusive or threatening would be asked, in the hope that this would put them at ease for the interview. Each interviewee was asked whether he/she was happy to be filmed during the interview, or whether they would prefer to have the camera directed away from them, and simply recording the voices of the interviewer and interviewee. All of the interviewees indicated that they were happy to be filmed during the interview.

3.3.4 Questionnaire completed by learners

The researcher obtained permission from the director of academics to ask learners to complete the questionnaire (included in the appendices) during their weekly academic tutor period, which is scheduled to run from 07:25 to 07:50 every Wednesday morning. During this period, the tutor generally spends time discussing academic progress and concerns with each of the tutees.

Teachers with regular access to an IWB, and the tutors associated with two of the boarding houses, were asked to invite their tutees to complete the questionnaire. The researcher emailed each of the teachers concerned and gave them a set of instructions for the administration of the questionnaire. They were asked to emphasise the fact that participation was voluntary, and to ensure that the learners completed the questionnaire individually, and in silence, in an attempt to ensure that they were expressing their personal views without being influence by their peers. Learners were asked to indicate that they were consenting to participate in the study voluntarily, by signing the appropriate form, which is included in the appendices.

This selection process resulted in the collection of a total of 230 questionnaires from learners, with at least 36 responses coming from each of the five grades (year groups) in the school. The 25-minute tutor period appeared to have been adequate for the completion of the questionnaire.

3.4 Data analysis

3.4.1 General comments on questionnaires

Once the questionnaires had been returned, the researcher read through them, checking for incomplete or poorly completed questionnaires. None of the 23 questionnaires received from the teachers was discarded, although there were sections that had been omitted or poorly completed

in some. Where necessary, the researcher approached the teacher concerned and asked for clarity on the relevant responses. Six of the 230 questionnaires received from the learners were discarded for various reasons: four contained large sections that were incomplete, in the fifth questionnaire, the learner failed to enter his identification code and grade, and the sixth discarded questionnaire contained blatantly contradictory responses.

The researcher then captured the data electronically in a conventional spreadsheet programme, based on the layout of the questionnaires. Each question in each questionnaire was assigned a code, and the response from each respondent was captured electronically in a spreadsheet programme to allow easier analysis, manipulation and representation of the data. Where necessary, responses on various scales as discussed below, were assigned numerical values, and thus the data was encoded in a manner that would allow easy counting and manipulation of the data.

Once all the data had been captured, the researcher did some provisional analysis on the data, counting and grouping responses, using the spreadsheet programme to carry out basic calculations. The data was then transferred from the spreadsheet programme into a word processing programme, where it was formatted and presented in a meaningful way. Initially, the formatting was, to a large extent, aligned with the format of the original questionnaires.

Following this provisional formatting process, the researcher began the process of synthesising the data and aligning the responses with the research questions. In several cases, a particular response addressed more than one research question, and so the results were processed and re-arranged where appropriate in an attempt to present them in the most meaningful way.

In certain sections of the questionnaires completed by both the teachers and the learners, the respondents were asked to consider various statements, and indicate the extent to which they agreed or disagreed with each statement. Each statement was structured as a Likert item, allowing the respondent to choose one of five options, as shown below in **Figure 5**. Where the respondents were invited to indicate the extent to which they agreed with a particular statement, the options offered were “Strongly disagree”, “Disagree”, “Neutral”, “Agree” and “Strongly Agree”.

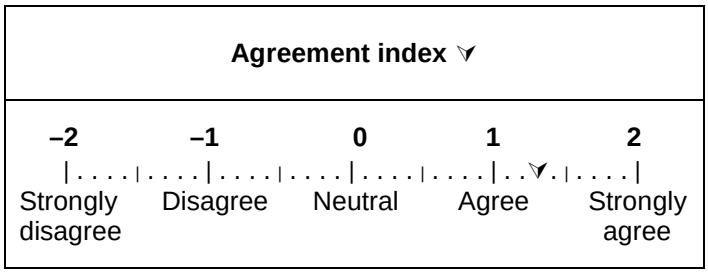


Figure 5: Graphic representation of an agreement index of 1,3

Likert items are limited in terms of the quantitative analysis they allow (Cohen, et al., 2005). The researcher recognised the fact that in using these scales it cannot be assumed that there are equal intervals between the categories. In the actual analysis and discussion of the results, little distinction was made between "Strongly agree" and "Agree", and little distinction was made between "Strongly disagree" and "Disagree". For each such, item the researcher endeavoured to determine whether the majority of respondents were neutral, or agreed or disagreed with the statement. However, in order to allow some level of comparison between statements, the researcher deemed it useful to equate each Likert item to a five-point scale on a number line, from –2 through to +2, as shown in **Figure 5**. Each response from each participant was assigned the corresponding integral value (–2, –1, 0, 1 or 2). For each item the mean of these values was calculated as the ***"agreement index"***, in an attempt to allow statements to be ranked in order of relative agreement, where necessary. The agreement index was used only as an indication of the level of agreement or disagreement with each statement. The researcher was careful not to draw conclusions from a comparison of statements based on these indices alone, and they were analysed in conjunction with the raw data.

Where frequency was the factor under consideration, the response options were each structured as a Likert item, allowing the respondent to choose one of five options, as shown in **Figure 6**, which follows. Where the respondents were invited to indicate the extent to frequency with which something occurred, the options offered were "Never", "Hardly ever", "In some lessons", "In most lessons" and "In every lesson".

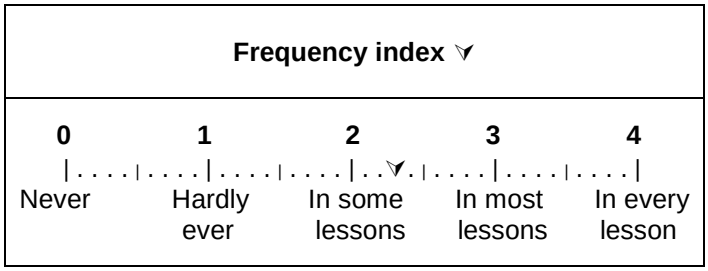


Figure 6: Graphic representation of a frequency index of 2,3

Once again, the researcher recognised the fact that in using Likert items, it cannot be assumed that there are equal intervals between the categories. In the actual analysis of the data, emphasis was placed on the actual number of responses in each category. However, in some cases it was useful to draw some comparisons between items, so each Likert item was equated to a five-point scale on a number line, from 0 through to 4, as shown in **Figure 6**. Each response from each participant was assigned the corresponding integral value (0, 1, 2, 3 or 4). For each item the arithmetic mean of these values was calculated as the ***"frequency index"***.

Similarly, where usefulness was the factor under consideration, the response options were each structured as a Likert item, allowing the respondent to choose one of five options, as shown in **Figure 7**.

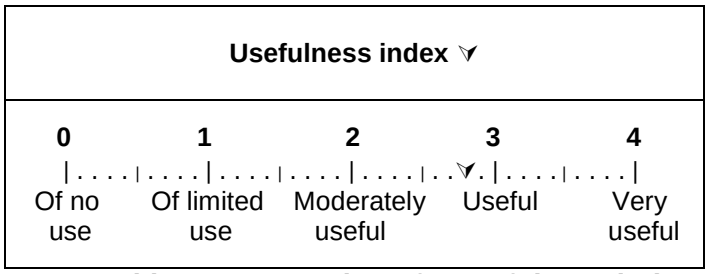


Figure 7: Graphic representation of a usefulness index of 2,3

As indicated in **Figure 7**, the Likert items relating to usefulness provided the respondent with the options "Of no use", "Of limited use", "Moderately useful", "Useful" and "Very useful". In order to allow a comparison of the responses to different items, each response from each participant was assigned the corresponding integral value (0, 1, 2, 3 or 4). The arithmetic mean of these values was calculated as the ***"usefulness index"***.

And likewise, where difficulty was the factor under consideration, the response options were each structured as a Likert item, allowing the respondent to choose one of five options, as shown in **Figure 8**.

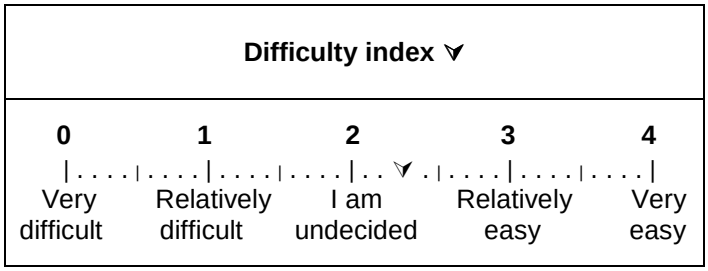


Figure 8: Graphic representation of a difficulty index of 2,3

As indicated in **Figure 8**, the Likert items relating to difficulty provided the respondent with the options "Very difficult", "Relatively difficult", "I am undecided", "Relatively easy" and "Very easy". In order to allow a comparison of the responses to different items, each response from each participant was assigned the corresponding integral value (0, 1, 2, 3 or 4). The arithmetic mean of these values was calculated as the ***"difficulty index"***.

In the cases where the statements under consideration related to influence the response options were each structured as a Likert item, allowing the respondent to choose one of four options, as shown in **Figure 9**.

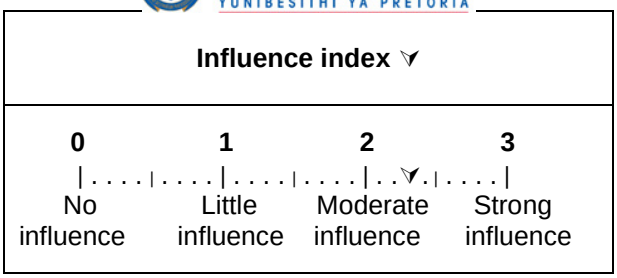


Figure 9: Graphic representation of an influence index of 2,3

As indicate in **Figure 9**, the Likert items relating to influence allowed the respondent to choose between the options of "No influence", "Little influence", Moderate influence" and "Strong influence". In order to allow a comparison of items, each response from each participant was assigned the corresponding integral value (0, 1, 2 or 3). The arithmetic mean of these values was calculated as the ***"influence index"***.

In all of these cases the researcher recognised the fact that, in using Likert items, it cannot be assumed that there are equal intervals between the categories. In the analysis of the data, emphasis was placed on the actual number of responses in each category, as defined by the descriptor, which was chosen by the respondent as a reflection of his/her opinion. Where appropriate and necessary, careful consideration was given to the number of responses grouped to each side of the neutral option, and little distinction was made between adjacent categories. The indices calculated for relative comparisons were thus used only as a guide for analysis.

In each case where Likert items were employed, tables, which have been placed in the appendices, were used to present and analyse the results, indicating the number of responses in each category, and the percentage of the respondents this represented. A graphic representation of the various indices has been used in the chapters of the research report which present the findings, and in certain cases, bar graphs (column charts) have been used to present the number or percentage of respondents in each category. The rationale behind this is that, given the volume of data, a visual depiction (rather than tabulated response counts or percentages) will be more meaningful to the reader, in spite of the fact that it disguises the details and nuances of the data. The reader is able to consult more detailed presentations of the results in the appendices.

3.4.2 Analysis of questionnaires completed by teachers

The data collected from the teachers by means of the questionnaire was mainly quantitative in nature. The responses from the teachers included "yes or no" responses, and a large number of responses on either a four-point or five-point scale, the processing of which has been described.

The questionnaire included several open-ended questions, inviting teachers to provide feedback that could not be given consideration in the response options provided in the questionnaire. Once the bulk of the quantitative data had been captured and organised appropriately, the responses to the open-ended questions were captured into a word processing programme and aligned with the research questions they addressed.

For many of the questions asked in the survey, it was appropriate simply to report the number of each particular response, and the percentage this represented. Tables and bar graphs were used where appropriate to present the collated responses. For many of the questions asked in the survey, it was appropriate simply to report the number of each particular response, and the percentage this represented. Where appropriate, tables and bar graphs (column charts) were used to present the collated responses.

3.4.3 Analysis of questionnaires completed by learners

The data collected from the learners by means of the questionnaire was mainly quantitative in nature. The responses from the learners included “yes or no” responses, responses indicating frequency of IWB use on a five-point scale, and responses indicating agreement or disagreement with a selection of statements, also on a five-point scale, the processing of which is discussed above.

The learners’ questionnaire included an open-ended question asking learners to indicate how they have used the IWB during lessons. The researcher scanned through the questionnaires and attempted to create a classification system with a limited number of groups into which the responses could be placed. The responses to this question were transcribed into a word processing programme. A table was used to summarise the responses to this question.

The learners’ questionnaire included another open-ended question asking learners to arrange their subjects in order of enjoyment. For each subject the learners were asked to indicate whether or not an IWB is present in that subject, and whether or not learners use the IWB in that subject. The number of IWBs present in each learner’s top three subjects was counted and recorded, as was the rank of the subjects in which the presence of an IWB was reported. An attempt was made to investigate whether there may be a correlation between the preference for a subject, and the presence or absence of an IWB. A combination of tables and bar graphs was used to present these results.

In order to determine the prevalence of IWBs and gain some insight into the nature of IWB use by the teachers and learners, the number of subjects in which each learner encountered an IWB was determined, as well as the number of subjects in which each learner experienced use of the IWB

by learners. These counts were totalled for all the learners as a group, and then for the learners in each grade, and the means and standard deviations were calculated. A combination of tables and bar graphs was used to present these results.

3.4.4 Analysis of interviews

After doing a preliminary analysis of the responses to the questionnaires, interviews were conducted with teachers in order to clarify some of the responses to the questionnaires and validate and gain insight into any trends that appeared in the data. Each of the interviews lasted between 25 and 45 minutes, and was captured on video, using a standard home video camera.

The interview footage was transferred from mini-DV tapes to DVDs using standard editing software and captured in AVI format. The researcher then played the DVDs using standard audiovisual software, the VLC Media Player, available as freeware on the Internet.

While listening to the audio stream from the DVDs, the researcher transcribed the dialogue from the interview using standard word processing software. The transcription of each interview was presented to the respective interviewee for verification, and feedback from the interviewees was taken in consideration.

Once the transcription was complete, the researcher re-organised the transcribed responses, cutting and pasting text from each transcript so that all five responses to each question on the interview schedule were grouped together and placed beneath the question in a single document.

The researcher then read through the responses to each question and highlighted key phrases. The responses were used to complement and enrich the data collected by means of the questionnaires. In some cases the key statement made by an in interviewee was paraphrased in the researcher's discussion. In other cases appropriate quotes from the interviews were used in the analysis of the results to confirm and reinforce the findings.

3.5 Validity and reliability

3.5.1 Internal validity

Where the internal validity of this study was concerned, the researcher endeavoured to ensure that the findings were an accurate depiction of the reality of the situation under investigation in this case study and, furthermore, that scrutiny of the data would show that it supports the descriptions and explanations presented in this report. In other words, throughout the planning and implementation

of this investigation, the researcher strove to ensure that the findings would accurately depict the situation under investigation (Cohen et al. 2000). The researcher endeavoured to maximise the internal validity and credibility of this study by employing the principles of triangulation, specifically methodological triangulation and data triangulation.

The principles of methodological triangulation were employed by making use a combination of different data collection instruments (questionnaires and interviews), which yielded a combination of both quantitative data and quantitative data. The researcher hoped that there would be a strong correlation between the data gathered in the questionnaires and the data gathered in the interviews, and that a satisfactory level of concurrent validity would thus be demonstrated.

The principles of data triangulation were implemented through the collection of data from two different groups in the school, namely the teachers and the learners. The teachers who participated in this study consisted of two groups, with the potential of offering different perspective on the integration of ICT: those who had permanent or frequent access to an IWB and those who had permanent access to a data projector, but no IWB. It was hoped that by structuring the study in this manner a satisfactory degree of validity would be achieved.

The researcher also addressed the issue of validity by encouraging participants to be honest in their responses, assuring them that their identities be protected, and that the intention of the study was not to scrutinise individual use of the IWB, nor criticise current practice amongst the staff as a whole. They were informed that the intention of the study was to seek way to improve the use of IWBs by staff.

The researcher also addressed the validity of the study by placing great emphasis on collecting rich data, covering the issues concerned in as much depth as possible within the given time constraints. The data collection instruments were carefully structured, with items included to provide cross-checks. The data collected was broad in its scope, and in most cases each issue or question was addressed through multiple questions, directly and indirectly, again providing cross-checks. The researcher addressed the issue of credibility by employing the principle of member checking with regard to the interviewees, offering them the opportunity to screen the transcripts of their interviews and provide feedback.

Throughout the study the researcher endeavoured to remain objective and maintain a level of disinterestedness in the study. Data capture and analysis was carried out in such a manner that trends would not become clearly evident until the analysis was complete. With the data being encoded, the trends were at least partially disguised initially.

3.5.2 External validity

With regard to the external validity of this study, the researcher was acutely aware of the fact that the school which is the focus of this case study was not a typical example of a South African high school. For this reason, at first glance, to the reader the school may not appear to be a sensible choice for a study such as this, the findings of which are intended to be generalised to the wider arena of South African education. The reader may thus, with good reason, question the comparability and transferability of this study (Cohen et al. 2000).

The school at which this study was based was fortunate to be exceptionally well-resourced, not only by South African standards, but by world standards. Certain aspects of the school were certainly comparable with top high schools around the world. However, the characteristic wealth of the school, with regard to facilities, resources and ICT, which makes the school atypical in the South African context, also renders it useful for the purposes of a study such as this. Because this wealth has allowed the school to acquire ICT resources ahead of most other South African schools it is also experiencing success and failure ahead of most other South African schools.

The researcher recognised that an evaluation of the ICT integration strategy that was employed at the school over the last few years had the potential to inform the decision making of other schools, which are lagging behind it in terms of ICT integration, as a result of financial constraints. Policies and strategies that have worked well could be emulated by other schools, while the failures and mistakes could be avoided to a greater or lesser extent. In other words, the lessons learnt in the context what is essentially an atypical South African high school could be extremely valuable in the broader context of South African education.

As indicated by various authors cited in Cohen et al. (2000, p. 109) in their discussion of external validity, researchers hoping to achieve a high degree of external validity, and specifically transferability, need to provide data that is rich enough to allow readers and, more specifically, other researchers wishing to build on the study, to determine whether or not transferability is possible. In this study the researchers has endeavoured to provide rich data that is sufficient for these purposes.

3.5.3 Reliability

In order to address the issue of reliability with regard to the data collection instruments, the construction of the questionnaires and interview schedules was modelled on instruments that had reportedly been used successfully in previous studies of IWB use. The researcher addressed the issue of reliability in the interviews by conducting structured interviews, using the format and

sequence of questions (and the wording) presented in the interview schedules, which are included in the appendices. The researcher ensured that the questions being asked are not leading, or misleading, and consciously attempted to prevent personal views from influencing the responses of the interviewees. The researcher ensured that the data collected during the interviews was dependable by allowing interviewees the opportunity to review the transcripts and then the findings and analysis of the data prior to their inclusion in the final research report.

In order to address the issues of reliability and validity an attempt was made to implement the principles of triangulation (Cohen et al., 2000) by making use a combination of different data collection instruments (questionnaires and interviews), which yielded a combination of both qualitative data and quantitative data. The researcher hoped that there would be a strong correlation between the data gathered in the questionnaires and the data gathered in the interviews, and that a satisfactory level of concurrent validity would thus be demonstrated. The principles of triangulation were also implemented through the collection of data from two different groups in the school, namely the teachers and the learners. It was hoped that by structuring the study in this manner a satisfactory degree of validity would be achieved.

3.6 Ethical considerations

3.6.1 Overview

Throughout this study the researcher endeavoured to ensure that no participants were harmed in any way, and that their privacy was protected. Given that the researcher was conducting the research within his work environment, and that the participants were his colleagues and learners, it was obviously in his best interest to ensure that involvement in this study was a positive experience for all participants, in the hope that he would maintain good relationships with them.

Being a member of the staff at the school where the research was conducted made it somewhat easier for the researcher to gain permission to conduct the research, than it would have been if he were an unknown outsider, but nothing was taken for granted. In accordance with the recommendations made by Bell (1987 in Cohen et al., 2000), and the requirements of the University of Pretoria's Ethics Committee, the researcher approached the Headmaster of the school, the Director of Academic Studies at the school and the Head of the Information Technology Department, presenting them with an outline of the plan for the research project, explaining the link to the studies, and describing possible benefits to the learners and the teachers of the school.

As suggested by Cohen et al. (2000), the researcher presented to the Head of Academics and the Head of Information Technology an outline of the aims of my research, the research project design, the target groups who would be invited to participate in the study, the data gathering instruments to be used, and the arrangements that would be made to guarantee confidentiality. The researcher also presented an outline of the intended time frame for the project, and details of assistance that was required in organising and administering the research. The researcher also discussed with them the role that feedback from the research could play in the future of the school, and the potential practical applications and implications envisaged.

Based on the recommendations of Bell (1991, in Cohen et al., 2000), the researcher undertook to ensure that the participants in the study would remain anonymous and that all information gathered in the study will be treated with the strictest confidentiality. To allow him to follow up on responses where necessary, each participant was assigned a research code, but these codes are meaningless to anyone beyond the confines of the school, and hence the identities of the participants remained protected beyond the confines of the school.

As far as the interviews were concerned, interviewees were given the opportunity to read through the transcriptions of their interviews, and they were asked to verify statements quoted from their transcripts while the research report was in its draft form. They were also offered access to a copy of the final report.

Because this study attempted to explore the use of ICT in the classroom, it was the researcher's intention that the final report may be of benefit to the participants (learners and teachers) at the school. The researcher indicated that he would provide the teachers who participated in the study with the opportunity to discuss the research and answer questions relating to the study and their use of IWBs. As far as the learners were concerned, the questions being asked in the questionnaire were not intrusive, so it was hoped that they would not feel threatened, and that they were happy to answer honestly.

As a result of the nature of this study and its concern with the use of technology, there was the possibility that the some participants, most likely amongst the teachers may experience a sense of failure or inferiority when comparing themselves to other. For example, there was the likelihood that certain teachers may consider their use of the IWB to be inferior to that of other colleagues. The researcher was sensitive to such issues, and endeavoured to ensure that no participants perceived their involvement as a negative experience. Teachers who completed the questionnaire or participated in the interview were assured that the aim of the study was not to scrutinise individual use of the IWBs in order to determine who makes best (or worst) use of the technology,

but rather to determine how all IWB users (irrespective of their current level of use) may improve their use of the technology so that it may enrich their teaching.

3.6.2 Protection of identities

The learners were asked to enter their school learner codes on the questionnaire to allow the researcher to follow up with individuals if the need arose. The learners were not asked to write their names on the questionnaires. Beyond the school the learner codes have no relevance, and thus the learners' identities were protected. Nowhere in the research report is mention made of individual learners by way of the codes or names.

Each of the teachers who were invited to participate in the study was assigned a code to allow the researcher to make follow up on the responses, where necessary, and to allow the researcher to make appropriate inferences and carry out important crosschecks on the data. Nowhere in the findings is the name of any of the teachers mentioned. The nature of the findings is such that, if the reader is familiar with the staff at the school, then the identity of particular respondents may be apparent.

3.6.3 Consent

Once the headmaster had given his approval for the study to proceed, the director of academic studies agreed to inform the parents that the study was taking place in the school, and that their sons may be chosen to participate in the study. The researcher asked the director of academic studies to invite parents to contact her, if they had any objections.

Learners and staff were given letters describing the study and inviting them to participate in it. Copies of these letters are provided in the appendices. The letter provided an outline of what participation in the study would involve, the intentions of the researcher and the potential benefits the study may yield for the participants. It was made clear to learners and staff that their identities would be kept confidential. They were informed that they may end their participation at any time during the course of the study. Potential respondents were asked to sign a document indicating that the voluntarily agreed to participate in the study and that they were happy for their input to be included in the research report to be submitted to the University of Pretoria.

3.7 Chapter three in summary

This chapter presents the methodology employed by the researcher in this study. It describes the nature of this study and the approach adopted by the researcher. The data collection instruments

are described and the implementation of the data collection strategy is discussed. The researcher's approach to analysis of the data is outlined. The measures taken to address the validity and reliability of the study are addressed, and the ethical considerations which were borne in mind by the researcher during this study are discussed.

The next chapter presents an introduction to the results of the study, including a description of the school which was the focus of this study. Profiles of the staff and learners are given. This lays the platform for the four chapters which follow, in which the findings that emerged from the data collected through the questionnaires and the interviews are presented. The results have been processed and grouped appropriately to answer each of the research questions linked to the four major themes of this study, which are listed below.

- The extent, frequency and nature of IWB use
- The impact of IWBs on teaching and learning as perceived by the teachers
- The challenges and needs of the teachers
- The impact of IWBs as perceived by the learners

CHAPTER 4
PREFACE TO FINDINGS
PROFILE OF THE SCHOOL AND RESPONDENTS

Research Questions

Theme 1
The extent, frequency and nature of IWB use in classrooms

1.1 How are IWBs distributed across the school, and how frequently do learners encounter them?

1.2 How frequently are the existing IWBs being used by the teachers and what factors influence their frequency of use?

1.3 What features of IWBs are being used by the teachers, and how frequently?

1.4 What resources and equipment do teachers use in combination with IWBs?

1.5 How frequently are the existing IWBs being used by the learners and what features are they using?

Theme 2
The impact of IWBs on teaching and learning as perceived by teachers

2.1 What is the general attitude of teachers towards IWBs?

2.2 What attitude do teachers perceive the learners to have with regard to the IWB?

2.3 What impact do teachers perceive IWB use to have on learners' behaviour, attentiveness, motivation and productivity?

2.4 What impact do teachers perceive IWB use to have on the learning process, specifically with regard to their effect on learners' understanding, retention and performance?

2.5 What impact do teachers perceive the IWB to have on lesson planning, preparation and resource development?

2.6 What impact do teachers perceive the IWB to have on presentation, teaching styles and classroom management?

continued/...

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Theme 3
The challenges and needs of teachers with regard to IWB use

3.1 How competent do teachers using IWBs perceive themselves to be in their use of the IWBs, and how do they believe the learners perceive their use of the IWB?

3.2 What factors do teachers believe influence the effectiveness of their use of IWBs?

3.3 What formal training did teachers receive in the use of IWBs, and how effective was this training perceived to be?

3.4 Do teachers feel the need to improve their use of IWBs and, if so, how do they believe they could best achieve this?

3.5 What perceptions do teachers have of the resources available for use with IWBs?

3.6 How do teachers feel about integrating ICT in the form of the IWB into their teaching, as opposed to using a data projector alone, or making use of computers in a dedicated computer laboratory?

3.7 What limitations, technical or otherwise, do teachers perceive to be preventing them from using IWBs more effectively?

Theme 4
The impact of IWBs as perceived by learners

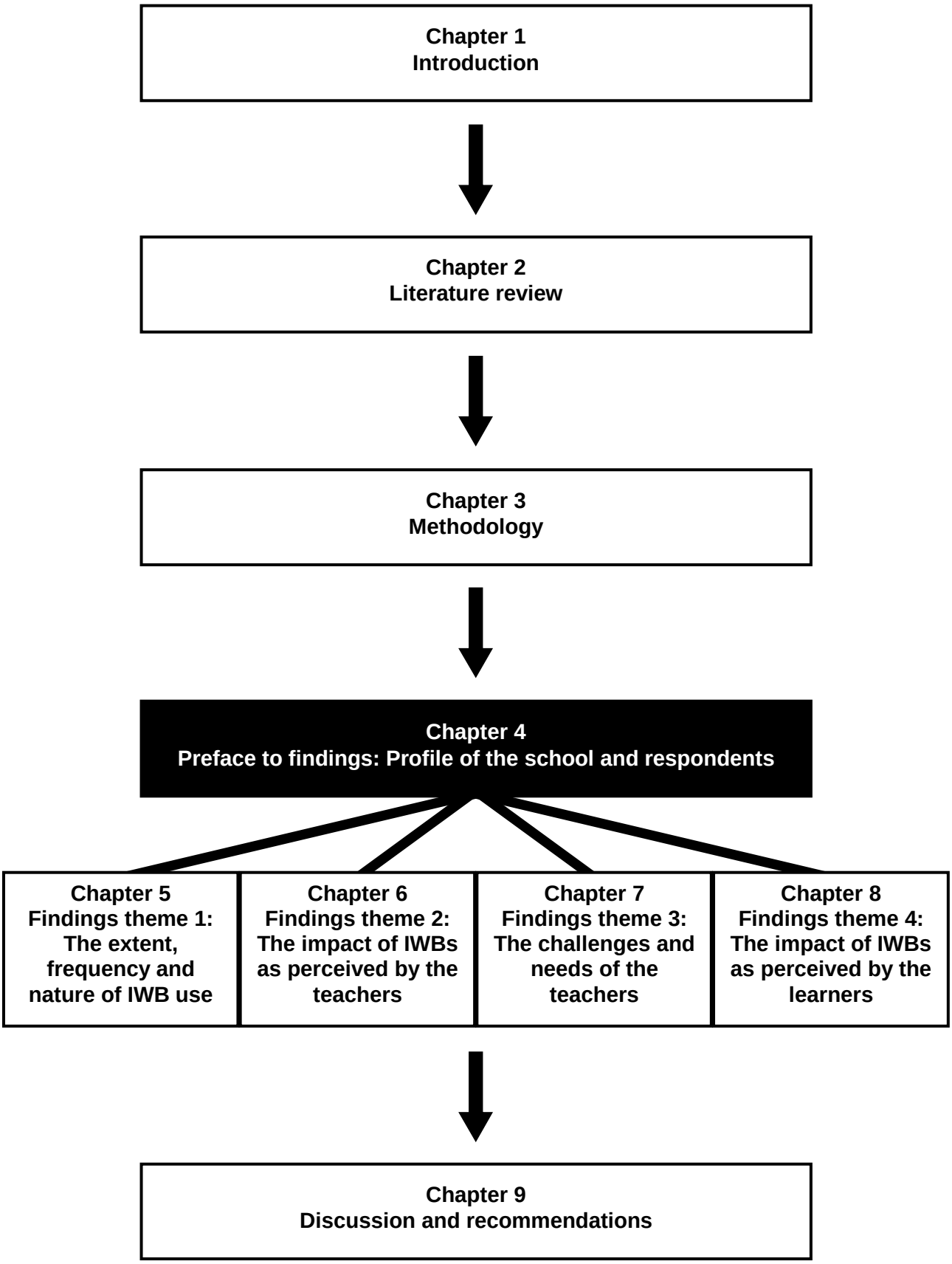
4.1 What is the learners' perception of the level of competency in IWB use amongst teachers?

4.2 What impact do learners perceive the IWB to have on their teachers and the manner in which they facilitate lessons, specifically with regard to the pace of lessons, the teacher's ability to capture and hold their attention, and the presentation and aesthetic appeal of the teacher's audiovisual aids?

4.3 What impact do learners perceive use of the IWB to have on the learning process, specifically on their understanding, retention and productivity?

4.4 What impact do learners perceive use of the IWB to have on their personal behaviour, attentiveness and motivation, and the behaviour of their fellow learners?

Outline of dissertation



Chapter 4: Preface to findings – Profile of the school and respondents

4.1 Introduction

The previous chapter describes the methodology employed by the researcher. It describes the data collection instruments and the data collection strategy. It also presents a brief outline of the data analysis process and the measures employed to maximise the validity and reliability of this study, as well as the ethical considerations.

This chapter sets the scene for the study. It describes the school where this study took place, including the profile of the staff respondents and the learner respondents. It lays the platform for the presentation of the findings, which follows in the next four chapters. The findings are grouped according to the main research themes, which are listed below.

- The extent, frequency and nature of IWB use
- The impact of IWBs on teaching and learning as perceived by the teachers
- The challenges and needs of the teachers
- The impact of IWBs as perceived by the learners

4.2 Brief description of the school

The school where this study took place is a private (independent) South African English-medium boys' high school, established over a hundred years ago (in 1872). The school is situated on a peri-urban estate (in KwaZulu-Natal), occupying 1700 hectares of land. The school facilities include eleven sports fields, six tennis courts, six squash courts and a swimming pool used for diving, swimming training and water polo. All the learners are full-time boarders. There are seven boarding houses, each occupied by approximately 80 boys. The majority of the academic staff live in housing on the estate.

Of particular relevance to this study is the fact that at the time the research was conducted, there are 37 classrooms, seven sciences laboratories, four computer laboratories and four lecture theatres (according to the ISASA survey completed in 2008). Of these 52 venues, fifty were used as permanent (regular) teaching venues. At the time of the commencement of this study, 21 teaching venues (42,0%) were equipped with IWBs. There were a further nine regular teaching venues and three lecture theatres equipped with data projectors, and thus 62,3% of all teaching venues (33 out of 53) were equipped with data projectors.

4.3 The school's academic programme

The school operates on a four-term system, and runs lessons on a two-week cycle. Each day from Monday to Friday the learners attend six 50-minute lessons. A normal school day consists of three lessons, and then a tea break, which is followed by another three lessons and then lunch, after which the learners have a rest period of approximately 45 minutes, before beginning the sports programme at 15:00. Most learners in Grades 8 and 9 are involved in sports on Monday and Wednesday afternoons. Most learners in Grades 10, 11 and 12 are involved in sports on Tuesday and Thursday afternoons. Most boys in the school are involved in sports matches on Friday afternoons and Saturday mornings. On most Saturday mornings learners attend one 50-minute lesson before participating in sport fixtures.

The learners in Grades 8 and 9 (for the purposes of this study, *junior* learners) take twelve academic subjects. An outline of their subject choice package follows in **Table 10**.

Table 10: Subject choice package for grades 8 and 9

Compulsory subjects (listed in alphabetical order)	
1	Accounting: Economic and Management Sciences
2	Arts and Culture
3	Design and Technology
4	English
5	Geography: Social Sciences
6	History: Social Sciences
7	Life Orientation (includes Physical Education and Religious Education)
8	Mathematics
9	Natural Sciences: Life Sciences
10	Natural Sciences: Physical Sciences
Choice subjects	
11	Second Language (Afrikaans, French or Zulu)
12	Third Language (French or Zulu) or Structured Reading (in Grade 9 only)

At the end of Graded 12, the learners write the Independent Examination Board (IEB) examinations, which are based on the New Curriculum Statements and qualify them for the National Senior Certificate. The learners in grades 10, 11 and 12 (for the purposes of this study, *senior* learners) take at least seven subjects during the course of the normal academic timetable. Learners may choose to do additional subjects after hours. An outline of their standard subject choice package follows in **Table 11**.

Table 11: Subject choice package for grades 10, 11 and 12

Compulsory subjects	
1	English
2	Life Orientation
Subject choice options	
3	Second Language (Afrikaans, Zulu or immigrants may choose French)
4	Mathematics or Mathematical Literacy
5	Physical Sciences, Life Sciences or Geography
6	Life Sciences, History, Dramatic Arts, Accounting or Business Studies
7	Geography, Visual Arts, French, Music, Accounting or Information Technology

As **Table 11** indicates, all learners take English and Life Orientation, and all learners are required to choose a second language, and then either Mathematics or Mathematical Literacy. Their other three subjects may consist of a variety of combinations.

4.4 ICT at the school

The school provides most of the staff (approximately 83%) with a personal laptop and those staff members without a laptop have a classroom or office desktop, for their use while they are employed by the school. The allocation of laptops and desktops is managed by a senior member of the management team. According to the ISASA survey completed in 2008, there were 300 computers in the school. This count included academic and administrative staff machines, as well as the computers provided for use by the boys. This number increased with the introduction of new laboratory computers in the second half of 2008, and the subsequent redeployment of the replaced machines for use by staff members who were previously without access to a computer.

In 1998, after conducting research and visiting other schools, the school management team decided not to adopt a “laptop programme”, where each learner would make use of a personal laptop during lessons. The headmaster at that time believed that such an initiative would not be worthwhile, unless teachers were going to facilitate lessons in such a way that boys would make extensive use of their laptops in the majority of their lessons. It was felt that the teachers would not facilitate extensive use of the technology. Other factors which influenced this decision were the additional costs that such a programme would impose on parents (for software and hardware) and on the school (for providing power, networking and technical support). It was felt that a more effective approach was to provide sufficient, computer laboratories of a high standard, with all the software boys may find necessary in their use of the computers as part of the academic programme. Another factor that was considered relevant is that the school, being all-boarding, can

make the computer laboratory facilities accessible to the learners in the evenings, thus in theory rendering personal laptops superfluous.

The following passage is taken from the school's website, where ICT is being considered in the context of the school's academic programme.

> "Information and Communication Technology (ICT) is playing an increasingly important role in the lives of all people in the global, connected world. The school is meeting the challenges posed by these new technologies by providing top class facilities for the boys. We have four up-to-date computer labs, and we have high speed (but carefully managed) Internet access.
>
> However, the main focus of our approach to ICT is not on the technology itself, but rather what it can do for the boys as they develop their cognitive and academic skills. All departments are engaged in finding sources of information and software applications which can improve the way their subjects are learned. This means that the technology is used in context, and as a means to developing other more fundamental skills such as problem solving, information management, etc."

Since April 2001, the school has had four computer laboratories, each equipped with 27 desktop computers and a data projector. The computers were all upgraded in June 2008. A teacher may take a class of learners to any of the computer laboratories during a lesson. The staff make use of an online booking system to secure a venue and submit requests for technical assistance or Internet access during the lesson. The learners have restricted, monitored access to the Internet between 14:00 and 18:30 each afternoon from Monday to Friday. In addition to this they are permitted to use the computer laboratories between 18:45 and 20:30 each evening, from Monday to Friday, for school work only (with no Internet access). Boys are given network access points for privately owned laptops in one of the computer labs.

In spite of the fact that the school has not adopted a "laptop programme", the vast majority of the learners do possess a personal laptop. At various times in the past few years, the possibility of providing each of the boarding houses with a wireless network and Internet access was investigated. It was decided that in the short term these facilities would not be provided for the boys, largely because the administrative and policing complexities that would arise, in the opinion of the housemasters, currently outweigh the undoubted benefits of providing access. Given that many parents provide their sons with laptops and mobile access to the Internet, the groups which have reviewed the situation have concluded that what the school offers in terms of the computer laboratories and Internet access is sufficient.

4.4.1 The introduction and integration of IWBs into the school

The school began investigating the possibility of introducing IWBs in 2001, after the chairman of the school board reported seeing a lot of activity relating to IWBs in the UK, and he was keen for the school to get involved. At about the same time, the head of Information Technology was reading about them and had seen demonstrations, and so he was keen to begin investigating the possibility of acquiring one. He put a motivation to the school board for one, and because the company he approached was having an introductory special, the school was given two, which were delivered in 2003. One was mounted in a lecture theatre (available to any staff member who booked the venue) to allow all staff to use it. The other was given to one of the Mathematics teachers, who is interviewed later in this study. This IWB was mounted on wheels, so others could also use it. This was the school's experimental period.

Soon after the installation of the first two IWBs, the Mathematics and Geography departments expressed enthusiasm about them, and were very keen to acquire more. A plan was drawn up for who was going to receive IWBs over the next few years. The Mathematics department was prioritised ahead of other departments, but the other departments were also included in this plan. During this time, the new science (Physical Sciences and Life Sciences) laboratories were built, and it was decided to install IWBs in them as part of the basic design. This resulted in the acquisition of additional IWBs, which had not necessarily been part of the original plan.

As far as the acquisition and distribution of IWBs were concerned, certain departments really wanted them and budgeted accordingly, while others liked the idea but needed to be encouraged to commit to budgeting for them. The head of Information Technology was keen to deploy IWBs, but wanted to follow a structured adoption path, following the sequence of providing each teacher with a laptop, then a data projector and then an IWB. The intention behind this was to provide each teacher with the opportunity to develop interest and gain competence in a stepwise manner.

Where the allocation of IWBs allocated to subject departments was concerned, after the Mathematics, Geography and Science Department, an attempt was made to try and give IWBs to the other subject departments that were keen, while simultaneously spreading the idea and fostering interest in other departments, possibly via data projectors first. With regard to the type of IWBs in classrooms at the school, all of the IWBs installed were SMARTboard IWBs. By comparison, in the study conducted in the United Kingdom by Moss et al. (2007), 70% of the IWBs being used by teachers were Promethean IWBs, and 24% of the IWBs were SMARTboard IWBs.

4.4.2 ICT and IWB-specific staff training

As far as general ICT-related staff training is concerned, soon after his arrival at the school, the head of Information Technology offered a selection of courses, but he felt that they were not very successful, because attendance was disappointing and he decided he needed to find another way of assisting the staff, more effectively. He also recruited teachers to attend Intel courses, which were well received. But he believes that the time involved in training makes it unattractive to most teaching staff.

Apart from that, he has adopted more of a coaching-based approach (rather than training) working with teachers on specific skills as and when they indicate their needs. He expressed the desire to do more of that kind of work, but is inhibited by the demands of his current workload.

As far as training in IWB use was concerned, no formal courses were offered, but the head of Information Technology ran a one-day conference based on subject groupings, and invited all the school staff to attend, along with other schools. Apart from that, he believes that departments have trained themselves by sharing resources and expertise informally. He has made himself available to assist when asked. Since the installation of the first IWBs, no evaluation of the integration and the use of IWBs has taken place.

4.4.3 ICT and IWBs: the school management team's vision

Where the school management team is concerned, and specifically with regard to their vision for ICT in teaching and learning, and the role IWBs may play, there is a perception that as an institution the school lacks a vision for teaching and learning. To quote one teacher "We are not really a *learning* institution, i.e. teachers and management are not keen on grappling with the big picture and new ideas, and then developing a vision out of that. So, IWBs are just a small part of a lack of vision."

With regard to the school management team's view on staff training and development, specifically in ICT-related areas, one staff member indicated that it seems as though the management team is happy "as long as everything works", and went on to suggest that because there is "...no apparent drive towards a dynamic vision, there is no real challenge, and hence no perceived need for training, other than to a point where everything keeps on working [satisfactorily]. If we were more of a learning organisation, there would be more hunger!"

There are staff members who are concerned about the fact that the school demands that its teachers are involved in several aspects of school life, from teaching in the classroom, to coaching on the sports field and fulfilling a pastoral role in the boarding houses. There does not appear to

be scope for teachers to become academic specialists. To quote one teacher, "I have become a multi-skilled, overstretched jack-of-all-trades rather than a focused specialist in professional development."

4.5 Description of the academic staff

At the time of this study, the academic staff who were teaching regularly included 47 full-time teachers and eight part-time teachers. It is this group of staff members that is of interest in this study, because these staff use the IWBs in the school. The distribution of these academic staff across the various subject departments in July 2008 is presented in **Table 12**.

Table 12: Distribution of teaching staff in July 2008

Subjects (listed alphabetically)	Number of full-time staff*	Number of part-time staff*	Total number of staff*
Accounting	2	2	4
Afrikaans	4	–	4
Dramatic Arts	–	1	1
English	7	–	7
French	1	2	3
Geography	5	–	5
History	2	–	2
Information Technology	2	–	2
Life Orientation*	4	–	4
Life Sciences	4	–	4
Mathematics	6	2	8
Music	3	–	3
Physical Sciences*	3	1	4
Visual Arts	2	–	2
Zulu*	2	–	2
Total	**47**	**8**	**55**

*Certain teachers teach more than one subject. Here teachers have been classified according to the subject department in which they teach the majority of their lessons.

In addition to the teaching staff listed in **Table 12**, there were three librarians, a part-time remedial teacher, a part-time visual arts teacher, three sciences technicians, an arts technician, a full-time sports coach and housemaster, and the sports administrator, who does physical education. The academic staff team also included the marketing manager, the director of marketing, the director of development and the headmaster, none of whom taught regularly. Thus there were, in total, 70 academic staff. The total number of full-time administrative staff was 36 and there were 2 part-time administrative staff. In addition to this, there were 17 full-time additional support staff. The total

staff complement was thus 125. The demographic breakdown of the academic staff members (full-time and part-time) who were teaching regularly at the time of this study is shown in **Table 13**.

Table 13: Demographic profile of teaching staff

Demographic classification (in order of prevalence)	Number of staff	Percentage of staff
White	49	89,1%
Indian	4	7,3%
African	1	1,8%
Coloured	1	1,8%
Asian	–	–
Total	**55**	**100%**

As **Table 13** indicates, the vast majority of the teaching staff (89,1%) was white. There were four Indian staff members (7,3%), one black staff member and one coloured staff member, who were teaching regularly.

4.6 Profile of staff respondents

The questionnaires completed by both groups of teachers (those with and those without an IWB) asked them to record their ages and their number of years of teaching experience. They were also asked to give an indication of their own levels of computer literacy and, where appropriate, their perceptions of their personal competence in IWB usage. Fifteen teachers who had regular access to IWBs at the time of the study completed the questionnaire. Two teachers with permanent access to an IWB did not complete the questionnaire, but they participated in an interview. Their details are included here, bringing the total number of teachers with regular access to an IWB to 17. Eight teachers who have permanent access to a data projector, but no IWB, completed a questionnaire. The responses from all 25 teachers with regard to their personal details are presented in **Table 14**.

None of the teachers who participated in the study was younger than thirty. As shown in **Table 14**, of the fifteen teachers with regular access to IWBs, six (35,3%) were 30 to 39 years old, eight (47,1%) were 40 to 49 years old, and three (17,6%) were over 50 years old. Of the eight teachers with a data projector, but no IWB, three (37,5%) were 30 to 39 years old, three (37,5%) were 40 to 49 years old and two (25,0%) were over 50 years old. Where the number of years of teaching experience was concerned, one teacher with an IWB had less than 5 years of teaching experience. Two teachers with IWBs and one teacher with a data projector and no IWB had 5 to 10 years of experience. The remaining fourteen with IWBs (82,4% of this group) and the remaining seven with no IWBS (87,5%) all had more than ten years of teaching experience.

Table 14: Profile of staff respondents

		Number of teachers with access to IWBs (n=17)	Number of teachers without an IWB (n=8)	Total number of respondents (n=25)
Age	30 – 39	6 35,3%	3 37,5%	9 36,0%
	40 – 49	8 47,1%	3 37,5%	11 44,0%
	Over 50	3 17,6%	2 25,0%	5 20,0%
Years of teaching experience	Less than 5 years	1 5,9%	–	1 4,0%
	5 – 10 years	2 11,8%	1 12,5%	3 12,0%
	More than 10 years	14 82,4%	7 87,5%	21 84,0%
Self-assessed level of computer literacy	Excellent	3 17,6%	–	3 12,0%
	Good	4 23,5%	5 62,5%	9 36,0%
	Average	10 58,8%	3 37,5%	13 52,0%
	Below Average	–	–	–
	Poor	–	–	–
Self-assessed expertise in IWB use	Expert	–		
	Near expert	–		
	Average	7 41,2%		
	Near beginner	8 47,1%		
	Beginner	2 11,8%		

Where the teachers' personal perception of their own level of computer literacy was concerned, three teachers with regular access to an IWB (17,6% of the group) indicated that their level of computer literacy was "excellent", four teachers with IWBs (23,5% of the group) indicated that their level of computer literacy was "good" and the remaining ten (58,8%) indicated that it was "average". Five of the teachers with data projectors but no IWB (62,5% of the group) indicated that their level of computer literacy was "good", and the remaining three (37,5%) indicated that it was "average". Where the teachers' personal perception of their IWB use was considered, seven of the seventeen teachers with IWBs (41,2%) indicated that their level of expertise was "average", eight (47,1%) indicated that it was "near beginner", and two (11,8%) indicated that it was "beginner". The demographic classification of each of the teachers who participated in the study is presented in **Table 15**. No black African, nor Asian teachers participated in the study.

Table 15: Demographic profile of staff respondents

		Number of teachers with IWBs (n=17)	Number of teachers without an IWB (n=8)	Total number of respondents (n=25)
Demographic classification	Coloured	1 5,9%	–	1 4,0%
	Indian	1 5,9%	2 25,0%	3 12,0%
	White	15 88,2%	6 75,0%	21 84,0%

Table 15 indicates that 21 of the 25 respondents (84,0%) were classified as white, and there were three (12,0%) classified as Indian and one (4,0%) classified as coloured. This is fairly representative of the academic staff, where 89,1% were classified as white, 7,3% were classified as Indian and one teacher (1,8%) was classified as coloured. The teachers were asked to indicate the subject(s) and the grades they were teaching in 2008. Their responses are summarised in **Table 16**, which follows.

Table 16: Teaching profiles of staff respondents

Subject department (listed alphabetically)	Number of respondents	Number of teachers who taught each grade in 2008				
		8	9	10	11	12
Accounting (including Economic and Management Sciences)	4	3	3	3	2	3
Afrikaans	1	1	–	1	1	1
Information Technology	1	1	1	–	–	–
English	2	–	1	2	2	2
French	1	1	1	1	1	1
Geography (including Social Sciences)	5	4	4	2	4	4
Life Orientation (including Physical Education and Religious Education)	3	2	3	3	3	2
Mathematics and Mathematical Literacy	4	2	3	3	3	3
Life Sciences (including Natural Sciences)	2	2	2	2	1	2
Physical Sciences (including Natural Sciences)	2	2	2	2	2	1
Totals	**25**	**18**	**20**	**19**	**19**	**19**

Table 16 indicates that similar numbers of respondents (18 to 20) were teaching each of the five grades, and each subject department represented here, apart from Information Technology and English, had representative members who were teaching all five grades. Of particular interest in

the analysis of the results are the teaching profiles of the teachers who had regular access to IWBs. They are presented in **Table 17**, which follows.

Table 17: Teaching profiles of respondents with regualr access to an IWB

Subject department (listed alphabetically)	Number of respondents*	Number of teachers who taught each grade in 2008				
		8	9	10	11	12
Information Technology	1	1	1	–	–	–
English	1	–	1	1	1	1
French	1	1	1	1	1	1
Geography (including Social Sciences)	5	4	4	2	4	4
Life Orientation	1	1	1	1	1	1
Mathematics and Mathematical Literacy	4	2	3	3	3	3
Life Sciences (including Natural Sciences)	2	2	2	2	1	2
Physical Sciences (including Natural Sciences)*	2	2	2	2	2	1
Totals	**17**	**13**	**15**	**12**	**13**	**13**

*Fifteen of the teachers represented here had permanent access to an IWB with all of their classes. The two Physical Sciences teachers (who both taught Design and Technology as well) did not. One had access to an IWB only with his Grade 12 Physical Sciences class. The other had access with all his Physical Sciences classes (from Grade 8 to 11).

Table 17 indicates that similar numbers of respondents were teaching each of the five grades, and each subject department represented here, apart from Information Technology and English, had representative members who were teaching all five grades. Seven teachers who had permanent access to an IWB were invited to participate in an interview. Five ultimately took part in an interview. The teaching profiles of the five interviewees are presented in **Table 18**.

Table 18: Profile of Interviewees

Interviewee code	Subjects taught in 2008	Grades taught in 2008	Additional information
A	Mathematics	8, 9, 11, 12	–
B	Life Sciences	8, 9, 10, 11, 12	Head of Department: Life Sciences
C	Geography	9, 11, 12	Director of Academic Administration
D	English and Information Technology (as part of Design and Technology)	8, 9	Head of Department: Information Technology
E	French	8, 9, 10, 11, 12	Head of Department: French

4.7 Profile of the learners

This study took place in the latter half of 2008. In July 2008 there were 555 learners attending the school. All of the learners attending the school are boys, and all of them are full-time boarders. **Table 19** indicates the distribution of the learners across the grades in July 2008.

Table 19: Distribution of learners across the grades

Grade	Number of learners	Percentage of learners
8	102	18,4%
9	115	20,7%
10	115	20,7%
11	111	20,0%
12	112	20,2%
Total	**555**	**100%**

As **Table 19** indicates, there were 102 learners in Grade 8, 115 learners in Grade 9, 115 learners in Grade 10, 111 learners in Grade 11, and 112 learners in Grade 12, giving a total of 555 learners, and a mean of 111 learners per grade. The demographic breakdown of the boys as recorded in July 2008 is presented in **Table 20**.

Table 20: Demographic profile of learners

Demographic classification (in order of prevalence)	Number of learners	Percentage of learners
White	450	81,1%
African	77	13,9%
Indian	24	4,3%
Asian	2	0,4%
Coloured	2	0,4%
Total	**555**	**100%**

As **Table 20** indicates, the vast majority of the learners in the school (81,1%) were white. The second largest group of boys, making up 13,9% of the learners, was African. The third largest group, making up 4,3% of the learners, was Indian, and then there were two Asian learners and two Coloured learners.

The annual fees for the boarding and tuition in 2008 were R129 560,00. The boys attending this school are thus generally from affluent backgrounds, unless they have been awarded a bursary or scholarship. This is significant in the context of this study, in that most of them are exposed to the latest technology, and many of them have powerful laptops, and electronic gaming equipment. Their level of computer literacy is thus generally quite high.

The head of Information Technology was asked to comment on various aspects of the learners' computer literacy. When asked to describe the general computer literacy levels amongst the boys in the school, he indicated that he believes that it is good, and that most boys are able to find their way around a programme quite easily. He said, "For me the hallmark of 'literacy' is not which programmes one 'knows', but rather how quickly one can pick up or figure out a piece of software and get it to do the particular thing you want it to do."

As far as their levels of general technological skills and knowledge are concerned, his impression is that they are generally reasonable, but "…only at a consumer level, rather than a 'geek level'. Most seem to be interested in what technology can do for them (iPods, games, cell phones etc.) rather than having an interest in technology as such, so they learn what they need to know, to accomplish what they want. Only one boy in all the years of [running software training courses] has shown any interest in doing the modules which mimic [a course for aspiring computer technicians], for example."

When asked how he thinks the learners' technological skills and knowledge compare with learners at other high schools, and whether the fact that many of our boys come from wealthy backgrounds influences these aspects of this school's learners, he indicated that "…their easy, comfortable [computer] literacy is because they [have easy] access to computers, and are expected to do a lot of work with them, e.g. most teachers would just expect major assignments to be typed. And maybe because it is all laid on for them, […] they don't really have to develop the kind of interest in more technical things which […] kids at another school might have to do in order to gain access. [In] …a less privileged environment, one is either cut out or becomes an expert. Here it is not cool to get too excited about [technological] things."

4.8 Profile of learner respondents

230 learners completed and returned the questionnaire. Two of the questionnaires were partially completed in a manner that allowed them to be included for those sections that were complete. Six questionnaires were discarded for various reasons. Four contained large sections that were incomplete. In the fifth questionnaire, the learner failed to enter his identification code and grade, and the sixth discarded questionnaire contained blatantly contradictory responses.

The results recorded for the first section of the questionnaire were drawn from the responses of 222 learners. In certain cases learners failed to respond to a particular statement and the results shown below are thus occasionally drawn from fewer than 222 responses, as indicated, where necessary. The results of the second section of the questionnaire were drawn from the responses

of 224 learners. In certain cases learners failed to respond to a particular statement and the results shown below are thus occasionally drawn from fewer than 224 responses, as indicated, where necessary. The distribution of the respondents across the grades is recorded in **Table 21**.

Table 21: Grade distribution of learner respondents

Grades	Number of learners in the respective grade(s)	Number of respondents from the respective grade(s)	Number of respondents as a percentage of the learners in the respective grade(s)
8	102	50	49,0%
9	115	47	40,9%
10	115	48	41,7%
11	111	36	32,4%
12	112	41	36,7%
Not recorded	–	2	–
8 to 12	555	224	40,4%

Table 21 indicates that there was substantial representation from learners in each grade, with 40,4% of the entire learner body participating in the study. The grade with the greatest number and percentage of its learners participating was Grade 8, which yielded 50 respondents (49,0% of the grade). Of the 115 learners in Grade 9, 47 (40,9%) participated in the study, and of the 115 learners in Grade 10, 48 (41,7%) participated. The grade with the lowest number and percentage of its learners participating was Grade 11, with 36 respondents (32,4% of the grade). Of the 112 learners in Grade 12, 41 (36,7%) participated in the study.

In the analysis of the results, the term “junior learner” is used to refer to a learner in Grade 8 or Grade 9. The term “senior learner” is used to refer to a learner in Grade 10, Grade 11 or Grade 12. In the analysis of certain results it is necessary to make a distinction between junior and senior learners, because junior learners generally take twelve subjects, while seniors generally take seven.

4.9 Chapter four in summary

This chapter provides an overview of the setting in which this study took place. The physical infrastructure of the school is described briefly, as well as the ICT resources. The staff and learners are described, with the respondents described in more detail. In Chapters 5 to 8, the findings relating to each of the research questions are presented, grouped according to the four research themes, which take into consideration the perspective of both the teachers and the learners. The first theme, explored in Chapter 5, is “The extent, frequency and nature of IWB use in the classrooms.” This theme is investigated from the perspective of the teachers and the learners.

CHAPTER 5
FINDINGS THEME 1:
THE EXTENT, FREQUENCY AND NATURE OF IWB USE

Research Questions

The focus of this chapter is theme one.

Theme 1
The extent, frequency and nature of IWB use in classrooms

1.1 How are IWBs distributed across the school, and how frequently do learners encounter them?
1.2 How frequently are the existing IWBs being used by the teachers and what factors influence their frequency of use?
1.3 What features of IWBs are being used by the teachers, and how frequently?
1.4 What resources and equipment do teachers use in combination with IWBs?
1.5 How frequently are the existing IWBs being used by the learners and what features are they using?

Theme 2
The impact of IWBs on teaching and learning as perceived by teachers

2.1 What is the general attitude of teachers towards IWBs?
2.2 What attitude do teachers perceive the learners to have with regard to the IWB?
2.3 What impact do teachers perceive IWB use to have on learners' behaviour, attentiveness, motivation and productivity?
2.4 What impact do teachers perceive IWB use to have on the learning process, specifically with regard to their effect on learners' understanding, retention and performance?
2.5 What impact do teachers perceive the IWB to have on lesson planning, preparation and resource development?
2.6 What impact do teachers perceive the IWB to have on presentation, teaching styles and classroom management?

continued/...

.../continued

Theme 3
The challenges and needs of teachers with regard to IWB use

3.1 How competent do teachers using IWBs perceive themselves to be in their use of the IWBs, and how do they believe the learners perceive their use of the IWB?

3.2 What factors do teachers believe influence the effectiveness of their use of IWBs?

3.3 What formal training did teachers receive in the use of IWBs, and how effective was this training perceived to be?

3.4 Do teachers feel the need to improve their use of IWBs and, if so, how do they believe they could best achieve this?

3.5 What perceptions do teachers have of the resources available for use with IWBs?

3.6 How do teachers feel about integrating ICT in the form of the IWB into their teaching, as opposed to using a data projector alone, or making use of computers in a dedicated computer laboratory?

3.7 What limitations, technical or otherwise, do teachers perceive to be preventing them from using IWBs more effectively?

Theme 4
The impact of IWBs as perceived by learners

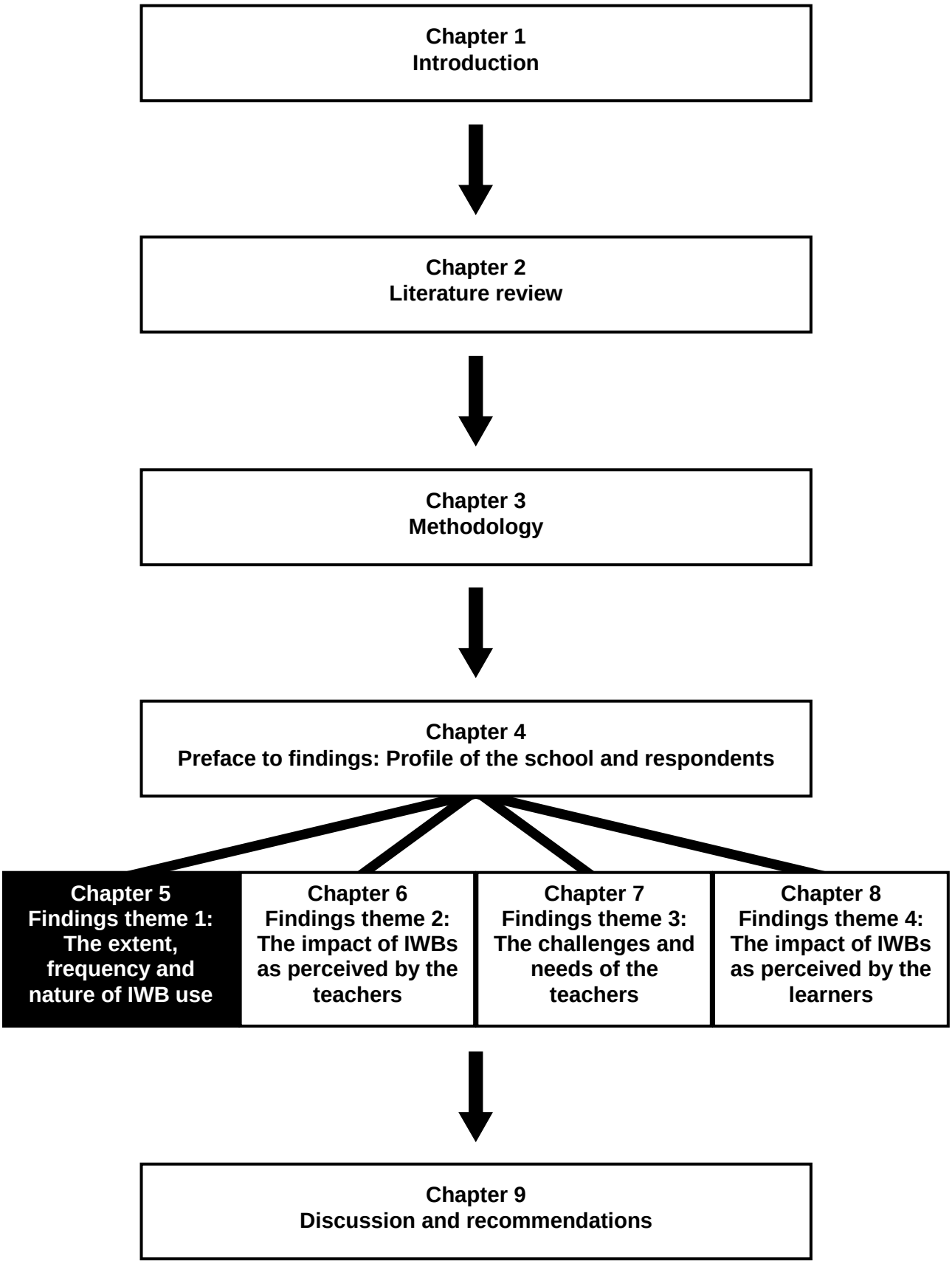
4.1 What is the learners' perception of the level of competency in IWB use amongst teachers?

4.2 What impact do learners perceive the IWB to have on their teachers and the manner in which they facilitate lessons, specifically with regard to the pace of lessons, the teacher's ability to capture and hold their attention, and the presentation and aesthetic appeal of the teacher's audiovisual aids?

4.3 What impact do learners perceive use of the IWB to have on the learning process, specifically on their understanding, retention and productivity?

4.4 What impact do learners perceive use of the IWB to have on their personal behaviour, attentiveness and motivation, and the behaviour of their fellow learners?

Outline of dissertation



Chapter 5: Findings Theme 1 – IWB distribution and use

5.1 Introduction

This chapter explores the prevalence of IWBs in the school, how frequently teachers use their IWBs and the manner in which they use them. It also investigates how frequently learners use the IWBs, and the manner in which they use them. The feedback received from teachers and learners is analysed with a view to answering the following research questions.

- How are IWBs distributed across the school, and how frequently do learners encounter them?
- How frequently are the existing IWBs being used by the teachers and what factors influence their frequency of use?
- What features of IWBs are being used by the teachers, and how frequently?
- What resources and equipment do teachers use in combination with IWBs?
- How frequently are the existing IWBs being used by the learners and what features are they using?

5.2 How are IWBs distributed across the school, and how frequently do learners encounter them?

5.2.1 Distribution of IWBs across the school

When this study commenced, according to the ISASA survey completed by the school in July 2008, there were fifty regular teaching venues in the school. These venues included 38 standard classrooms, eight sciences laboratories and two computer centres. **Table 22** shows the number of venues where an IWB was present when this study commenced.

Table 22: Distribution of IWBs in teaching venues

Venue description	Number of venues	Number of venues equipped with IWBs
Classrooms	38	14 36,8%
Laboratories	8	6 75,0%
Computer centres	2	1 50,0%
Regular teaching venues	50	21 42,0%

*Venues such as lecture theatres were excluded from this table, because they are not regular teaching venues.

Table 22 indicates that fourteen of the 38 classrooms (36,8%), six of the eight sciences laboratories (75,0%) and one of the two computer centres (50,0%) were equipped with IWBs. Thus, in total, 21 of the 50 regular teaching venues (42,0%), were equipped with IWBs.

As part of a new phase of ICT integration in the school, classes were equipped with data projectors, but initially no IWB. At the time of the commencement of this study, in addition to the 21 venues equipped with IWBs, there were nine regular teaching venues equipped with a data projector, but no IWB. Thus 60,0% of all teaching venues were equipped with data projectors. **Table 23** indicates the distribution of data projectors installed in classrooms, without IWBs, by subject department. Eight of the teachers who were teaching in these venues were invited to participate in the study and all eight teachers completed the questionnaire

Table 23: Data projector distribution (without accompanying IWBs)

Subject departments (listed alphabetically)	Number of data projectors (without IWBs) in the subject department	Number of teachers who returned the questionnaire
Afrikaans	1	1
Accounting	4	4
English	1	1
Life Orientation	2	2
Information Technology	1	0
Total	**9**	**8**

As **Table 23** indicates, there was one data projector in an Afrikaans classroom, one in an English classroom and one in an Information Technology classroom. There were four in Accounting classrooms and two in Life Orientation classrooms. In addition to these venues, a computer laboratory, two lecture theatres and a drama theatre were equipped with data projectors at the time this study commenced. None of these venues is a regular teaching venue.

In an attempt to determine the time frame over which the IWBs were installed in classrooms, and any delay that occurred between installation of the equipment and the teacher beginning to use it, the teachers with permanent access to an IWB were asked to indicate when it was installed, and when they began using it. The head of Information Technology was also consulted in this regard, in an attempt to determine when the IWBs used by teachers who did not participate in the study were installed. The chronological order in which the IWBs were installed, are shown in **Table 24**.

Table 24: Chronological order of IWB installation and distribution

Subject departments (listed alphabetically)	Year					Total
	2004	2005	2006	2007	2008	
English	–	–	–	–	1	1
French	–	–	–	1	–	1
Geography	–	–	2	2	–	4
Information Technology	–	–	–	–	1	1
Lecture theatres	1*	–	–	–	–	0
Life Orientation	–	–	–	1*	–	1
Life Sciences	–	–	3	–	–	3
Mathematics	1	–	4	–	2	7
Physical Sciences	–	–	3	–	–	3
Cumulative IWB count	**2**	**2**	**14**	**17***	**21**	**21**

*The IWB, which was originally installed in a lecture theatre in 2004, was moved to a Life Orientation classroom in 2007.

The responses from the teachers indicated that, almost without exception, first use of each IWB took place very soon after installation. Very little is known about pattern of use of the IWB that was installed in the Lecture Theatre and made available for general use. With regard to the teachers who had a data projector, but no IWB installed in their classrooms, five of the eight respondents indicated that their data projector had been installed in 2008 and the other three teachers had their data projectors installed in 2007.

5.1.2 Distribution of IWBs across subject departments

At the time this study was conducted, the academic staff who were teaching regularly included 47 full-time teachers and eight part-time teachers. It is this group of staff members that are of interest in this study, because they use the IWBs in the school. The number teaching staff who had access to an IWB in at the time this study commenced is presented in **Table 25**, which follows.

As **Table 25** indicates, 22 of the 47 full-time teaching staff (46,8%) had access to an IWB. Twenty of these teachers (42,5%) had permanent access to an IWB. In addition, three of the eight part-time staff (37,5) had access to an IWB, only one of them permanently.

Table 25: Staff access to IWBs

Staff description	Number of staff	Number of staff with permanent access IWBs	Number of staff with restricted access to IWBs	Number of staff with access to IWBs
Full-time teaching staff	47	20 42,5%	2 4,3%	22 46,8%
Part-time teaching staff	8	1 12,5%	2 25,0%	3 37,5%
All teaching staff	55	21 38,2%	4 7,3%	25 45,5%

The set of data presented in **Table 25** thus indicates that, in total, 25 of the 55 teaching staff (45,5%) had access to an IWB, 21 of them (38,2%) permanently, during all of their lessons. Three other teachers, two Science teachers and a Maths teacher, had permanent access to them with particular classes only. One teacher, a French teacher, had access to an IWB during certain lessons.

Table 26 indicates the distribution of IWBs through the school, by subject department. Fifteen teachers, out of the 25 who have access to IWBs (62,5%), completed the questionnaire for teachers with IWBs. The only subject department in which an IWB is present, but which did not have a teacher complete a questionnaire, is the IT department. The head of the IT department participated in an interview. The researcher was a member of the Mathematics department, and hence was excluded from the research.

Table 26: IWB distribution across subject departments

Subject departments (listed alphabetically)	Number of IWBs in the subject department	Number of teachers with access to IWBs	Number of teachers with permanent access to IWBs	Number of teachers who returned the questionnaire	Number of teachers who participated in an interview
English	1	1	1	1	–
French	1	2	1	1	1
Geography	4	5	5	5	1
Information Technology	1	1	1	0	1
Life Orientation	1	1	1	1	–
Life Sciences	3	3	3	2	1
Mathematics	7	8	7	3*	1
Physical Sciences	3	4	2	2	–
Total	**21**	**25**	**21**	**15**	**5**

*Note: The researcher, who was a member of the Mathematics Department, had permanent access to an IWB, but did not participate in the study.

As **Table 26** indicates, the Mathematics department, with seven IWBs installed, has the most IWBs of all the subject departments. The Geography department has four IWBs installed, and the Life Sciences and Physical Sciences departments each have three IWBs installed. In order to determine the level of awareness of the introduction of technology into the school, teachers were asked to name the subject department they believed has the most IWB's. Their responses are recorded in **Table 27**.

Table 27: Teachers' perceptions of IWB distribution across departments

Subject department named by the teachers	Number of teachers with IWBs who named this department	Number of teachers without IWBs who named this department	Total number of responses
Geography	2 10,5%	–	2 7,1%
Life Sciences	–	1 11,1%	1 3,6%
Mathematics	10 52,6%	6 66,7%	16 57,1%
Physical Sciences	4 21,1%	2 22,2%	6 21,4%
Uncertain / No response	3 15,8%	–	3 10,7%
TOTALS	**19***	**9***	**28***

*Certain teachers named more than one subject department, and hence the total number of responses from the teachers exceeds the number of respondents (23).

Table 27 indicates that the majority of responses from teachers with access to IWBs (52,6%) correctly named the Mathematics department and, similarly, the majority of the responses from teachers without IWBs (66,7%) also correctly named the Mathematics department. Approximately one-fifth of the responses incorrectly named the Physical Sciences department as the department with the most IWBs.

Teachers were asked to indicate what they thought to be the most important reason for the department they mentioned having the most IWBs. They were provided with seven options and then invited to write down any other reason of their own, if they felt that none of the seven options was applicable. The percentage of teachers who indicated each of the respective reasons is given in **Table 28**, which follows. The reasons are ranked according to their overall popularity (based on the total number of responses).

Table 28: Reasons for existing IWB distribution pattern

	Reason for the relevant subject department having the most IWBs (ranked in order of popularity)	Number of teachers with IWBs who selected this response	Number of teachers without IWBs who selected this response	Total number of responses
1	The curriculum covered in that subject area makes it most likely to benefit from the use of interactive whiteboards.	6 30,0%	5 62,5%	11 39,3%
2	The staff in this department are best able to make good use of interactive whiteboards.	5 25,0%	1 12,5%	6 21,4%
3	The teachers in the department were skilled in their use of ICT and showed initiative prior to the installation of IWBs.	4 20,0%	–	4 14,3%
4	This was the first department to invest in IWBs.	3 15,0%	1 12,5%	4 14,3%
5	This department has the best classroom facilities to accommodate interactive whiteboards.	1 5,0%	1 12,5%	2 7,1%
6	The technology would enhance an already successful department.	1 5,0%	–	1 3,6%
7	It was less well equipped with ICT equipment than the other departments.	–	–	–
	TOTALS	**20**	**8**	**28**

As **Table 28** indicates, the reason most frequently chosen to account for a particular subject department having the most IWBs was "The curriculum covered in that subject area makes it most likely to benefit from the use of interactive whiteboards." This accounted for 39,3% of all the responses. The second most popular reason, which accounted for 21,4% of the responses, was that the staff in the particular subject department were best able to make good use of the IWBs. The other two reasons that attracted a significant number of responses (14,3% each) were that that the department in question was the first to invest in IWBs, and that the teachers in the department were skilled in their use of ICT and showed initiative prior to the installation of IWBs.

When teachers named the Mathematics department as the department which has the most IWBs, the reason most frequently given for it having the most IWBs, was "The curriculum covered in that subject area makes it most likely to benefit from the use of interactive whiteboards." Of all the responses in this regard, 32,1% named the Mathematics department and gave this reason. With regard to the other possible reasons, 14,3% of the responses suggested that the Mathematics department had the most IWBs because the staff in the department were best able to make good use of the IWBs and another 14,3% of the responses suggested that it was because this was the first department to invest in IWBs. Amongst the teachers who named the Physical Sciences department as the subject department with the most IWBs, the most popular reason for this department having the most IWBs was that the Science curriculum makes it the subject most likely to benefit from the use of IWBs.

Apart from the reasons indicated in **Table 28**, it was suggested that other reasons for the Mathematics department having the most IWBs include *"a combination of the [influence of] the previous head of maths, and perhaps the previous headmaster being a maths teacher"* and "[the fact that the members of the] *Maths* [Department] *get whatever they want…"*

The following was given as another reason for the Science departments (Life Sciences and Physical Sciences) having the most IWBs: [The Sciences Block is the...] *"most recently constructed facility and* [this was part of the] *attempt to deliver* [a] *'state of the art' facility / equipment."*

5.1.3 Learner encounters with IWBs

Learners were asked to indicate in which of their subjects they encountered an IWB, and this data provided an indication of the frequency with which each learner encounters an IWB. A distinction was made between junior learners (in grades 8 and 9) who take twelve subjects, and senior learners (in grades 10, 11 and 12) whose standard subject package consists of seven subjects.

Given the distribution of the IWBs across the eight different subject departments, the maximum number of subjects in which a junior learner could encounter an IWB was eight, and the maximum number of subjects in which a senior learner could encounter an IWB was seven. In other words, theoretically there could be senior learners who encountered an IWB in all of their subjects.

Analysis of the data collected from the learners revealed that the maximum number of subjects in which a junior learner reported the presence of an IWB was seven, and the maximum number of subjects in which a senior learner reported the presence of an IWB was six. Combining the responses from junior learners and senior learners, the data indicate that the mode is three, with 26,8% of the boys reporting the presence of an IWB in three of their subjects.

Figure 10, which follows, gives a graphic representation of the tally of responses from the junior learners (in grades 8 and 9). As indicated, for each possible IWB count, from zero to seven, the percentage of junior learners who reported an IWB present in the relevant number of subjects is shown. This graph thus represents the responses of 97 learners.

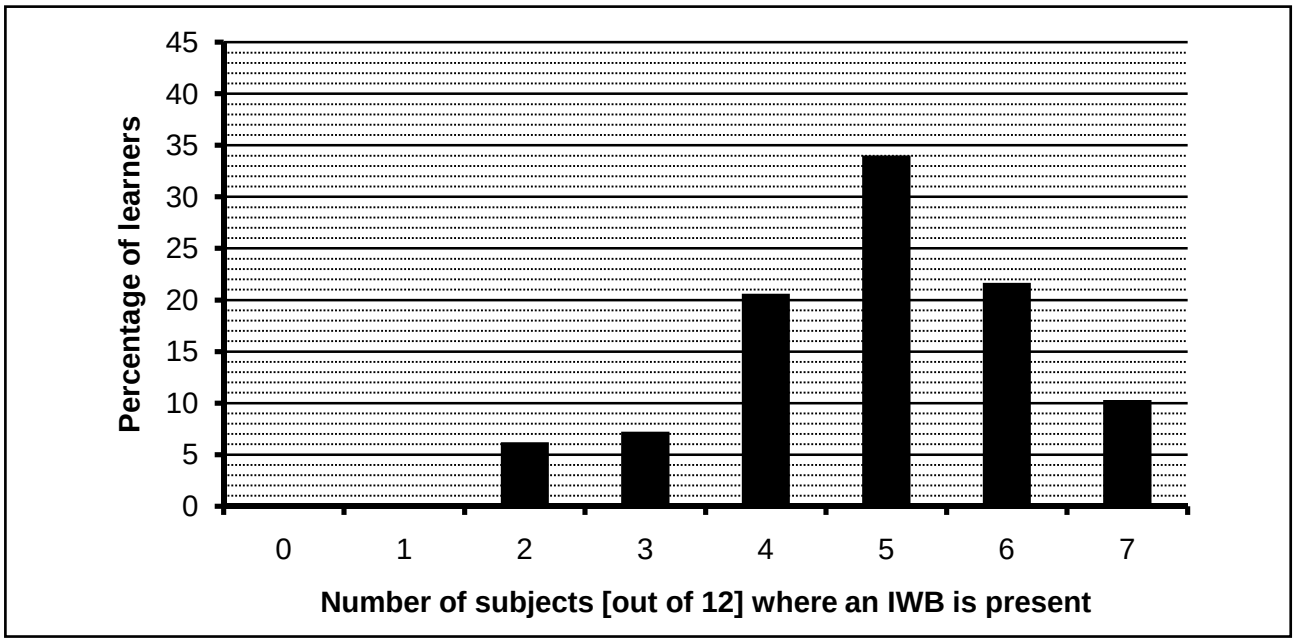


Figure 10: Prevalence of IWBs in junior classes

Figure 10 indicates that, amongst the junior learners, every learner encounters an IWB in at least two of his subjects, and the highest number of subjects in which a learner encounters an IWB is seven. The mode for this set of data was five, with 34,0% of the junior learners reporting that they encounter an IWB in five of their twelve subjects. **Figure 10** shows that 20,6% of the junior learners reported that an IWB was present in four of their seven subjects, and 21,6% reported that an IWB was present in six of their seven subjects. **Figure 11**, which follows, shows a graphic representation of the tally of the responses from the senior learners, giving the percentage of senior learners (in grades 10, 11 and 12) who reported IWBs present in the subjects they take.

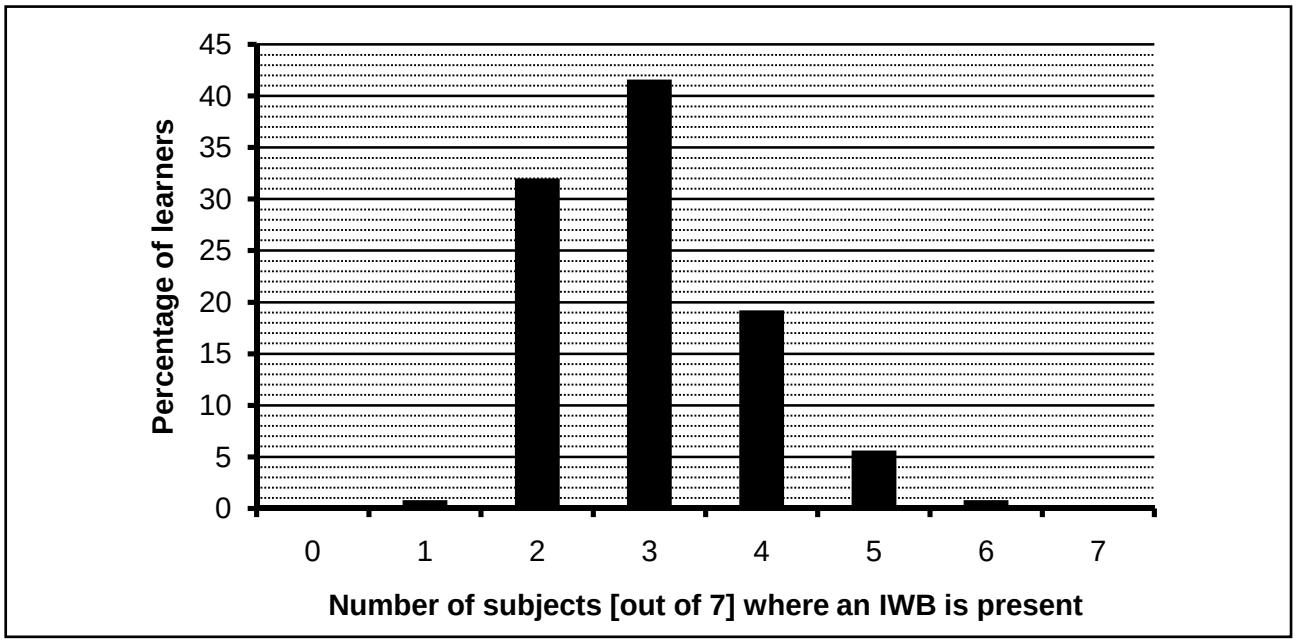


Figure 11: Prevalence of IWBs in senior classes

As **Figure 11** shows, every senior learner who completed the questionnaire reported that an IWB was present in one or more of his subjects, and the maximum number of subjects in which an IWB was present was six. From the bar graph it is clear that the mode for this set of data was three, with 41,6% of the senior learners reporting that they encounter an IWB in three of their seven subjects. The graph also shows that 32,0% of the senior learners reported that an IWB was present in two of their seven subjects, and 19,2% reported that an IWB was present in three of their seven subjects.

The set of data collected from the learners was analysed from a different perspective, and the mean percentage of each learner's subjects where an IWB is present was calculated for learners in each grade, and then for the school as a whole. The results are presented in **Figure 12**, which shows that the overall mean for all respondents was 41,9(±12,2)%. For each grade the height of the bar represents the mean percentage, and the standard deviation is given by the line superimposed on the bar.

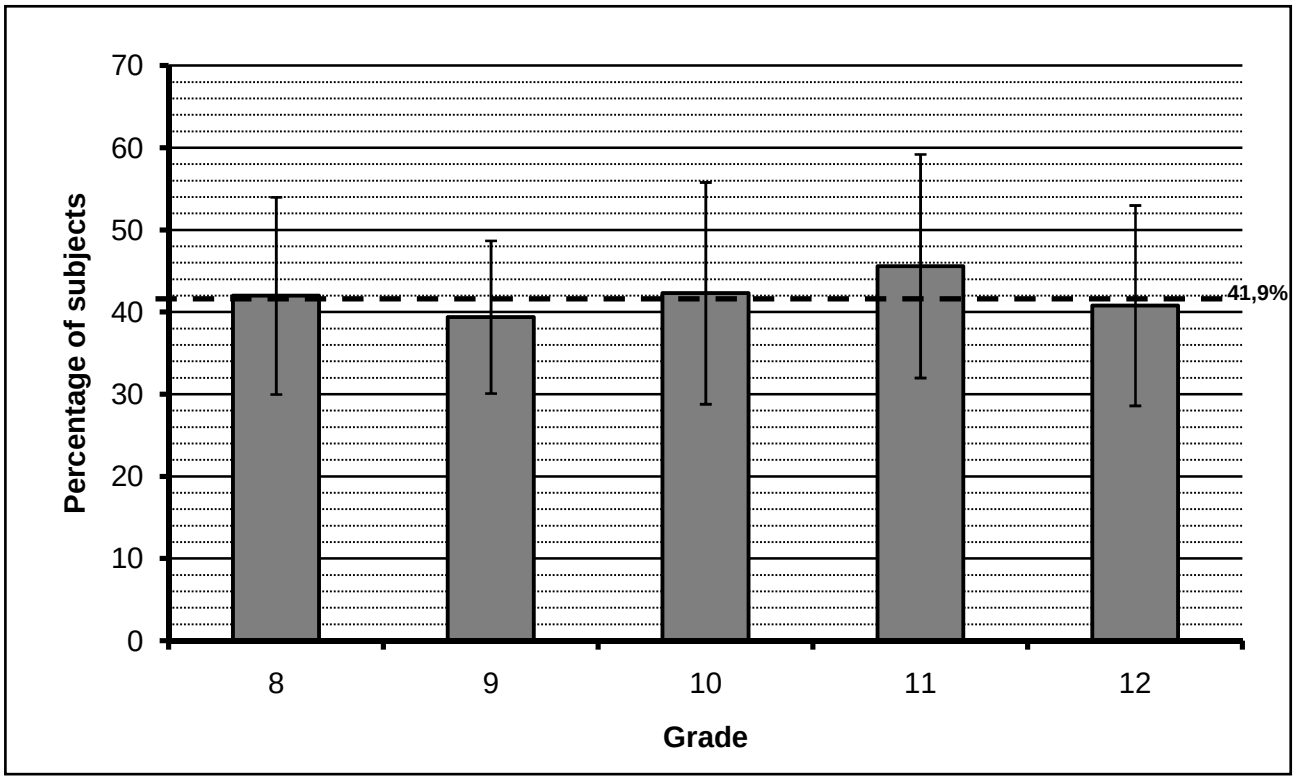


Figure 12: Prevalence of IWBs reported by learners

As **Figure 12** indicates, the Grade 11's reported the highest mean percentage of subjects where an IWB is present, 45,6(±13,6)%. The Grade 9's reported the lowest mean percentage of subjects, where an IWB is present, 39,4(±9,3)%. When the responses from the learners across all five grades are taken into consideration, the data indicate that on average an IWB is present in 41,9(±12,2)% of a learner's subjects. This result is consistent with the fact that 21 of the 50 regular teaching venues (42,0%) were equipped with IWBs and that 25 of the 55 teaching staff (45,5%) had access to an IWB, 21 of them (38,2%) permanently.

Subsequent to the commencement of this research, another IWB was installed in the Music Department. This IWB was not included in the research, although learners made mention of it in their responses to the questionnaires. A small number of learners also mentioned the presence of an IWB in their Afrikaans classes, and the Library, which was puzzling. It is possible that these learners confused the IWB with a data projector projecting on to a conventional whiteboard.

5.3 How frequently are the existing IWBs being used by the teachers and what factors influence their frequency of use?

5.3.1 Frequency of IWB use by teachers, as reported by learners

Learners were asked to indicate the frequency with which each of the IWBs they encountered is used by the teacher. As described in Chapter 3, for each subject the response options were structured as a Likert item, allowing the learner to choose one of five options, as shown below in **Figure 13**, and the response to each Likert item was equated to a five-point scale on a number line, from 0 through to 4, as indicated in **Figure 13**. Each response from each participant was assigned the corresponding integral value (0, 1, 2, 3 or 4). For each subject the arithmetic mean of these values was calculated as the frequency index. **Figure 13**, which follows, indicates how a frequency index of 2,3 will be represented graphically, showing that the general frequency of use is closes to the descriptor “In some lessons.”

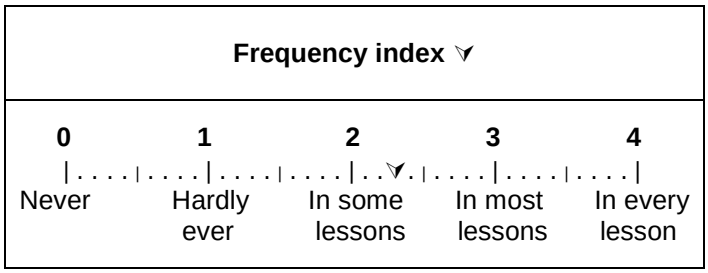


Figure 13: Graphic representation of a frequency index of 2,3

Various factors influenced the number of learners who responded for each subject. These factors include the number of IWBs installed in each subject department and the number of learners who take the subject. **Figure 14** presents a summary of the learners’ responses in this regard, indicating the number of IWBs in each department, the number of learners who rated the frequency of IWB use in that department and the frequency index calculated for each subject. The subjects are listed in order of the frequency of use, decreasing from left to right, based on this index.

As **Figure 14** indicates, based on the calculation of the frequency index, the Information Technology department makes the most frequent use of the IWB. Interestingly, the subject in

which the greatest number and percentage of respondents (56,2%) reported IWB use in every lesson was Mathematics, and that Information Technology was the subject with the second highest percentage of respondents (44,0%) reporting IWB use in every lesson. However, taking all responses into account for each of these subjects, the mean frequency of use index suggests that the general frequency of use of the IWB in Mathematics is lower than Information Technology. This is largely as a result of the fact that there are certain teachers in the Mathematics department who use their IWBs very seldom.

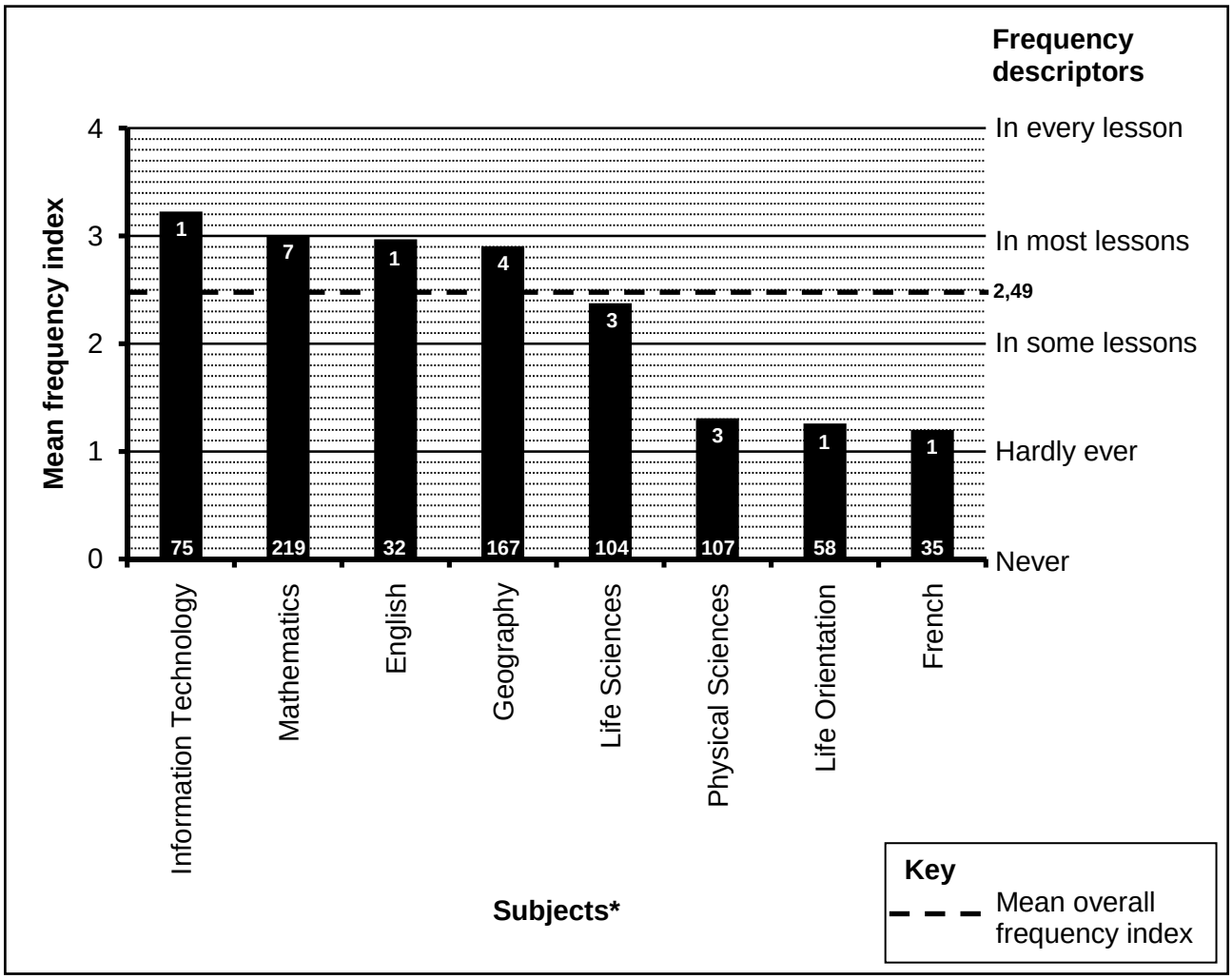


Figure 14: Frequency of IWB use reported by learners

*The number of IWBs per department is given at the top of each bar, and the number of responses received from learners for each of the respective subjects is given at the bottom of each bar.

The frequency indices presented in **Figure 14** suggest that the frequency of use of the single IWB in the English department is comparable to the overall frequency of use of the IWBs in the Mathematics Department. This is consistent with the fact that 72,7% of the learners indicated that the IWBs present in the Mathematics department are used in most lessons or in every lesson, and 75,0% of the learners indicated that the IWB in the English department is used in most lessons or in every lesson. The frequency of use of the IWBs in the Geography department is marginally lower than in Mathematics and English, with 70,1% of the learners reporting use of the IWBs in this

department in most lessons or in every lesson. Only 44,2% of the respondents reported use of the IWBs in the Life Sciences department in most lessons or in every lesson, and thus mean frequency of use was significantly lower than those for Mathematics, English and Geography.

The subject department with the highest number and percentage of respondents (35,5%) reporting that the IWB was never used, was the Physical Sciences department. However, taking into account general use of the IWBs throughout this department, the mean frequency of use index suggested that that overall frequency of use of the three IWBs in the Physical Sciences department was slight higher that the frequency of use of the single IWB in the Life Orientation department, and the single IWB in the French department.

Taking into consideration all the responses from the learners for all the subjects, a mean index of overall IWB use was calculated, and this is reflected in **Figure 14**. It suggests that in general, the IWBs in the school are used in some or most lessons. The subject departments in which the frequency of IWB use is "above average" are the Information Technology department, the Mathematics department, the English department and the Geography department. It appears that in these departments IWBs are typically used in most lessons. The general frequency of use of the IWBs in the Life Sciences department is very close to the average, tending towards use in some lessons, rather than most lessons.

The general frequency of use of the three IWBs in the Physical Sciences department, the single IWB in the French department and the single IWB in the Life Orientation department is significantly lower than the average use, and the responses from the learners suggest that these IWBs are verging on hardly ever being used.

When considering the learners' responses and the mean frequency index for each subject, consideration should be given to the number of IWBs in that particular department. The IWB in the Information Technology department is used by a single teacher, and the results are thus a reflection of his use of it. Similarly the single IWB in the English department and the single IWB in the Life Orientation department are each used by a particular teacher. The single IWB in the French department is used mainly by a single teacher, although a second French teacher does use the venue occasionally, so the results reflect the combined use of this particular IWB.

Although the frequency of use by individual teachers was not investigated directly, in the Mathematics, Geography, Life Sciences and Physical Sciences departments, where there are numerous IWBS, and numerous IWB users, the results may provide some insight into the nature of IWB use within that department, given that for the most part each IWB is used by one teacher.

Table 29 shows the results for the four subject departments where more than one IWB is present. Taking into consideration the number of IWBs in each department, and the number of learners who responded with regard to IWB use within the department, the number of learner responses per IWB was calculated.

Table 29: Frequency of IWB use in subjects with more than one IWB

Subject departments (listed in order of frequency)	Number of IWBs	Number of learner responses per IWB	Percentage of learners indicating respective frequencies for the subject					Frequency index [out of 4]
			Never	Hardly ever	In some lessons	In most lessons	In every lesson	
Mathematics	7	31,3	17 7,8%	25 11,4%	20 9,1%	34 15,5%	123 56,2%	3,01
Geography	4	41,8	3 1,8%	5 3,0%	42 25,1%	72 43,1%	45 26,9%	2,90
Life Sciences	3	34,7	4 3,8%	16 15,4%	38 36,5%	29 27,9%	17 16,3%	2,38
Physical Sciences	3	35,7	38 35,5%	24 22,4%	23 21,5%	18 16,8%	4 3,7%	1,31

In most cases a particular IWB is used by one teacher only. Considering the frequency of use reported for each IWB, the pattern of use for a particular IWB may depend on the teacher, or the class. If it is assumed that the pattern of use which a teacher displays is consistent across all classes, then the results in **Table 29** may be used to give an indication of the nature of IWB use by individual teachers within the subject department. Given that the learners who participated in the study were randomly selected based on criteria independent of their grades, classes, teachers and subject package, it is reasonable to assume that each IWB is equally represented by these data.

If this is the case, then the set of data presented in **Table 29** suggests that five of the IWBs in the Mathematics department are used in most lessons, or every lesson, while two of them are used less frequently. Similarly, the data suggest that three of the IWBs in the Geography department are used in most lessons, while the fourth is used somewhat less frequently. The data relating to IWB use in the Life Sciences department suggest that one of the IWBs is used frequently, one less often, and one quite seldom. The data relating to IWB use in the Physical Sciences department suggest that one IWB is never used, the second is hardly ever used, and the third may be used in some lessons. The principles of triangulation were employed in comparing this set of data with the data collected from the teachers, which follows.

5.3.2 Frequency of use as reported by teachers

In an attempt to gain more insight into individual use of IWBs, teachers were asked to indicate when they had last used their IWB during a lesson. They were given six options, as shown in **Figure 15**, which gives a graphical representation of the tally of their responses.

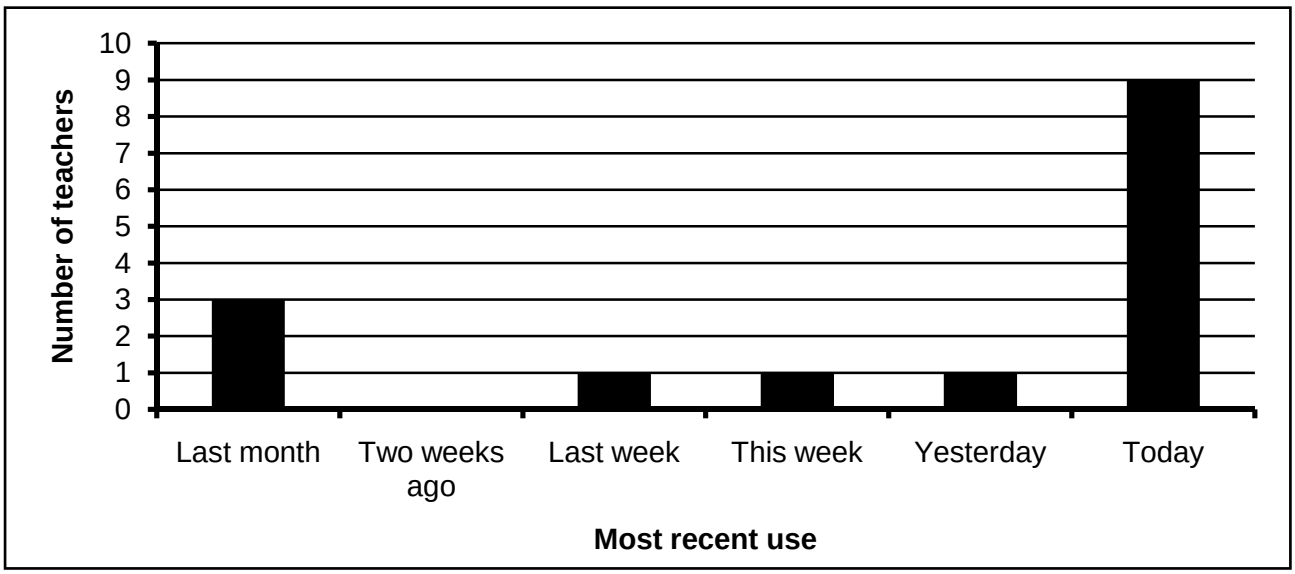


Figure 15: Most recent use of IWBs as indicated by individual teachers

As **Figure 15** indicates, the majority of the teachers (nine of the fifteen respondents) indicated that they had used their IWBs on the day they completed the questionnaire. One teacher indicated they had most recently used their IWB yesterday, another earlier that week, and another the previous week. Three of the teachers indicated that they had most recently used their IWBs the previous month. Teachers were asked, in general, how frequently they used their IWBs. They were given five options, as shown in **Figure 16**, which presents the tally of their responses.

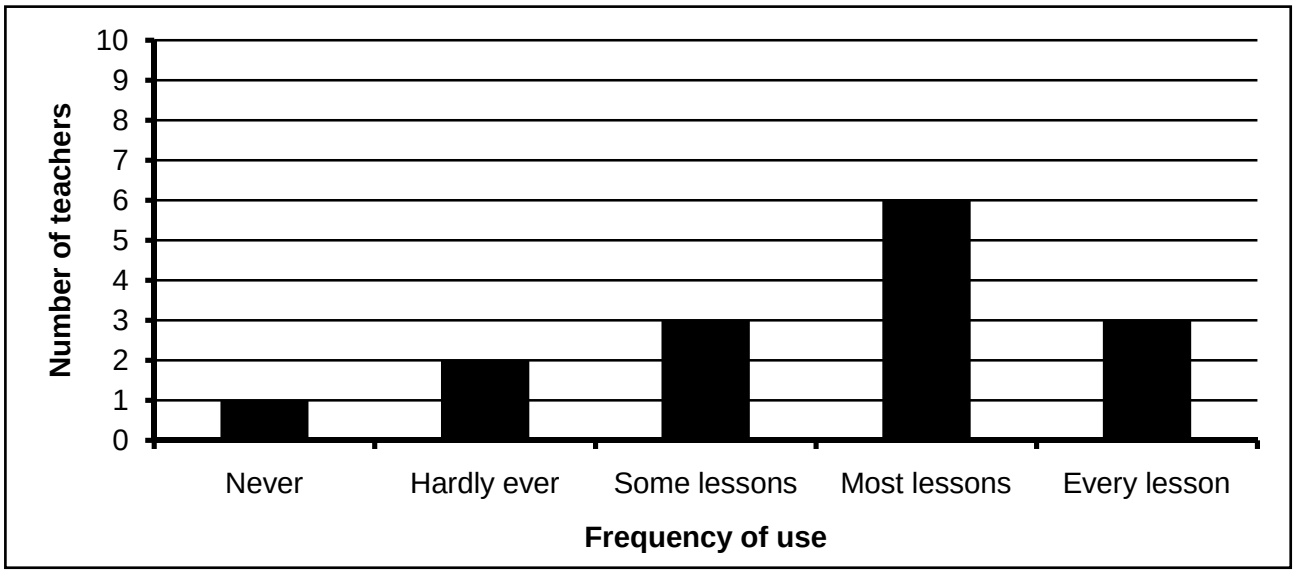


Figure 16: General frequency of IWB use as indicated by individual teachers

As **Figure 16** shows, three of the fifteen respondents indicated that they use their IWB in every lesson, six use their IWB in most lessons, three use their IWB in some lessons, two hardly ever, and one teacher indicated that he never uses it. **Table 30**, which follows, shows the frequency of IWB use, as indicated by teachers within each subject department. The fact that only fifteen of the

25 teachers with access to an IWB completed the survey means that there are ten teachers (spread across various subject departments) for whom the frequency of IWB use is unknown.

Table 30: Frequency of IWB use within each subject department

Subject department	Number of IWBs	Number of teachers with access to the IWBs	General frequency of use as indicated by teachers (n=23)					
			Never	Hardly ever	In some lessons	In most lessons	In every lesson	Not indicated
English	1	1					1	
French	1	2			1			1
Geography	4	5			1	3	1	
Information Technology	1	1						1
Life Orientation	1	1		1				
Life Sciences	3	3			1	1		1
Mathematics	7	8				2	1	5
Physical Sciences	3	4	1	1				2
Totals	**21**	**25**	**1**	**2**	**3**	**6**	**3**	**10**

The data in **Table 30** can be compared with the feedback from the learners to allow some cross-referencing of results. Of the learners who reported the presence of an IWB in English, 46,9% reported that it was used in most lessons and 28,1% reported that it was used in every lesson. This is reasonably inconsistent with the teacher's indication that he uses it in every lesson, although one would expect that, if he uses it in every lesson, a higher percentage of the learners would indicate that it was used in every lesson.

Of the learners who reported the presence of an IWB in French, 31,4% reported that it was never used, 31,4% reported that it was hardly ever used, and 25,7% reported that it was used in some lessons. This may seem inconsistent with the teacher's indication that she uses it in some lessons. However, the second French teacher never uses the IWB, and this lack of use by the second teacher who has access to the IWB may account for the lower frequency reported by the respondents, who would be learners from both classes.

Of the learners who reported the presence of an IWB in Geography, 25,1% reported that it was used in some lessons, 43,1% reported that it was used in most lessons, and 26,9% reported that it was used in every lesson. Further analysis of the data suggested that three of the IWBs in the Geography department are used in most or every lessons, while the fourth is used in some lessons. This appears to be consistent with the frequency of use reported by the teachers. It should be borne in mind that in the Geography department there are five teachers using four IWBs.

The lack of feedback from the teacher who uses the IWB in Information Technology obviously prevents cross-referencing the data from the learners with his/her indication of the frequency with which he uses the IWB. Of the learners who reported the presence of an IWB in Life Orientation, 20,7% reported that it was never used, 50,0% reported that it was hardly ever used and 17,2% reported that it was used in some lessons. This is consistent with the indication from the Life Orientation teacher that he hardly ever uses it.

Of the learners who reported the presence of an IWB in Life Sciences, 36,5% reported that the IWB was used in some lessons and 27,9% reported that the IWB was used in most lessons. Further analysis of the data suggests that one of the IWBs is used in most lessons (or every lesson), one is used in some lessons (or most lessons), and one hardly ever. This may be consistent with what is reported by the teachers. The data suggests that the third IWB user in the department uses the IWB less frequently than the two teachers who completed the questionnaire.

Of the learners who reported the presence of an IWB in the Mathematics Department, 56,2% reported that the IWB was used in every lesson, 15,5% reported that it was used in most lessons, 9,1% reported that it was used in some lessons, 11,4% reported that it was hardly ever used and 7,8% reported that it was never used. Further analysis of the data in **Table 30** suggested that of the seven IWBs in the Mathematics department, five are used in most lessons or every lesson, while two of them are used less frequently. Of the four teachers who did not complete the questionnaire, two reportedly use their IWBs in every lesson, and two hardly ever use their IWBs. This suggests that the feedback from the learners is consistent with the feedback from the teachers.

Of the learners who reported the presence of an IWB in Physical Sciences, 35,5% reported that the IWB was never used, 22,4% reported that it was hardly ever used and 21,5% reported that it was used in some lessons. Futher anaysis of the data suggested that one IWB is never used, one is hardly ever used, and the third may be used in some lessons. The third Physical Sciences teacher did not complete the questionnaire, but reportedly hardly ever used the IWB. The responses from the learners thus appear to be consistent with the responses from the teachers.

5.3.3 Factors influencing the frequency of use

The teachers were asked to consider a set of factors which are believed to have a positive effect on the frequency of use of an IWB by a teacher (Moss et al., 2007; Rudd, 2007). They were asked to consider their own experiences and indicate the extent to which each factor positively influences their frequency of IWB use. As described in Chapter 3, for each factor, the response options were structured as a Likert item, allowing the teacher to choose one of four options, as shown below in,

and the response to each Likert item was equated to a four-point scale on a number line, from 0 through to 3, as indicated in **Figure 17**. Each response from each participant was assigned the corresponding integral value (0, 1, 2 or 3). For each subject the arithmetic mean of these values was calculated as the influence index. **Figure 17**, which follows, indicates how an influence index of 2,3 will be represented graphically.

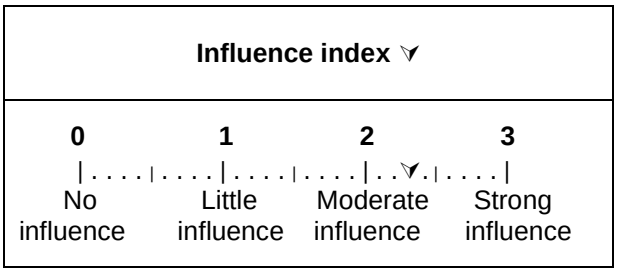


Figure 17: Graphic representation of a influence index of 2,3

As **Figure 17** indicates an influence index of 2,3 is closest to the descriptor "Moderate influence". Considering the teachers' responses, the factors were arranged in order from strongest positive influence to weakest positive influence, as shown in **Table 31**.

Table 31: Influence of factors believed to positively influence frequency of IWB use

	Factors (ranked in order of influence)	**Influence index**
1	Teacher's positive attitude towards IWB use	No influence / Little influence / Moderate influence / Strong influence
2	Teacher's perception that learners feel positive about use of the IWB in lessons	No influence / Little influence / Moderate influence / Strong influence
3	Improved attentiveness amongst learners when an IWB is used	No influence / Little influence / Moderate influence / Strong influence
4	Improved learner motivation when an IWB is used	No influence / Little influence / Moderate influence / Strong influence
5	Teacher's confidence in his/her ability to use the IWB effectively	No influence / Little influence / Moderate influence / Strong influence
6	Teacher's ability to store and reuse material from lessons	No influence / Little influence / Moderate influence / Strong influence
7	Teacher's ability to save and refer to previous lessons	No influence / Little influence / Moderate influence / Strong influence
8	Good IWB resources for use in lessons	No influence / Little influence / Moderate influence / Strong influence
9	Improved learner behaviour when an IWB is used	No influence / Little influence / Moderate influence / Strong influence

As the data in **Table 31** indicate, the teachers felt that all of the factors listed here have a recognisable influence on their frequency of use of the IWB. Their responses indicate that the two most influential factors which positively influence the frequency of IWB use by a teacher are the "Teacher's positive attitude towards IWB use" and the "Teacher's perception that learners feel positive about use of the IWB in lessons". The teachers also indicated that they believed "Improved attentiveness amongst learners when an IWB is used" and "Improved learner motivation when an IWB is used" are factors with a relatively strong, positive influence on the frequency of IWB use by a teacher.

There may have been some ambivalence in the statement "Teacher's confidence in his/her ability to use the IWB effectively". Two of the teachers indicated with written comments that they lacked confidence in their ability to use the IWB, and that this has a negative impact on their IWB use, rather than a positive impact.

The teachers indicated that the ability to store and reuse material, and the ability to save and refer to previous lessons also had a significant positive influence on their frequency of IWB use. As **Table 31** indicates, the teachers believe the least influential positive factors to be "Good IWB resources for use in lessons" and "Improved learner behaviour when an IWB is used". The teachers were invited to list other factors which positively influence the frequency with which they use their IWB. None of the teachers listed any additional factors.

The teachers were asked to consider various factors, which are believed to have a negative effect on the frequency of use of an IWB by an teacher (Moss et al., 2007; Rudd, 2007). They were asked to consider their own experiences and indicate the extent to which each factor negatively influences their frequency of IWB use. Considering their responses, the factors were arranged in order from strongest negative influence to weakest negative influence, as shown in **Table 32**.

As the set of data presented in **Table 32** indicates, the teachers responses showed that they believe some of these factors are significantly more influential than others. The two factors which teachers believe are most influential are the "Teacher's lack of confidence in his/her ability to use the IWB effectively" and "A lack of suitable IWB resources". The mean influence for each of these factors suggests that teachers believe these two factors are significantly more influential than the any of the other factors listed.

Table 32: Influence of factors believed to negatively influence frequency of IWB use

	Factors (ranked in order of influence)	Influence index ⮟
1	Teacher's lack of confidence in his/her ability to use the IWB effectively	| . . . . | . . . . | . . . . | . . . ⮟ | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
2	A lack of suitable IWB resources	| . . . . | . . . . | . . . . | ⮟ . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
3	Problems relating to alignment/orientation of the image on the board	| . . . . | . . . ⮟ | . . . . | . . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
4	Environmental factors, such as lighting	| . . . . | . ⮟ . . | . . . . | . . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
5	Problems relating to the data projector	| . . . . ⮟ . . . . | . . . . | . . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
6	Problems relating to connecting and activating the IWB	| . . . . ⮟ . . . . | . . . . | . . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
7	Teacher's negative attitude towards the IWB	| . . ⮟ . | . . . . | . . . . | . . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
8	Teacher's perception that learners have a negative attitude towards the IWB	| ⮟ . . . | . . . . | . . . . | . . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence

Three teachers indicated that "Problems relating to alignment / orientation of the image on the board" had a moderate or strong influence on their frequency of IWB use. This was mentioned as a problem by the interviewees as well. Interviewee B said, "…That's why I don't use it… reorientation." and Interviewee A said, "…The [thing] that I don't like about the [IWB] in that sense… is the fact that […] sometimes you have to adjust the accuracy. It is never accurate enough, especially if you want to do fine things and so on." Interviewee D said "…When it comes to text and input I just feel happier on the keyboard, and you know, there are some things in certain drawing programmes and whatever, where the sort of the click-and-drag doesn't work so well on the [IWB], so I rather do that [at the desktop computer]…"

Four teachers indicated that "Environmental factors, such as lighting" had a moderate or strong influence. Lighting was also mentioned by the interviewees, although there was not a formal question asking what prevented them from using the IWB more frequently. Interviewee B indicated that instead of using the data projector and IWB in her classroom when showing movies, she would take learners to one of the media centres, "mainly because the sound thing is not working I don't use it here, and the lighting is not great in this classroom…"

A similar sentiment was expressed by Interviewee E, who said, "…obviously I've used [the IWB] as a screen… for DVDs, but that has to be cloudy days, […] so I haven't shown many whole films [in my classroom] because it's not pleasant… all the dark scenes disappear…"

The responses from the teachers suggest that "Problems relating to the data projector" and "Problems relating to connecting and activating" have very little influence on the frequency of IWB use. The results suggest that any negativity the teachers may feel towards IWBs, or negativity they perceive amongst learners does not influence the frequency with which they use the IWB. These data may suggest that the vast majority of the teachers do not feel any negativity towards the IWBs, and that they do not perceive there to be any negativity amongst the learners.

The teachers were invited to list other factors which negatively influence the frequency with which they use their IWB. Two teachers mentioned insufficient time to improve their use of the IWB as a factor, one mentioned a lack of training, and another mentioned problems with sound as a factor, but suggested that this may be "possibly more linked to communications technology". In another section of the questionnaire, teachers were asked to indicate which factors prevent them from using the IWB more frequently. The factors are listed in **Table 33**, in order of significance, based on the number of teachers which indicated the factor is influential. The most influential factor is listed first and the least influential factor is listed last. The number of teachers (out of the 15 respondents) and the percentage which this represents is shown alongside each factor.

Table 33: Factors which prevent teachers from using an IWB more frequently

	Factors (arranged in order of significance)	**Number of teachers (out of 15) who indicated the factor**
1	My lack of training in the use of an IWB	10 66,7%
2	My lack of confidence in my ability to use the board	8 53,3%
3	Technical issues relating to the board	7 46,7%
4	Technical issues relating to my computer	6 40,0%
5	My fear of making mistakes in front of the learners	2 13,3%
6	Technical issues relating to my data projector	2 13,3%
7	My failure to see any advantage in working on the IWB	2 13,3%
8	My preference for normal whiteboards and / or an overhead projector	1 6,7%

As **Table 33** indicates, the factor which teachers recognise as most influential in preventing them from using the IWB more frequently is a lack of training in IWB use, which was highlighted by two-thirds of the respondents. Most likely linked to this lack of training is the second factor, a lack of confidence in their ability to use the IWB, which was recognised by eight of the fifteen respondents. Technical issues relating to the IWB, and technical issues relating to their computers were also recognised by a significant number of the teachers as influential in this regard. The responses from the teachers suggest that the remaining factors are relative insignificant in general, with only one or two of the fifteen respondents recognising them as influential.

A possible lack of training became apparent in the interviews. Interviewee E made the comment, "I don't actually know all the features [of the IWB]. I've been shown them, but I can't remember them… so I vaguely remember there are things like… that you can… I know you can drag down a little thing and half cover half the board, and that sort of thing would be useful …but I've forgotten how to use it, but I know it exists…"

Technical issues relating to the computers were also mentioned in the interviews as being problematic. Interviewee E made the comment, "…There's huge potential [for using the IWB] – those lessons and interactive things which are put on the web every single week, but we can't get them… [the Internet connection is] not powerful enough or whatever… we can't get it, so you have to download it ahead of time… and… it just never works out… the… [Internet] connection or something isn't powerful enough, so it takes too long to come up, so you can't just click on to Internet and call it up… which is the reality of how you would use it…"

5.4 What features of IWBs are being used by the teachers, and how frequently?

5.4.1 Use of general IWB capabilities

Teachers were asked, in general, how frequently they use their IWBs, how frequently they save IWB content from the lesson and how frequently they recall saved content for use in a subsequent lesson. They were provided with five options for frequency, as shown in **Table 34**, and a frequency index was calculated from the results, as described previously. **Table 34** presents an indication of the mean frequency with which each operation is performed by the teachers.

Table 34: General frequency of IWB use, and saving and recalling content

	Operation (ranked in order of frequency of use)	Frequency index ⩛
1	Using the IWB	|....|....|....|....|....⩛....|....|....| Never Hardly ever Some lessons Most lessons Every lesson
2	Saving IWB content	|....|....|..⩛.|....|....|....|....|....| Never Hardly ever Some lessons Most lessons Every lesson
3	Recalling saved content	|....|....|..⩛.|....|....|....|....|....| Never Hardly ever Some lessons Most lessons Every lesson

As **Table 34** indicates, the frequency of IWB use is in some or most lessons, while the mean frequency of saving and recalling content is verging on hardly ever. In order to allow the relationship between frequency of IWB use, and saving and recalling of content to be investigated more closely, the responses of individual teachers were captured and are presented in **Table 35**.

Table 35: Individual frequency of IWB use, and saving and recalling content

General frequency of IWB use	Frequency of saving IWB content from the lesson	Frequency of recalling saved content for use in a subsequent lesson	Number of respondents
In every lesson	In every lesson	In every lesson	1
	In some lessons	In some lessons	1
	Hardly ever	Hardly ever	1
In most lessons	In some lessons	In some lessons	3
	In some lessons	Hardly ever	1
	Hardly ever	Hardly ever	2
In some lessons	In most lessons	In most lessons	1
	Hardly ever	Hardly ever	1
	Never	Never	1
Hardly ever	Never	Never	2
Never	Never	Never	1

The set of data represented in **Table 35** indicates that three of the fifteen respondents use their IWB in every lesson, but only one of these teachers saves and recalls content in every lesson. **Table 35** also indicates that the second of these teachers, who uses the IWB in every lesson, saves and recalls content in some lessons, and the third teacher who uses the IWB in every lesson hardly ever saves and recalls content. Of the six teachers who use the IWB in most lessons, three save and recall content in some lesson, one saves content in some lessons but hardly recalls it,

and two hardly ever save or recall content. As might be expected, the teachers who hardly ever or never use the IWB, never save or recall content.

Some confusion appeared to arise with regard to the meaning of the frequency descriptors in this context. For example, one teacher was uncertain as to whether in this context "In every lesson" meant "In every lesson where the IWB is used" or in every single lesson. In other words, he was uncertain as to whether this frequency of use was absolute, or relative to the use of the IWB. Unfortunately no teachers approached the researcher in this regard before they submitted their questionnaires, and so this uncertainty may have had some effect on the results, but does not appear to have distorted them.

5.4.2 Use of more specific capabilities and features

The teachers were asked to consider various capabilities and features of an IWB that may be used during a lesson. They were asked to indicate the frequency with they use each of the capabilities and features. Considering their responses, the capabilities and features were arranged in order from most frequently used to least frequently used, as shown in **Table 36**.

Table 36: Frequency of use of specific capabilities and features of the IWB

	Capabilities and features (ranked in order of frequency of use)	Frequency index ⩛
1	Revisiting my own material	| . . . . | . . . . | . . . . | . . . ⩛ | . . . . | . . . . | . . . . | . . . . | Never Hardly ever Some lessons Most lessons Every lesson
2	Using colour, shading and highlighting	| . . . . | . . . . | . . . . | ⩛ . . . | . . . . | . . . . | . . . . | . . . . | Never Hardly ever Some lessons Most lessons Every lesson
3	Annotating and saving material	| . . . . | . . . . | . . . . ⩛ . . . . | . . . . | . . . . | . . . . | . . . . | Never Hardly ever Some lessons Most lessons Every lesson
4	Movement or animation	| . . . . | . . . . | . . ⩛ . | . . . . | . . . . | . . . . | . . . . | . . . . | Never Hardly ever Some lessons Most lessons Every lesson
5	Dragging or hiding labels or images	| . . . . | . . . . | ⩛ . . . | . . . . | . . . . | . . . . | . . . . | . . . . | Never Hardly ever Some lessons Most lessons Every lesson

The data in **Table 36** suggest that, in general, teachers are making limited use of the features of the IWB, with at least one third of the respondents never using, or hardly ever using each feature. The data indicate that, of the features and capabilities listed, "Revisiting my own material" is the one most commonly utilised by the teachers, with six of the fifteen teachers utilising this capability in most lessons or in every lesson. "Using colour, shading and highlighting" was the second most commonly used feature, but this only two teachers use this feature regularly. The frequency with

which teachers indicated that they use the IWB's ability to annotate and save material is consistent with their responses on how regularly they save IWB content. Only three of the fifteen respondents regularly annotate and save material. Only two teachers regularly utilise the movement and animation capabilities of the IWB, and only one teacher utilises the ability to drag or hide labels or images. Thus, in general, movement or animation, and the dragging or hiding labels or images is hardly ever used.

Limited use by teachers also became apparent in the interviews. Interviewee E said, "…At the moment [my IWB] is just like a [conventional] whiteboard… most of the time [and] obviously I've used it as a screen." And Interviewee B made the comment, "…I know we don't use [the IWB] as much… the idea is we use [the IWB] rather than [the conventional whiteboard] … and so you can be storing stuff which you have done, which hasn't been rubbed off… I don't use it like that… I use it more, just as I say, ...for [the learners] to come up… a few times for [the learners] to come up and label. So it does [add] a bit of variety. I don't use it that often, because it creates quite a bit of chaos in the class sometimes. It's got to depend on when it works for me and it doesn't. And, as I say, to write on and to show things, that's the interactive part… the rest of it, in reality, I think I could be doing just with [the laptop] and [the data projector]."

Limited use of the IWB's capacity for allowing a teacher to write on the surface was apparent in a comment from Interviewee D, who said, "…Well I don't really use the… writing surface… I don't use that that much… mainly because my writing is pretty awful… so anything I draw on there looks terrible […] I have been trying to do that a bit more, because I think… that it's quite a good way to develop ideas and that sort of thing and seeing how lessons will go kind of on the fly and then one can rework it…"

When Interviewee B was asked what features and characteristics of the IWB she finds most useful, she said, "It's mainly projecting images… being able to use [the learners] to come in and try to label things in the drawings… [And with regard to recapping material] you quickly access it… but, you see, because there are three of us using [the material]… we don't save our changes to it. So, you know, if you've scribbled on it, we don't save it, because then the next person comes and teaches and might want to do something different with it, so we don't do that."

During the interviews, the interviewees were asked what features and characteristics of an IWB they find most useful during lessons. Interviewee C highlighted the usefulness of being able to annotate, save and revisit material, saying, "The fact that you could save stuff… that's a good thing, so you can always go back to it and you can add and subtract from it… the fact… I think the biggest thing for [my subject] is to be able to get pictures up on the board and then to be able to sketch over them and label them… the boys can come up, they can label it, they can draw over it

…and you can rid of it again. […] So I can put a [chart] up there and I draw all over that [chart] and I can save it and I can keep for tomorrow, and I can get rid of it and I can change it and I can do everything with [the IWB]…"

Interviewee A indicated that the dynamic visual display which the IWB offers was most useful to him, saying "I think the fact that, if I need a graphical display, I can access it immediately. I can show [the learners] using, you know… and I can access it from my [IWB] and it will be automatically on display – I don't have to make a Photostat copy. And I will have a dynamic picture… I can have a dynamic picture for them to see."

Interviewee D also highlighted the importance of the visual display, specifically in the context of guiding learners through the use of a software packages. He said, "[…] What I have found is, even for [demonstrating] ICT techniques, which I don't do that often, …but doing it on the [IWB] works much better, because the kids actually know where you're at, …because you are there actually, showing them where it is…. and you can say follow my mouse, but they don't actually, they just see what happens… I suppose it's the same thing as the poor people who have to stand with the flags at the road works, I mean… why do you need a person to hold a red flag? It's because there is a person there [that] you actually notice the flag."

Interviewee B commented on the ability to use the IWB for quick revision and assessment at the beginning of a lesson, with specific reference to the graphical display and labelling, saying, "Instead of handing out a sheet of paper and they've got to fill in the answers sort-of-thing. It's one quick way… quick revision at the beginning of the lesson… you know… I have the labels… particularly for naming and remembering things… labels." She also highlighted the usefulness of the visual display for demonstrating processes through multimedia applications, such as "…visually showing them something happening, so for example kidney ultra filtration in the multimedia things… being able to quickly show them that. […] So it's mainly projecting images… being able to use them [the learners] to come in and try to label things in the drawings…"

5.5 What resources and equipment do teachers use in combination with IWBs?

5.5.1 Use of ICT resources

The teachers were asked to consider various ICT resources that may be used in combination with an IWB during a lesson. They were asked to indicate the frequency with they use each of the resources. Considering their responses, the resources were arranged in order from most frequently used to least frequently used, as shown in **Table 37**, which follows.

Table 37: Frequency of use of ICT resources used in combination with an IWB

	Resources (ranked in order of frequency of use)	Frequency index ⮟
1	Downloaded images or sounds	|....|....|....|....|....⮟....|....|....| Never Hardly ever Some lessons Most lessons Every lesson
2	Preloaded pages	|....|....|....|...⮟|....|....|....|....| Never Hardly ever Some lessons Most lessons Every lesson
3	Subject specific websites	|....|....| ....|..⮟.|....|....|....|....| Never Hardly ever Some lessons Most lessons Every lesson
4	Subject specific application software	|....|....|....|.⮟..|....|....|....|....| Never Hardly ever Some lessons Most lessons Every lesson
5	Material downloaded from the school network	|....|....|....|⮟...|....|....|....|....| Never Hardly ever Some lessons Most lessons Every lesson
6	Search engines	|....|....|...⮟|....|....|....|....|....| Never Hardly ever Some lessons Most lessons Every lesson
7	National Curriculum material	|....|....|...⮟|....|....|....|....|....| Never Hardly ever Some lessons Most lessons Every lesson

Table 37 indicates that downloaded images or sounds are the resources most frequently used by teachers in combination with an IWB, and that the frequency with which these are used is significantly higher than the other resources listed. Preloaded pages are the next most frequently used resource, followed by subject specific websites and subject specific application software. Only one or two teaches make frequent use of material downloaded from the school network, search engines or National Curriculum material. Some confusion arose with regard to the meaning of the frequency descriptors in this context. For example, some teachers were uncertain as to whether in this context “In every lesson” meant “In every lesson where the IWB is used” or in every single lesson. In other words, they were uncertain as to whether this frequency of use was absolute, or relative to the use of the IWB. Unfortunately none of them approached the researcher in this regard before they submitted their questionnaires, and so this uncertainty may have affected the results.

The teachers were asked to consider various potential sources of IWB resources that may be used during a lesson. They were asked to indicate the frequency with they use each of the sources of IWB resources. Considering their responses, the sources of IWB resources were arranged in order from most frequently used to least frequently used, as shown in **Table 38**, which follows.

Table 38: Use of IWB resources

	Resources (ranked in order of frequency of use)	Frequency index
1	Resources that I have created	Never / Hardly ever / Some lessons / Most lessons / Every lesson
2	Internet websites	Never / Hardly ever / Some lessons / Most lessons / Every lesson
3	Resources created by a colleague	Never / Hardly ever / Some lessons / Most lessons / Every lesson
4	Commercial software	Never / Hardly ever / Some lessons / Most lessons / Every lesson

The results in **Table 38** indicate that it is their own personal resources (which they have created themselves) that teachers most frequently access, in some lessons. Internet websites are the source accessed second most often, followed by resources created by a colleague and then commercial software. Teachers were asked to name software they have used in combination with IWBs and to describe briefly how they have used the software. Their responses are summarised in **Table 39**, with subjects listed in alphabetical order.

Table 39: Software used in combination with the IWB

Subject	Software named by teacher	Teacher's description of use
English	–	–
French	En Route	Oral / recognition
Geography	Microsoft PowerPoint	Various lessons (subject material)
	Animation software	Various lessons (subject material)
	GIS software	To demonstrate aspects of the programme
	Internet	Downloading pictures, maps, photos
	Geography Interactive	For labelling, explaining, adding to material and utilising the animations to help explain concepts by adding own details as they roll through
Information Technology	–	–
Life Orientation	Inspiration	Developing concepts
	Microsoft PowerPoint	Presentations
Life Sciences	Multimedia Science School	An interactive tool with exercises and worksheets; designing an exercise to use with it; not used interactively, but rather as a visual aid to enhance a concept or the functioning of an organ, etc.
	Biological Drawing	
Mathematics	Autograph	Graphs; screen capture
	The Geometer's Sketchpad	Transformations; screen capture
	Casio Calculator Emulator	Screen capture
	Class Performance System	Assessment using true/false, yes/no and multiple questions
Physical Sciences	Multimedia Science School	Using virtual experiments to reinforce concepts; choosing ions to make compounds

5.5.2 Use of ICT equipment

The teachers were asked to consider various items of ICT equipment that may be used in combination with an IWB. They were asked to indicate the frequency with which they use each item. Considering their responses, the equipment was arranged in order from most frequently used to least frequently used, as shown in **Table 40**.

Table 40: ICT equipment used in combination with the IWB

	Resources (ranked in order of frequency of use)	Frequency index ⮟
1	The IWB pens	Never | Hardly ever | Some lessons | Most lessons | Every lesson
2	My laptop	Never | Hardly ever | Some lessons | Most lessons | Every lesson
3	The school network	Never | Hardly ever | Some lessons | Most lessons | Every lesson
4	The Internet	Never | Hardly ever | Some lessons | Most lessons | Every lesson
5	A sound system (speakers)	Never | Hardly ever | Some lessons | Most lessons | Every lesson
6	A printer	Never | Hardly ever | Some lessons | Most lessons | Every lesson
7	Voting pads	Never | Hardly ever | Some lessons | Most lessons | Every lesson
8	A slate / tablet	Never | Hardly ever | Some lessons | Most lessons | Every lesson
9	Learners' laptops	Never | Hardly ever | Some lessons | Most lessons | Every lesson

The IWB pens were included in this list as a measure of the level of interactivity of the teacher with the board, assuming that when teachers use the IWB, they use the pens rather than their own fingers to interact with the IWB surface. One of the teachers indicated that he/she generally uses the IWB as a screen. Some of the teachers run the IWB from their personal laptops and some run them from a dedicated desktop. **Table 40** indicates that, apart from the IWB pens and personal laptops, it is the school network, the internet and a sound system which teachers most frequently use in combination with the IWB. Each of these is typically used in some lessons. The responses from the teachers indicate that they seldom use a printer. All the teachers, except two, indicated that they never use voting pads, a slate or tablet, and all except one indicated that they never use or the learners' laptops.

5.6 To what extent are the existing IWBs being used by the learners?

5.6.1 The prevalence of IWB use by learners

For each subject where an IWB was indicated to be present, learners were asked to indicate whether or not learners in the class use the IWB. **Figure 18** provides a graphical representation of the feedback from the learners, indicating, for each grade, the mean percentage (± standard deviation) of subjects where learners reported the presence of an IWB is present, and the mean percentage (± standard deviation) of subjects where an IWB is used by the learners.

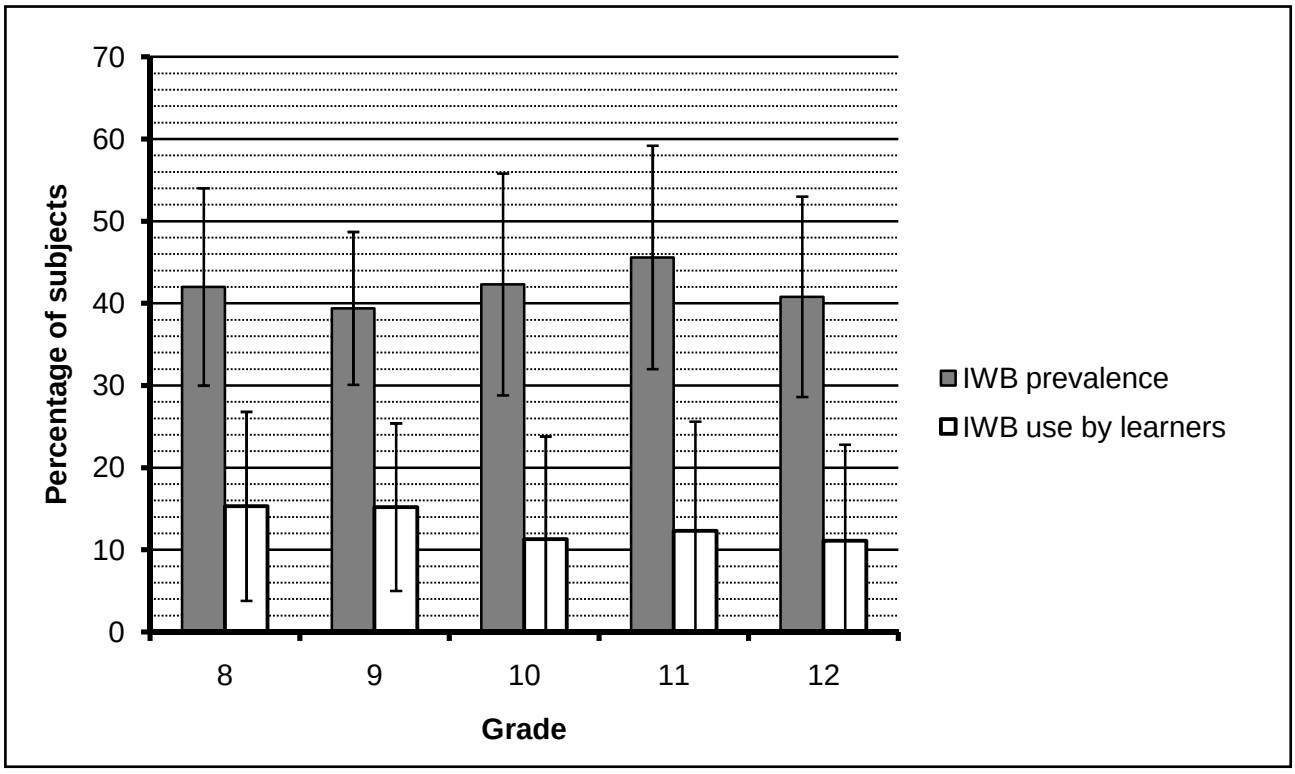


Figure 18: Prevalence of IWBs and the extent of IWB use by learners

As **Figure 18** indicates, the most prolific use of IWBs by learners was reported by Grade 8's who experience the use of the IWB by classmates in 15,3(±11,5)% of their subjects. IWB use reported by Grade 9's is comparable to this, with learners reporting the use of the IWB by classmates in 15,2(±10,2)% of their subjects. However, given that the Grade 9's are exposed to IWBs in fewer of their classes than the Grade 8's, the mean percentage use of the IWBs by the learners is higher, at 40,6(±28,1)%, compared to 34,9(±23,3)% in Grade 8.

The Grade 10's reported use of the IWB by class mates in 11,3(±12,5)% of their classes and the Grade 11's in 12,3(±13,3)% of their classes. The lowest frequency of use was reported by the Grade 12's who experience use of the IWB by class mates in 11,1(±11,7)% of their subjects. However, given the differing prevalence of IWBs in their subjects, it was the Grade 11's who

reported the lowest mean percentage use of IWBs by classmates, indicating that 26,3(±27,7)% of the IWBs in their classes are used by class mates. Considering what these percentages mean in terms of the number of subjects in which an IWB is present, and the number of subjects in which a learner experiences uses of the IWB by other learners, **Figure 19** provides an indication of what the data revealed.

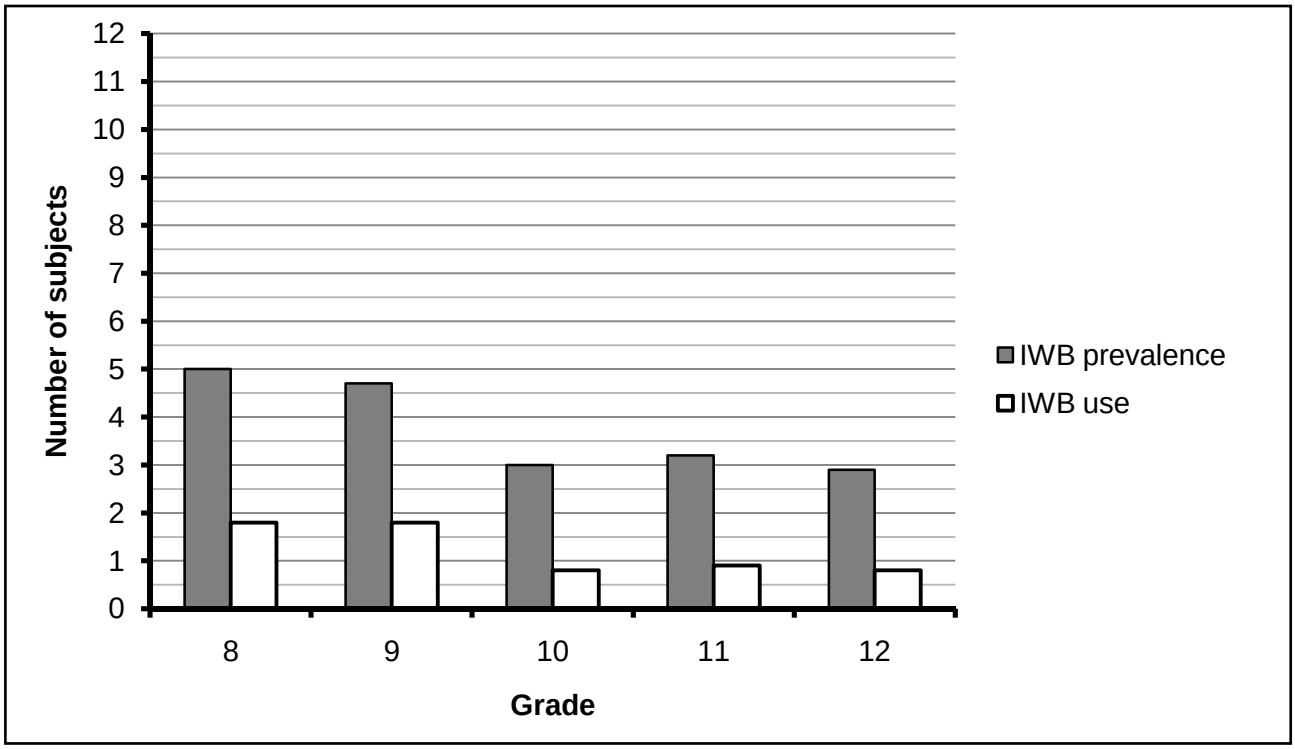


Figure 19: Mean number of subjects in which an IWB is present, and used by learners

Figure 19 indicates that for a Grade 8 learner the mean number of subjects in which an IWB is present is 5,0 (out of 12), while the mean number of subjects in which an IWB is used by learners is 1,8. For a Grade 9 learner the mean number of subjects in which an IWB is present is 4,7 (out of 12), while the mean number of subjects in which an IWB is used by learners is 1,8. For a Grade 10 learner the mean number of subjects in which an IWB is present is 3,0 (out of 7), while the mean number of subjects in which an IWB is used by learners is 0,8.

For a Grade 11 learner the mean number of subjects in which an IWB is present is 3,2 (out of 7), while the mean number of subjects in which an IWB is used by learners is 0,9. And for a Grade 12 learner the mean number of subjects in which an IWB is present is 2,9 (out of 7), while the mean number of subjects in which an IWB is used by learners is 0,8. The mean (± standard deviation) percentage of IWBs used by the learners in each grade was calculated and the results are represented graphically in **Figure 20**.

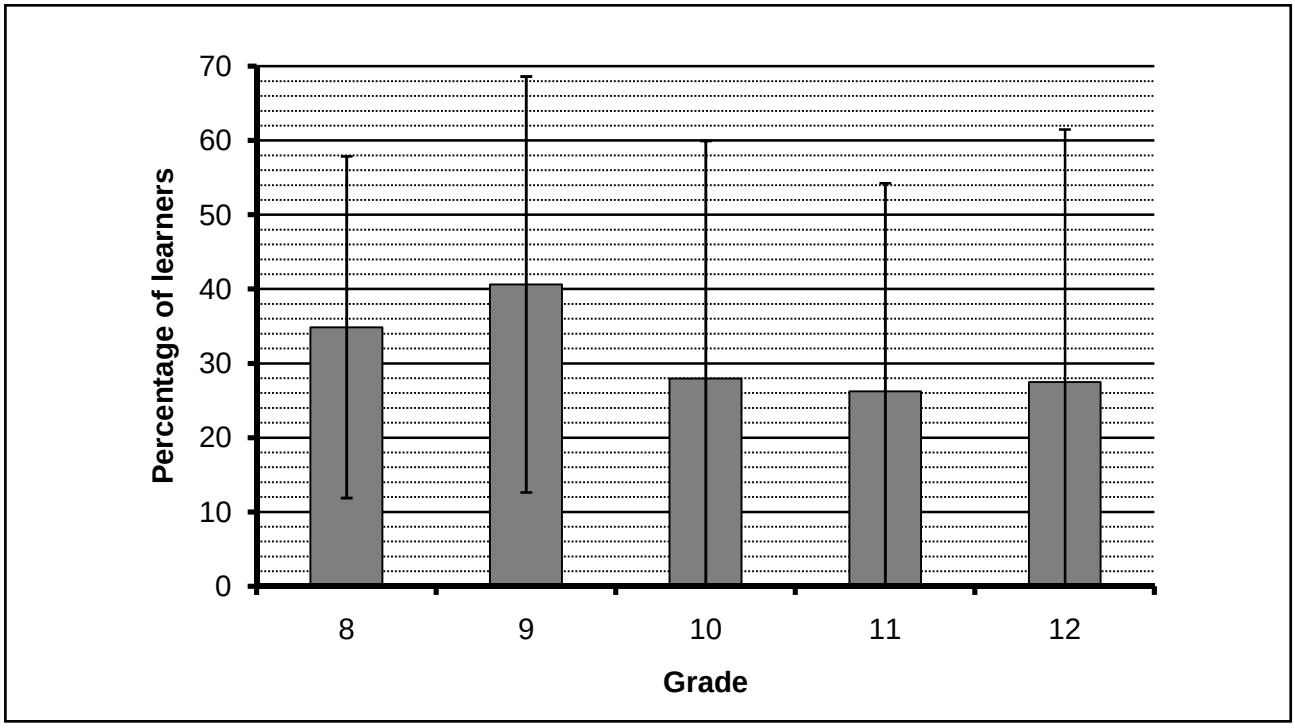


Figure 20: Prevalence of use of existing IWBs by learners in each grade

Figure 20 highlights the fact that in Grade 9 the learners use the highest percentage, 40,6(±28,1)%, of the boards available, while in Grade 11, the utilisation of the existing boards by learners is lowest, at 26,3(±27,7)%. This data was analysed from a different perspective, considering the percentage of learners who report use of an IWB by themselves or their classmates in the respective number of their classes.

This information is displayed in **Figure 21**, which shows that, amongst the juniors learners (in Grades 8 and 9), 32,0% of them report use of the IWB by class mates in one of their twelve subjects and 33,9% of them report use of the IWB by class mates in two of their twelve subjects. Amongst the senior learners (in Grades 10, 11 and 12), 47,2% of them report use of the IWB by class mates in none of their classes, and 29,6% of them report use of the IWB by class mates in one of their twelve subjects.

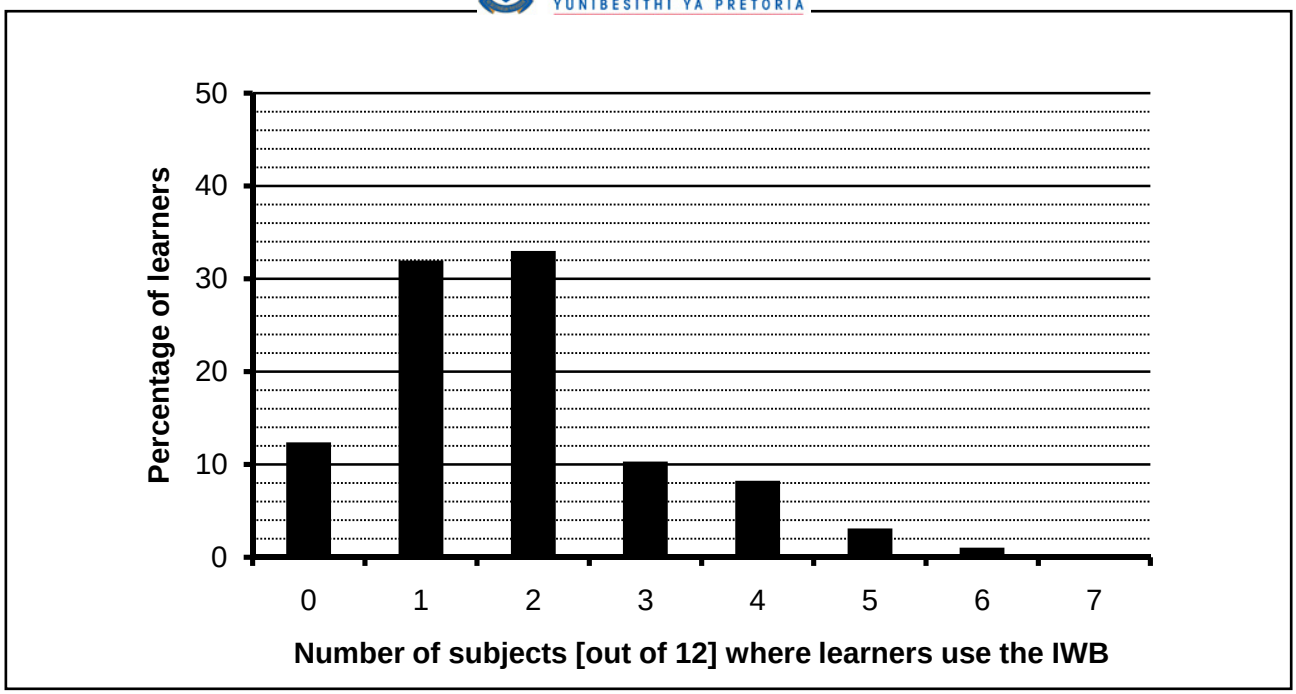


Figure 21: Percentage of junior learners who IWB use by fellow learners

Figure 21 shows the percentage of junior learners (in grades 8 and 9) who reported that IWBs were used by fellow learners in their classes. This chart indicates that 12,4% of the juniors reported that in none of their subjects was the IWB used by the learners. The maximum number of classes in which the juniors reported use of the IWB by fellow learners was six, and this was reported by only one of the 97 junior learners. Most of the junior learners reported use of the IWB in only one or two of their twelve subjects.

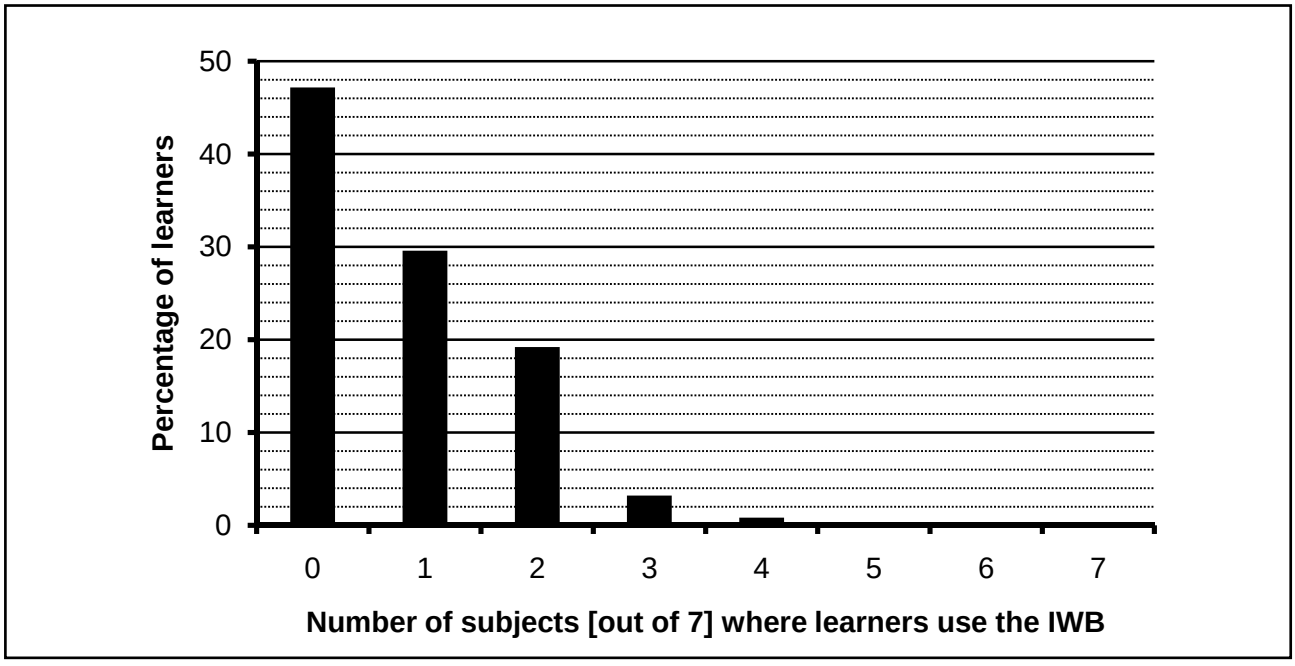


Figure 22: Percentage of senior learners who report IWB use by fellow learners

The bar graph **Figure 22** shows the percentage of senior learners (in grades 10, 11 and 12) who reported that IWBs were used by fellow learners in their classes. This graph indicates that 47,2% of the seniors reported that in none of their subjects was the IWB used by the learners. The

maximum number of classes in which the seniors reported use of the IWB by fellow learners was four, and this was reported by only one of the 125 senior learners.

5.6.2 The nature of IWB use by learners

Learners were asked to describe how they or their class mates use the IWB during lessons. In the questionnaire they were given the examples "for writing, drag-and-drop or clicking on a button." Their responses are summarised in **Table 41**.

Table 41: IWB features used by learners

Feature, capability or task	Grade of the respondents					Total	Additional Comments
	8	9	10	11	12		
Writing, writing answers and data	19	17	16	19	7	78	Sharing answers, answering questions, filling in things, putting in the answer
Showing working out in Mathematics	10	13	5	9	11	48	Performing calculations, for explaining or solving a sum or equation or word sum or Maths problem, solving questions, working out answers, explaining formulas
To do presentations	14	6	4	1	4	29	MS PowerPoint , slides, slide shows
For drag-and-drop or moving things	5	9	6	1	2	23	–
For clicking on a button	5	3	1	–	–	9	To indicate answers
Working with it for fun	1	2	–	–	–	3	Playing / messing around when we are free
Drawing (diagrams)	–	6	1	1	4	12	e.g. a graph or landscapes
Graph work, making graphs	–	5	3		1	9	Using graphing programmes, putting in equations for the graphs
Showing pictures and diagrams	–	2	1	1	1	5	Indicating on pictures where things are, giving visual examples
Writing on diagrams and pictures and explaining them	–	1	1	1	2	5	Labelling diagrams, circling
Doing research on topics	–	1	1	–	–	2	–
Using Google Earth	–	2	–	1	1	4	–
Explaining, showing ideas and information, illustrating a problem	–	2	–	5	3	10	Working out, when stuck or confused

In addition to these comments, individual learners indicated that they had used the IWB for the following purposes.

- For everything, in Maths (a Grade 11 learner)
- For looking at the Internet (a Grade 10 learner)
- For finding specific things (a Grade 10 learner)
- For finding different continents (a Grade 10 learner)
- For map work (a Grade 9 learner)
- To edit (a Grade 8 learner)
- For learning programmes in French (a Grade 8 learner)

With regard to this section of the questionnaire, in spite of very specific wording of the questions, there seems to have been some confusion, with some learners seemingly reporting what their teachers do. However, the vast majority of the responses from the learners did appear to describe activities that they themselves would be doing on the IWB.

As **Table 41** indicates, the main thing that learners do on the IWB is write, with a high percentage of the writing specifically being done in Mathematics (according to the learners). Doing presentations and moving objects on the screen (including doing a drag-and-drop operation) was also mentioned by many learners. The visual strength of the IWB comes through in the fact that many learners mention using the IWB for drawing, and for explaining, showing ideas and information, and illustrating a problem.

5.7 Chapter five in summary

This chapter presents the findings related to the extent, frequency and nature of IWB use by learners and teachers, together with the findings related to the distribution of IWBs across the school. The frequency with which IWBs are used by teachers and learners, and the nature of this use is described. The factors influencing the frequency of IWB use by teachers are investigated. In Chapter 6, the perspectives of the teachers with regard to the impact of IWBs on the teaching-learning process and the learners themselves, are presented and analysed.

CHAPTER 6
FINDINGS SECTION 2:
THE IMPACT OF IWBs AS PERCEIVED BY THE TEACHERS

Research Questions

Theme 1
The extent, frequency and nature of IWB use in classrooms

1.1 How are IWBs distributed across the school, and how frequently do learners encounter them?

1.2 How frequently are the existing IWBs being used by the teachers and what factors influence their frequency of use?

1.3 What features of IWBs are being used by the teachers, and how frequently?

1.4 What resources and equipment do teachers use in combination with IWBs?

1.5 How frequently are the existing IWBs being used by the learners and what features are they using?

The focus of this chapter is theme two.

Theme 2
The impact of IWBs on teaching and learning as perceived by teachers

2.1 What is the general attitude of teachers towards IWBs?

2.2 What attitude do teachers perceive the learners to have with regard to the IWB?

2.3 What impact do teachers perceive IWB use to have on learners' behaviour, attentiveness, motivation and productivity?

2.4 What impact do teachers perceive IWB use to have on the learning process, specifically with regard to their effect on learners' understanding, retention and performance?

2.5 What impact do teachers perceive the IWB to have on lesson planning, preparation and resource development?

2.6 What impact do teachers perceive the IWB to have on presentation, teaching styles and classroom management?

continued/...

.../continued

Theme 3
The challenges and needs of teachers with regard to IWB use

3.1 How competent do teachers using IWBs perceive themselves to be in their use of the IWBs, and how do they believe the learners perceive their use of the IWB?

3.2 What factors do teachers believe influence the effectiveness of their use of IWBs?

3.3 What formal training did teachers receive in the use of IWBs, and how effective was this training perceived to be?

3.4 Do teachers feel the need to improve their use of IWBs and, if so, how do they believe they could best achieve this?

3.5 What perceptions do teachers have of the resources available for use with IWBs?

3.6 How do teachers feel about integrating ICT in the form of the IWB into their teaching, as opposed to using a data projector alone, or making use of computers in a dedicated computer laboratory?

3.7 What limitations, technical or otherwise, do teachers perceive to be preventing them from using IWBs more effectively?

Theme 4
The impact of IWBs as perceived by learners

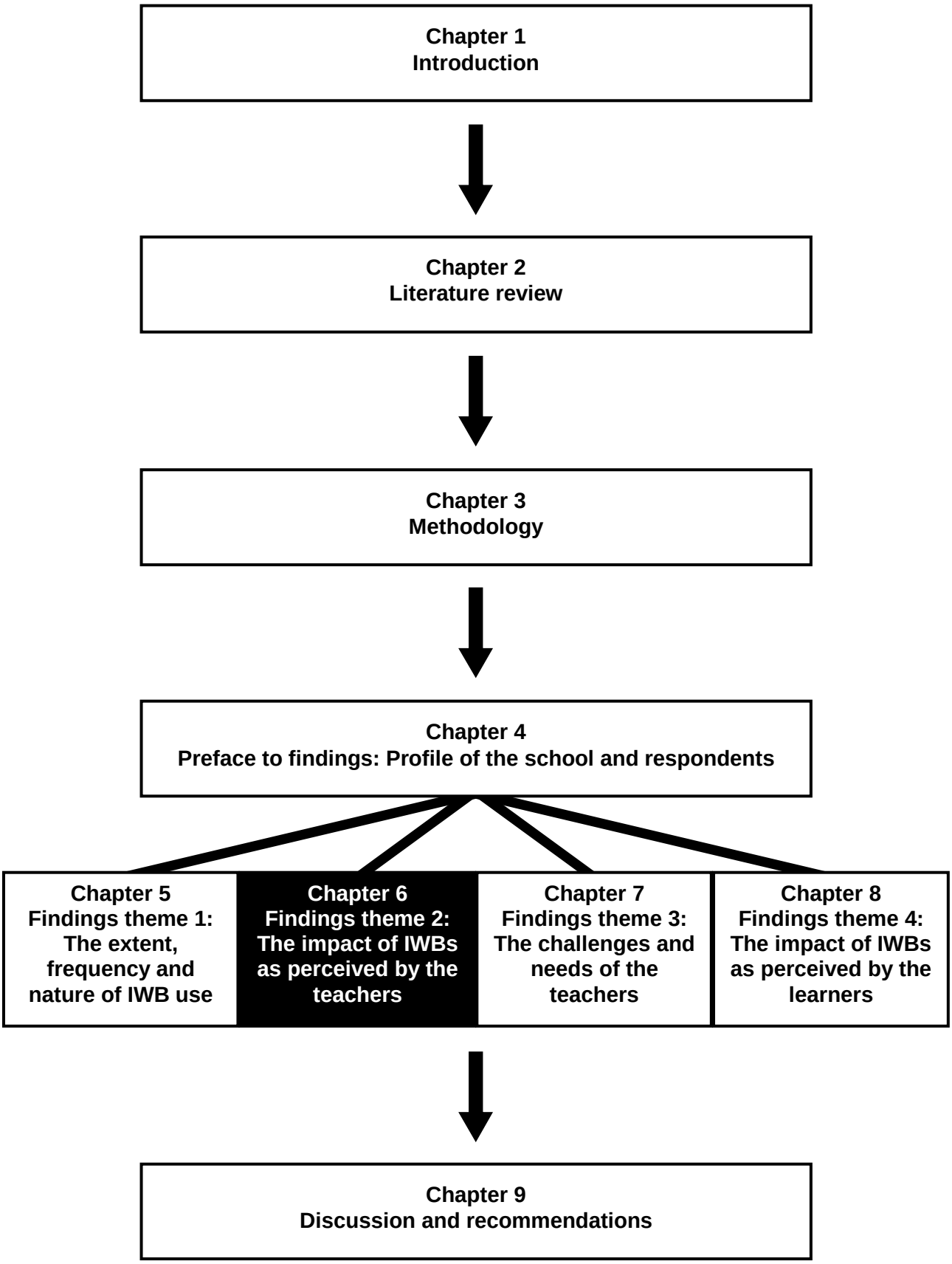
4.1 What is the learners' perception of the level of competency in IWB use amongst teachers?

4.2 What impact do learners perceive the IWB to have on their teachers and the manner in which they facilitate lessons, specifically with regard to the pace of lessons, the teacher's ability to capture and hold their attention, and the presentation and aesthetic appeal of the teacher's audiovisual aids?

4.3 What impact do learners perceive use of the IWB to have on the learning process, specifically on their understanding, retention and productivity?

4.4 What impact do learners perceive use of the IWB to have on their personal behaviour, attentiveness and motivation, and the behaviour of their fellow learners?

Outline of dissertation



Chapter 6: Findings theme 2 – Teachers' perceptions

"…You need to use the right technology for the right section of work that you're doing, to get the right impact […and…] you need to have a clear plan of action [indicating] what you want to achieve and how you are going to do that, otherwise it falls apart…"

Interviewee C

6.1 Introduction

This chapter explores the impact of IWBs from the perspective of the teachers. It investigates the teachers' perceptions of the impact of IWBs on learner behaviour, attentiveness and motivation, as well as the impact on the learning process, with specific reference to understanding, retention and performance. Consideration is given to the impact teachers perceive the IWB to have on their lesson planning, preparation and resource development. The impact of the IWB on teaching styles is also investigated, with regard to the manner in which teachers facilitate their lessons, the extent to which they attempt to promote interactivity in their lessons, and the extent to which they attempt to accommodate different learning styles. The effect of the IWB on collaboration with colleagues, efficiency and quality of work is also investigated. The feedback received from teachers is analysed with a view to answering the following questions.

- What is the general attitude of teachers towards IWBs?
- What attitude do teachers perceive the learners to have with regard to the IWB and its impact on lessons?
- What impact do teachers perceive the IWBs to have on learners' behaviour, attentiveness, motivation and productivity during lessons?
- What impact do teachers perceive IWBs to have on the learning process, specifically with regard to their effect on learners' understanding, retention and performance?
- What impact do teachers perceive IWBs to have on teaching, specifically with regard to lesson planning, preparation and resource development?
- What impact do teachers perceive the IWB to have on teaching, specifically with regard to lesson facilitation, presentation, teaching styles, classroom management, interactivity and accommodating different learning styles?

Teachers were asked to indicate the extent to which they agreed or disagreed with various statements. As described in the chapter on methodology, for each statement the response options were structured as a Likert item, allowing the teacher to choose one of five options, as shown below in **Figure 23**, and the response to each Likert item was equated to a five-point scale on a number line, from –2 through to +2, as indicated in **Figure 23**.

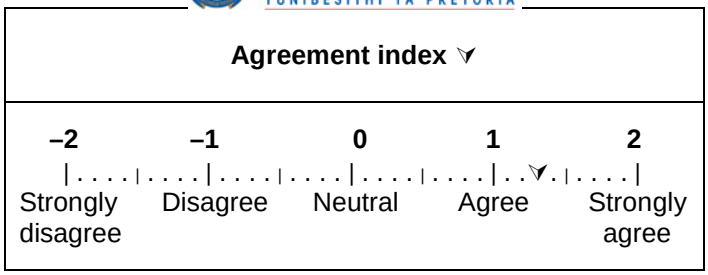


Figure 23: Graphic representation of agreement index 1,3

Each response from each participant was assigned the corresponding integral value (–2, –1, 0, 1, 2). For each subject the arithmetic mean of these values was calculated as the agreement index. **Figure 23**, indicates how a frequency index of 1,3 will be represented graphically. As indicated, this agreement index closest to the descriptor "Agree". With certain statements, the agreement descriptors were replaced with other relevant descriptors and the same method of calculating an index was applied.

6.2 What is the general attitude of teachers towards IWBs?

As part of the investigation into the general opinion of teachers with regard to IWBs in teaching, they were asked to consider the following statement and indicate the extent to which they agreed with it. **Table 42** shows their responses.

> "In the 21st century a learner's life revolves around electronic media: cell phones, iPods, movies, computer games, TV games… the list is virtually endless. An IWB allows the teacher to capture a learner's attention through a medium that he/she can relate to better than chalkboards, OHP's and traditional whiteboards."

Table 42: Responses to the statement on the IWB as a modern teaching medium

	Teacher group	Mean index of agreement
1	Teachers with IWBs (n=14)	Strongly disagree – Disagree – Neutral – Agree – Strongly agree
2	Teachers without IWBs (n=8)	Strongly disagree – Disagree – Neutral – Agree – Strongly agree

As **Table 42** indicates, both groups of teachers, those with IWBs and those without IWBs, generally agree with the statement. Of the 22 teachers who responded to this statement, twenty (90,9%) agreed or strongly agreed with this statement, and two were neutral in their opinions. These results suggest that teachers recognise a need to engage learners through technology, and that they believe that an IWB may help to facilitate this process.

In an attempt to determine the general attitude of teachers towards IWBs, five statements were presented to them and they were asked to indicate the extent to which they agree with each statement. The statements and the responses are presented in **Table 43**, which follows. The statements invited teachers to consider IWBs from the point of view of the cost of the equipment, in the context of the school, within the broader context of the South African schools, and finally in educational institutions in general. They were also asked to consider whether an IWB allows them to achieve more than they could with a data projector alone, and the impact of the IWB on their teaching style. Both groups of teachers (those who currently have an IWB available for use, and those who have a data projector, but no IWB) were asked to consider each of the statements. They were informed that the cost of an IWB and data projector (installation included), is approximately R35 000, excluding a computer, which is obviously a necessity.

Table 43: Responses to the statements on the cost and general value of IWBs

	Statements	Teacher group	Agreement index ⮟
1	In the context of our school, the cost of an IWB cannot be justified in terms of its contribution to teaching and learning.	with IWB	Strongly disagree | Disagree ⮟ | Neutral | Agree | Strongly agree
		without IWB	Strongly disagree | Disagree | Neutral ⮟ | Agree | Strongly agree
2	In most state schools in South Africa the cost of an IWB cannot be justified in terms of its contribution to teaching and learning.	with IWB	Strongly disagree | Disagree | Neutral | Agree ⮟ | Strongly agree
		without IWB	Strongly disagree | Disagree | Neutral | Agree ⮟ | Strongly agree
3	In general, considering what an IWB contributes to education, the cost cannot be justified in any educational institution.	with IWB	Strongly disagree | Disagree ⮟ | Neutral | Agree | Strongly agree
		without IWB	Strongly disagree | Disagree | Neutral ⮟ | Agree | Strongly agree
4	Most of what I (could) achieve with an IWB I could achieve with a data projector alone.	with IWB	Strongly disagree | Disagree | Neutral ⮟ | Agree | Strongly agree
		without IWB	Strongly disagree | Disagree | Neutral | Agree ⮟ | Strongly agree
5	Use of an IWB reinforces traditional teacher-centred teaching styles.	with IWB	Strongly disagree | Disagree ⮟ | Neutral | Agree | Strongly agree
		without IWB	Strongly disagree | Disagree ⮟ | Neutral | Agree | Strongly agree

Table 43 shows the responses of the two groups of teachers to each of the statements. Considering the statement "In the context of our school, the cost of an IWB cannot be justified in terms of its contribution to teaching and learning." the majority (86,7%) of the respondents who currently have an IWB disagreed or strongly disagreed with the statement, indicating that they believe that the cost of an IWB can be justified within the context of the school, and that it is a worthwhile investment. The second group of respondents (who do not have an IWB) were divided in their opinions on this. Three of the eight teachers agreed with the statement, three disagreed and two were neutral. These results may suggest that, after using an IWB, a teacher may grow to appreciate its value and the contribution it makes to the learning process. The results may also suggest that the teachers who currently have an IWB saw the potential of the technology and received IWBs first as a result of a proactive move to acquire one.

Considering the statement "Most of what I (could) achieve with an IWB I could achieve with a data projector alone.", ten of the 22 respondents agreed or strongly agreed. Five of these respondents currently have an IWB and five do not. Two teachers from each group were neutral in their opinions. Only one of the teachers who do not have an IWB disagreed with the statement and of the fifteen respondents who do have an IWB, eight (53,3%) disagreed or disagreed strongly with the statement, indicating that the IWB allows them or would allow them to do things that they could not without it. Considering the entire group of 23 respondents, only nine (39,1%) indicated that they disagree or strongly disagreed with the statement. These results seem to contradict, at least to some extent, the teachers' responses to the previous statement, especially from those who do have an IWB. After indicating that the cost of setting up the IWB can be justified, they then suggest that it is actually unnecessary for most of what they achieve with the technology. This would seem to indicate that for many of them the data projector alone could be sufficient.

In response to the statement "In most state schools in South Africa the cost of an IWB cannot be justified in terms of its contribution to teaching and learning.", eight (53,3%) of the teachers with IWBs and four (50,0%) of the teachers without IWBs agreed or strongly agreed. Three teachers in each group were neutral in their opinions of this statement. The intention of this statement was to ask the teachers to consider the cost of an IWB in light of the financial pressure that the majority of South African schools face. Most of the teachers have at some stage during their teaching careers worked in state schools. Four teachers with IWBs and one without an IWB disagreed with the statement, indicating that they believe that in the state sector the cost of an IWB can be justified in terms of its contribution to teaching and learning.

Considering the statement "Use of an IWB reinforces traditional teacher-centred teaching styles." the majority of the respondents (73,9%) disagreed or strongly disagreed. Three teachers agreed with the statement and three were neutral in their opinions. As **Table 43** indicates, of the fifteen

respondents who use IWBs, thirteen (86,7%) disagreed or strongly disagreed with the statement, while four (50%) of the teachers without IWBs disagreed. These results suggest that teachers who have the experience of using an IWB feel more strongly about this than those who do not.

When asked to consider the statement "In general, considering what an IWB contributes to education, the cost cannot be justified in any educational institution.", 65,2% of the respondents disagreed or strongly disagreed with the statement, three (13,0%) were neutral in their opinions and three (13,0%) disagreed with the statement. Of the respondents who have IWBs, 86,7% disagreed or strongly disagreed with the statement, compared to 50,0% of the respondents without IWBs who disagreed with it. These results are consistent with the responses to the first statement, which suggest that teachers who have used an IWB feel more strongly that the cost of an IWB can be justified in terms of its contribution to education.

In order to gain further insight into the perception of teachers with regard to the value of IWBs, the teachers who currently have a data projector installed in their classrooms, but do not have access to an IWB, were asked to indicate their perception of their need for an IWB. None of the teachers saw the IWB as a high priority, and none of them indicated that they see no need for an IWB. Five (62,5%) indicated that they see their need for an IWB as a medium priority, and three (37,5%) see it as a low priority.

Teachers were asked to indicate their perceptions of the impact of IWBs on their own teaching, on the teaching of their colleagues within their own subject departments, and on the teaching of their colleagues beyond their own subject departments. **Table 44** shows a summary of their responses. None of the respondents indicated that the IWB has a negative impact on their own teaching, nor on that of their colleagues. Indeed, as **Table 44** indicates, the general opinion amongst the fifteen respondents who have access to IWBs was that it enhances their teaching. The vast majority (93,3%) of the respondents in this group believe the IWB enhances their own teaching, at least to some extent. Only one of the respondents indicated that the IWB makes no difference.

Similarly, the majority (92,3%) of the respondents who have access to an IWB believe that the IWB enhances the teaching of their colleagues within their own subject departments, at least to some extent. The two respondents who do not have access to an IWB themselves, but who teach in the same department as a colleague that does were divided in their opinions. Further analysis of the responses revealed that the teacher whose colleague believes has his teaching enhanced by use of the IWB indicated that he uses it every lesson. And the teacher whose colleague believes that the IWB has no effect on his teaching indicated that he hardly ever uses it.

Table 44: Teachers' perceptions of the effect of the IWB on teaching

	Statements	Teacher group	Impact index ⮟
1	Personal perception of the effect of the IWB on **personal teaching**	with IWB (n=15)	|....|....|....|....|....|....|..⮟.|....| Definitely negative / Negative / None / Enhances somewhat / Definitely enhances
2	Perception of the effect of IWBs on **colleagues' teaching within the subject department**	with IWB (n=13)	|....|....|....|....|....|....|⮟...|....| Definitely negative / Negative / None / Enhances somewhat / Definitely enhances
		without IWB (n=2)	|....|....|....|....|....|....⮟....|....| Definitely negative / Negative / None / Enhances somewhat / Definitely enhances
3	Perception of the effect of IWBs on **colleagues' teaching beyond the subject department**	with IWB (n=15)	|....|....|....|....|....|...⮟|....|....| Definitely negative / Negative / None / Enhances somewhat / Definitely enhances
		without IWB (n=6)	|....|....|....|....|....|....|..⮟.|....| Definitely negative / Negative / None / Enhances somewhat / Definitely enhances
	Overall summary (mean of all 51 responses)	both	|....|....|....|....|....|....|⮟...|....| Definitely negative / Negative / None / Enhances somewhat / Definitely enhances

Considering use of the IWB beyond their own subject departments, **Table 44** indicates that respondents appeared to be less certain of the positive impact that the IWB is having on their colleagues' teaching. Of the 21 respondents who indicated their perceptions, six (28,6%) indicated that the IWB definitely enhances their colleagues' teaching, nine (42,9%) indicated that the IWB enhances it to some extent, and six (28,6%) indicated that the IWB makes no difference.

The teachers' responses to this section of the questionnaire were analysed further, in order to determine the perceptions within each subject department, and to explore the relationship between the frequency of IWB use and the perception of its impact on teaching. The results reflected that, irrespective of the frequency with which a teacher uses the IWB, he/she reports that the IWB does have an impact on his/her teaching. In the majority of cases, teachers believe that within their subject departments their colleagues' teaching is enhanced by the use of the IWB. In two cases teachers reported that in their opinion the IWB makes no difference. In the case of the Life Orientation department, the teacher who has an IWB reported that he hardly ever uses it, and his colleague within the department reported that in her opinion the IWB makes no difference to his teaching.

In the Mathematics department the teacher who reported that the IWB makes no difference to his teaching also reported that in his opinion the IWB makes no difference to his colleagues' teaching. As mentioned in the discussion of the results shown in **Table 44**, when considering the use of the IWB by their colleagues in other subject departments, the teachers seem less convinced that it

enhances their teaching. Six (28,6%) of the respondents indicated that they believe the use of the IWB makes no difference to their colleagues' teaching beyond their own subject departments.

In the English department, Geography department, Mathematics department and Physical Sciences department, individual teachers who believe the IWB enhances their colleagues' teaching *within* their particular subject department believe that the IWB makes no difference to the teaching of colleagues in other departments. Teachers who use IWBs were asked to consider various statements concerning general use of the IWB. The results are presented in **Table 45**.

Table 45: Teachers' responses to statements concerning general IWB use

	Statements (listed in order of agreement)	**Agreement index ⩛**
1	The **effectiveness of an IWB** depends on the **skill level and confidence of the teacher**.	| . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . ⩛ . | Strongly disagree Disagree Neutral Agree Strongly agree
2	The **effectiveness of an IWB** depends on the **skills and professional knowledge** of the teacher.	| . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . ⩛ . . . . | Strongly disagree Disagree Neutral Agree Strongly agree
3	IWBs make my **lessons more fun**.	| . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . ⩛ | . . . . | Strongly disagree Disagree Neutral Agree Strongly agree
4	Use of the IWB creates a **more captivating learning environment**.	| . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . ⩛ . . | . . . . | Strongly disagree Disagree Neutral Agree Strongly agree
5	IWBs make **whole class teaching easier**.	| . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | ⩛ . . . | . . . . | Strongly disagree Disagree Neutral Agree Strongly agree
6	Knowing how to use an IWB **will help my career**.	| . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | ⩛ . . . | . . . . | Strongly disagree Disagree Neutral Agree Strongly agree
7	IWBs make my **teaching appear up to date**.	| . . . . | . . . . | . . . . | . . . . | . . . . | . . . . ⩛ . . . . | . . . . | Strongly disagree Disagree Neutral Agree Strongly agree
8	**IWBs DON'T often break down**.	| . . . . | . . . . | . . . . | . . . . | . . . . ⩛ . . . . | . . . . | . . . . | Strongly disagree Disagree Neutral Agree Strongly agree
9	When **something goes wrong** with an IWB **I can easily get help to resolve it**.	| . . . . | . . . . | . . . . | . . . ⩛ | . . . . | . . . . | . . . . | . . . . | Strongly disagree Disagree Neutral Agree Strongly agree
10	When looking for a job I will only **consider schools which already have IWBs**.	| . . . . | . . . . | . . . . | . ⩛ . . | . . . . | . . . . | . . . . | . . . . | Strongly disagree Disagree Neutral Agree Strongly agree

As reflected by the high general level of agreement shown in **Table 45**, all of the respondents agreed or strongly agreed with the statement "The effectiveness of an IWB depends on the skill level and confidence of the teacher." and 92,3% agreed or strongly agreed with the statement "The effectiveness of an IWB depends on the skills and professional knowledge of the teacher." One

teacher disagreed with the latter statement. These results suggest that the teachers recognise that the effectiveness of the IWB does not necessarily lie in the technology itself, but is largely dependent on the teacher who uses it.

With regard to the statement "Use of the IWB creates a more captivating learning environment." 92,9% of the respondents agreed or strongly agreed with the statement, and a similarly high percentage (93,3%) of the respondents agreed or strongly agreed with the statement "IWBs make my lessons more fun." Considering the statement "IWBs make whole class teaching easier.", 80,0% of the teachers agreed or strongly agreed with the statement and the other 20,0% were neutral in this regard. The responses to these statements suggest that the teachers believe that IWBs have a positive impact on teaching, making whole class teaching easier and allowing the teacher to make lessons more fun and captivating.

The majority of the respondents (73,3%) agreed or strongly agreed with the statement "Knowing how to use an IWB will help my career." Three teachers were neutral in their opinions of this statement and one disagreed with it. The teachers responded similarly to the statement "IWBs make my teaching appear up to date.", with (73,3%) agreeing or strongly agreeing, and the remainder (26,7%) neutral in their opinions. Considering the statement "When looking for a job I will only consider schools which already have IWBs." only four of the teachers 26,7% agreed or strongly agreed and 43,3% disagreed or strongly disagreed.

Overall this group of results suggests that, when considering the future of teaching, teachers do believe it is important to be competent in the use of the IWB and they also believe that IWB helps to make their teaching appear up to date. However, it appears that few teachers have become completely dependent on IWBs, and few consider the IWB to be an essential part of their teaching, indicating that they are willing to consider teaching without an IWB in the future.

Considering the reliability of IWBs, 46,7% of the respondents agreed or strongly agreed with the statement "IWBs DON'T often break down." 40,0% were neutral, and 13,3% disagreed. With regard to technical support, only 33,3% of the teachers agreed or strongly agreed with the statement "When something goes wrong with an IWB I can easily get help to resolve it." 20,0% of the teachers were neutral and 46,7% disagreed or strongly disagreed with this statement. These results suggest that reliability and technical support may be issues of concern to staff.

During the interviews, interviewees were asked whether they would describe their perception of IWBs as positive, negative or neutral. Three of the five interviewees described their perceptions as positive. Interviewee E described her perception as "potentially very positive, definitely, but… as it stands… more like a bad conscience… or something… something I'm not using properly… and costs a lot of money… something that puts pressure on me, because I don't know how to use it

properly and it cost a lot of money and I'm privileged to have it and it sits there in my room… but I do have a positive attitude to its potential…"

And Interviewee B was hesitant, suggesting that personal frustration with regard to technology in general may be an issue preventing her from fully enjoying the benefits of an IWB, as is apparent from her comment, "If it's working, fine, brilliant, if it's not then it can be a bit frustrating, particularly if you don't know really what you're doing. You know, so, from that point of view… But generally very positive… the only negative is frustration with technology, not with the [IWB]. …[…]…that's why I don't use it… reorientation [struggling with alignment between the data projector and the IWB]."

6.3 What attitude do teachers perceive the learners to have with regard to the IWB?

The teachers were asked to consider five statements dealing with the learners' perception of the IWB and its impact on lessons. The results are presented in **Table 46**.

Table 46: Teachers' responses to statements concerning learners' perceptions of IWBs

	Statements (listed in order of agreement)	**Mean index of agreement ⩛**
1	**Learners believe** that IWBs make learning **more interesting and exciting**.	| . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |⩛. . . | . . . . | Strongly disagree Disagree Neutral Agree Strongly agree
2	When I use the IWB, **learners find the lesson more interesting**.	| . . . . | . . . . | . . . . | . . . . | . . . . | . . . . |⩛. . . | . . . . | Strongly disagree Disagree Neutral Agree Strongly agree
3	**Learners prefer lessons** which are taught with an IWB.	| . . . . | . . . . | . . . . | . . . . | . . . . | . . . .⩛. . . . | . . . . | Strongly disagree Disagree Neutral Agree Strongly agree
4	**Learners think that IWBs are difficult to use**.	| . . . . | . . .⩛| . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | Strongly disagree Disagree Neutral Agree Strongly agree
5	**Learners dislike going out to the front to use the IWB**.	| . . . . | .⩛. . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | Strongly disagree Disagree Neutral Agree Strongly agree

Considering the statement "Learners believe that IWBs make learning more interesting and exciting.", 92,9% of the teachers agreed or strongly agreed, and a similarly high percentage (86,7%) agreed or strongly agreed with the statements "When I use the IWB, learners find the lesson more interesting." and "Learners prefer lessons which are taught with an IWB." No teacher disagreed with this last statement.

With regard to the statement "Learners think that IWBs are difficult to use.", 80,0% of the teachers disagreed or strongly disagreed with the statement. Similarly, when considering the statement "Learners dislike going out to the front to use the IWB.", the vast majority of the teachers (86,7%) disagreed or strongly disagreed and two (13,3%) were neutral.

These results suggest that teachers believe the learners view IWBs very favourably, that they prefer lessons where the IWB is used and that they find lessons where the IWB is used more exciting and interesting. The results also suggest that the teachers believe that learners find the IWB easy to use and that they like using the IWB in front of the class.

6.4 What impact do teachers perceive IWB use to have on learners' behaviour, attentiveness, motivation and productivity?

Teachers were asked to consider statements relating to learners' behaviour, attentiveness and motivation during lessons. The results are presented in **Table 47**.

Table 47: Teachers' responses to statements concerning learners' behaviour, attentiveness, and motivation

	Statements (listed in order of agreement)	**Agreement index ⩛**
1	Use of the IWB creates a **more captivating learning environment**.	|. . . . |. . . . |. . . . |. . . . |. . . . |. . . . |. ⩛ . . |. . . . | Strongly disagree Disagree Neutral Agree Strongly agree
2	Use of the IWB **improves the focus of the learners**.	|. . . . |. . . . |. . . . |. . . . |. . . . |. . . . |⩛. . . |. . . . | Strongly disagree Disagree Neutral Agree Strongly agree
3	Use of the IWB helps to **increase the attention spans** of the learners.	|. . . . |. . . . |. . . . |. . . . |. . . . |. . .⩛|. . . . |. . . . | Strongly disagree Disagree Neutral Agree Strongly agree
4	Learners **concentrate better** in class when an IWB is used.	|. . . . |. . . . |. . . . |. . . . |. . . . |. . ⩛. |. . . . |. . . . | Strongly disagree Disagree Neutral Agree Strongly agree
5	Learners **behave better** in lessons with IWBs.	|. . . . |. . . . |. . . . |. . . . |. . . . |. ⩛ . . |. . . . |. . . . | Strongly disagree Disagree Neutral Agree Strongly agree
6	Use of the IWB **improves the motivation** of the learners.	|. . . . |. . . . |. . . . |. . . . |. . . . |. ⩛ . . |. . . . |. . . . | Strongly disagree Disagree Neutral Agree Strongly agree
7	Learners' **behaviour during the lesson is better** when I use the IWB.	|. . . . |. . . . |. . . . |. . . . |. . . . |⩛. . . |. . . . |. . . . | Strongly disagree Disagree Neutral Agree Strongly agree
8	Learners **would work harder if I used the IWB more often**.	|. . . . |. . . . |. . . . |. . . . |. . ⩛. |. . . . |. . . . |. . . . | Strongly disagree Disagree Neutral Agree Strongly agree

With regard to learner behaviour, when considering the statements "Learners behave better in lessons with IWBs." and "Learners' behaviour during the lesson is better when I use the IWB.", the

teachers' responses were, not surprisingly, identical. In each case two teachers (13,3%) disagreed with the statement, suggesting that learners to not behave better when an IWB is used. As a result of the phrasing of the statements, it is not clear whether these teachers believe that the learners' behaviour is unaffected by use of an IWB, or in fact worse when an IWB is used. In each case 33,3% of the teachers were neutral in their opinion of the statement, and 53,3% agreed or strongly agreed with the statement.

Considering the concentration and attentiveness of the learners, all of the respondents either agreed or strongly agreed with the statement "Use of the IWB improves the focus of the learners." All except one of the teacher agreed or strongly agreed with the statement "Use of the IWB creates a more captivating learning environment." With regard to the statement "Learners concentrate better in class when an IWB is used.", the majority of the teachers (73,3%) agreed or strongly agreed with the statement. Similarly 78,6% of the teachers agreed or strongly agreed with the statement "Use of the IWB helps to increase the attention spans of the learners."

Where the impact of the IWB on learner motivation was considered, 57,1% of the respondents agreed or strongly agreed with the statement "Use of the IWB improves the motivation of the learners." and the remaining teachers were neutral in their opinions.

The majority of the teachers were neutral in their opinion of the statement "Learners would work harder if I used the IWB more often." One teacher disagreed with the statement and four (26,7%) agreed or strongly agreed with it.

Considering the responses to this group of statements, teachers appear to be convinced that the use of the IWB creates a more captivating learning environment where learners displayed improved focus and concentration, and they remain attentive for longer when an IWB is used. It appears that many believe the IWB may have a positive impact on learner behaviour, but several are non-committal in this regard. They are also cautious in suggesting that use of the IWB may improve learner motivation, and they appear uncertain as to whether or not the IWB leads to increased productivity amongst learners.

6.5 What impact do teachers perceive IWBs to have on the learning process, specifically with regard learners' understanding, retention and performance?

As discussed earlier in this section, all except one of the teachers agreed or strongly agreed with the statement "Use of the IWB creates a more captivating learning environment.", which suggests that they believe the IWB does have a positive impact on the learning process. An attempt was

made to investigate this in more depth by asking them to consider various statements relating to the impact of the IWB on the learning process. Their responses, which are presented in **Table 48**, were generally very positive.

Table 48: Teachers' responses to statements concerning the learning process

	Statements (listed in order of agreement)	**Agreement index ⩛**
1	IWBs **make it easier to repeat, re-explain and summarise teaching points**.	|....|....|....|....|....|....|....|..⩛..| Strongly disagree Disagree Neutral Agree Strongly agree
2	Use of the IWB creates a **more captivating learning environment**.	|....|....|....|....|....|....|.⩛..|....| Strongly disagree Disagree Neutral Agree Strongly agree
3	Use of the IWB **improves the focus of the learners**.	|....|....|....|....|....|....|⩛...|....| Strongly disagree Disagree Neutral Agree Strongly agree
4	The **interactive features** of IWBs **enhance children's learning**.	|....|....|....|....|....|....|⩛...|....| Strongly disagree Disagree Neutral Agree Strongly agree
5	Use of the IWB helps to **increase the attention spans** of the learners.	|....|....|....|....|....|...⩛|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
6	The **learners learn more** when I use an IWB.	|....|....|....|....|....|...⩛|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
7	Learners **find it easier to understand the work** when I use an IWB.	|....|....|....|....|....|.⩛..|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
8	Use of the IWB **improves the motivation** of the learners.	|....|....|....|....|....|.⩛..|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
9	Use of the IWB allows learners to have a **greater tactile connection** with the learning content.	|....|....|....|....|....|⩛...|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
10	Learners find it **easier to remember** what they have learnt during a lesson if I used the IWB.	|....|....|....|....|....⩛....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree

As the agreement index in **Table 48** suggests, all the teachers either agreed or strongly agreed that "IWBs make it easier to repeat, re-explain and summarise teaching points." The majority of the teachers (83,3%) agreed or strongly agreed with the statement "The learners learn more when I use an IWB." One teacher disagreed with the statement and three were neutral in their opinions of it. Teachers were less convinced of the fact that "Learners find it easier to understand the work when I use an IWB.", with nine (60,0%) agreeing or strongly agreeing with the statement, five (33,3%) neutral in their opinions and one disagreeing. They were even less certain as to whether "Learners find it easier to remember what they have learnt during a lesson if I used the IWB.", with seven respondents (46,7%) agreeing or strongly agreeing with the statement, while six were neutral and two disagreed.

The vast majority (86,7%) of the teachers agreed or strongly agreed with the statement "The interactive features of IWBs enhance children's learning." and the remaining respondents were neutral in this regard. Considering the statement "Use of the IWB allows learners to have a greater tactile connection with the learning content.", eight respondents (57,1%) agreed or strongly agreed with the statement, and the remaining six (42,9%) were neutral in this regard. This aspect of IWB use should benefit the learners whose learning styles tend to be kinaesthetic.

The teachers responses to these statements suggest that, in general, they believe the IWB has a positive impact on the learning process. The majority believe that the interactivity of the IWB enhances learning and they appear to be convinced of the fact that, when an IWB is used, the learners find it easier to understand the work and learn more. There seems to be a feeling amongst the teachers that learners may find it easier to remember what they have learnt when an IWB is used, but they are not convinced of this.

As indicated earlier in this section, the majority of the teachers appear to agree that use of the IWB improves the focus of the learners, helps to increase their attention spans and improves their motivation. All of these factors should contribute to making the learning process more effective.

With regard to the impact which the IWB has on teachers' attempts to accommodate different learning styles, interviewees' opinions were divided. Interviewee A suggested that teachers are only beginning to realise what can be achieved with an IWB. Interviewee C said, "If we take all of these courses that we have been on, most of the boys are visual learners, so therefore pictures…. and models… and computers…. and those sort of things actually appeal to them… it makes more sense to them, I think."

Interviewee D said, "I think it's particularly kids who battle where one has to work harder at finding what is it that… what mode works for them and I think that's where things like [IWBs] and that can be really positive, because then it might just be the one way that a particular kid might sort of feel at home and able to get involved in a class and so on."

Interviewee E indicated that in her opinion the IWB does not make much difference to her attempts to accommodate different learning styles, but suggested that it could do. She indicated that she does see the potential which the IWB holds, especially for the visual and aural aspects of her subject, a language. She suggested that most of the potential benefits actually lie in "the projector, because potentially to use video clips …is fantastic… because there are things in those programmes where you have a clip with someone speaking. And then you know you could do it, so instead of just a straight listening exercise, it could be listening where you actually visually see people doing things and… no, it's huge, the potential."

Interviewee B made an interesting observation on the manner in which the IWB accommodated the kinaesthetic learners, suggesting that "it has allowed us an acceptable way… in a 'non - this is inappropriate behaviour way'… [to cater for learners] who need to get up and do it to come up and do that… and then visually, caters for and auditory… yes, I suppose it also does… Ja, so I think it has enhanced [my attempts to accommodate different learning styles]."

Interviewee D was very enthusiastic about the impact the IWB had. He made some exciting observations which led him to suggest that effective use of the IWB should really lead to it becoming "invisible" to the learners, no longer the centre of attention or the focus of the lesson, but rather just another mode of learning. He said, "in terms of my theory about… you know, kids who battle… like that [particularly weak class] last year, was definitely one of those… ja, certainly the [IWB] had a huge impact there. Um… what was interesting, though, and I was quite pleased with it, was that they… none of them really… saw it as 'the [IWB] did it for me'… but it was… but it was sort of what was on the other side of the [IWB], if you know what I mean…so […] [the IWB] became kind of transparent to them… and so they weren't interacting with the [IWB], but they were interacting with the material and… so I think …when I tried to research it, I think it was sort of a bit of a problem of mixing hardware and content, you know …in saying well what did you most enjoy about the lessons and whatever. And I was initially a bit disappointed because none of them said 'the [IWB]' and then I realised afterwards that it was actually the content… because they'd actually engaged with the content that that was the most exciting possible answer that… and, um… I think it's part of a whole package. So that… You know we had to do the [prescribed Shakespeare play] … for a bunch of kids who can't even read was really quite challenging, so I didn't really try and do the play with them as such. But I took it more like a film study… but even that was difficult for them… so I had to like prepare them for it and…I… so all the preparation for watching the movie I did on the [IWB], with materials that I developed… but then at the end of the day they actually really enjoyed the movie, and that's what they said they'd enjoyed. But I don't think they would have enjoyed the movie, if it hadn't been for the preparatory work. But it sort of became a, I would like to think, like a gateway that allowed them to get through to that."

In terms of learning styles, and possible new dimensions the IWB introduced Interviewee D said it enhanced "…visual learning as well… because then you could…'cause now instead of it being a dusty old Shakespeare play… it was pictures of characters, it was… you know them sort of matching the characters with their descriptions and their relationships and sort of actually then making it a visual map of the play. Um… So I think they could take that very visual sort of understanding with them into watching the movie, and sort of refer back to it and therefore make sense of what was going on in terms of plot and all that."

He suggested that the main leaning channels that the IWB accommodated were "visual-tactile … it was a mixture of both… um… yes, for instance the timeline of the action in the play… they had to put things on the timeline in the right places and all that sort of thing."

With regard to the small class he had worked with, and the impact class size may have on the effectiveness of IWB use he said, "…I would wonder how, if you have a whole lot of kids sitting at desks, and then, you know… I suppose you can invite kids to come up and do it and so on… but it just sort of feels like there's a whole lot of stuff in the way then… in a way the sort of the primary… pre-primary type of model of [the IWB]… actually sitting on the floor, I think is brilliant. You just have kids sitting on cushions around, then they can come and just… you know, there's nothing in between them and the board… and so whether it's the teacher doing it or the kids, I think it's sort of all the furniture and all that that gets in between there and I think… you know, even if the kids aren't actually touching the board, the fact that they feel that they could, I think is important."

6.6 What impact do teachers perceive the IWB to have on lesson planning, preparation and resource development?

"…Maybe if… [the IWB] brings about some sort of paradigm shift in people's way of thinking and teaching, maybe that's enough."

Interviewee D

Teachers were asked to consider various statements relating to lesson planning, preparation and resource development. The statements, together with the tally of the responses are presented in **Table 49**, which follows. Considering the general impact of IWBs on teaching, the general level of agreement shown in **Table 49** reflects the fact that eight (57,1%) of the respondents agreed or strongly agreed with the statement "My IWB has changed how I teach." Of the remaining teachers, three (21,4%) were neutral and three (21,4%) disagreed or strongly disagreed with the statement, indicating that the presence of an IWB has resulted in no change in their teaching.

With regard to specific aspects and features of the IWB, the majority of the respondents (78,6%) agreed or strongly agreed that "The IWB allows teachers to organise and manage information more effectively." One teacher disagreed with the statement, and the other two were neutral.

The majority of the respondents indicated that they disagree or strongly disagree with the statement "Lessons for the IWB do NOT take longer to prepare.", suggesting that lessons for the IWB take at least as long, if not longer to prepare than lessons where an IWB is not to be used. However, all of the respondents agreed or strongly agreed that "Building up a bank of IWB resources to share with colleagues will save time in the long run."

Table 49: Teachers' responses to statements concerning lesson planning, preparation and resource development

	Statements (listed in order of agreement)	**Agreement index ⩛**
1	Building up a **bank of IWB resources to share with colleagues will save time** in the long run.	|....|....|....|....|....|....|....|..⩛..| Strongly disagree Disagree Neutral Agree Strongly agree
2	The IWB allows teachers to **organise and manage information more effectively**.	|....|....|....|....|....|...⩛|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
3	My IWB has **changed how I teach**.	|....|....|....|....|....⩛....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
4	In order to **accommodate the possibility of problems** with the IWB, I always **prepare non-IWB alternative resources** for a lesson.	|....|....|....⩛....|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
5	Lessons for the IWB **do NOT take longer to prepare**.	|....|....|....⩛....|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
6	Using **pre-prepared IWB resources makes it harder to improvise** when teaching.	|....|....|⩛...|....|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree

The set of data presented in **Table 49** indicates that the majority of the respondents (60,0%) disagreed or strongly disagreed with the statement "In order to accommodate the possibility of problems with the IWB, I always prepare non-IWB alternative resources for a lesson." This suggests that they find the IWB reliable.

The vast majority of the teachers (86,7%) disagreed or strongly disagreed with the statement "Using pre-prepared IWB resources makes it harder to improvise when teaching." The remainder agreed with the statement. These responses suggest that teachers do not find the IWB restrictive, and that they are unlikely to avoid using pre-prepared IWB resources.

In terms of the impact of the IWB on lesson planning, Interviewee C suggested that the critical thing is choosing when to use the IWB, deciding which sections of work are best suited to learning with the IWB. Interviewee E indicated that the IWB does not have an impact on her lesson planning. Interviewee B indicated that the major benefit for her in terms of lesson planning has come through the resources developed by her colleagues for the IWB. She mentioned a particular topic for which two colleagues had each developed a module which reflected their personal styles and thus allowed her to use a combination of the two approaches.

Interviewee A indicated that "the [IWB] is wonderful in terms of [its impact on planning]. As I said, you can store information, so you can always reflect back on what you have done, how you have

introduced a lesson, which is something that, if you wanted to do it, you would have to use a word from a book, and so on, and it's difficult to make adjustments like that, you know… because you know you don't want to… maybe a simple thing… but you don't want to rewrite whatever is there…[…]… whereas with your [IWB], with your computer, if you want to change something in terms of a lesson you can do it there… it will take you… it will be no effort at all. So you can always improve upon your lesson planning, you can improve upon your examples of the resources that you are using, and so on."

During the interviews the interviewees were asked to describe the impact their IWBs have had on their teaching. Interviewee D indicated that, "In terms of planning and preparation, it's probably made me more keen to look for good resources and you know try and sort of put together things a bit more beforehand, or different sorts of things… you know …it's difficult to say, because I think I'm sort of on a whole lot of journeys at the same time."

6.7 What impact do teachers perceive the IWB to have on presentation, teaching styles and classroom management?

"IWBs are […] a tool to make your message clearer to the [learners] in your class... and to have them interact to a greater level with the lesson that you have.

So there is more interaction, there is more discussion – there's an opportunity for them to get involved – and you yourself have a bigger, brighter lesson than what you would normally have."
Interviewee C

As discussed previously in this section, the majority of teachers recognise that the effectiveness of an IWB is dependent on the skill level, professional knowledge and confidence of the user. The technology itself is really only as effective as the teacher who uses it. In order to investigate the impact of IWBs on teaching in greater depth, teachers were asked to consider several statements relating to various aspects of lesson facilitation. They were asked to consider the effect that an IWB has on their efforts to accommodate different learning styles and whether or not it allows a teacher to incorporate greater interactivity into lessons. Their responses to three groups of statements are presented in **Table 50**, **Table 51** and **Table 52**, which follow.

Table 50 presents a summary of the teachers' responses to a group of statements relating to presentational aspects of lessons, including the visual appeal and clarity of material, and lesson pace. The statements are listed in order of agreement. Equivalent statements were presented to the learners in their questionnaire and a comparison of the learners' responses and the teachers' responses is presented in a later chapter.

Table 50: Teachers' responses to statements relating to lesson presentation

	Statements (listed in order of agreement)	Agreement index ⩛
1	The **effectiveness of an IWB** depends on the **skill level and confidence of the teacher**.	|....|....|....|....|....|....|....|..⩛.| Strongly disagree Disagree Neutral Agree Strongly agree
2	The **effectiveness of an IWB** depends on the **skills and professional knowledge** of the teacher.	|....|....|....|....|....|....|....⩛....| Strongly disagree Disagree Neutral Agree Strongly agree
3	An IWB **makes a lesson more interesting** because the **presentation of material is clearer**.	|....|....|....|....|....|....|..⩛.|....| Strongly disagree Disagree Neutral Agree Strongly agree
4	IWBs **make it easy for me to repeat, re-explain, and summarise**.	|....|....|....|....|....|....|.⩛..|....| Strongly disagree Disagree Neutral Agree Strongly agree
5	An IWB **makes a lesson more interesting** because the **presentation of the material is more attractive**.	|....|....|....|....|....|....|⩛...|....| Strongly disagree Disagree Neutral Agree Strongly agree
6	IWBs make my **drawings and diagrams easier to see**.	|....|....|....|....|....|...⩛|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
7	Learners **get to join in lessons more** when I use an IWB.	|....|....|....|....|....|.⩛..|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
8	When I use an IWB, we move through the material at a **faster pace** than without it.	|....|....|....|....|....⩛....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
9	My **lessons are better prepared and more organised** when I use an IWB.	|....|....|....|....|...⩛|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
10	When I use an IWB, we move through the material at a **slower pace** than without it.	|....|....|....⩛....|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
11	**Learners think we go too fast** when I use the IWB.	|....|....|..⩛.|....|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
12	**I teach just the same** with or without an IWB.	|....|....|..⩛.|....|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
13	Whether or not I use the IWB, **it makes no difference** to the lesson.	|....|....|.⩛..|....|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree

With regard to the presentation of material, 93,3% of the teachers agreed or strongly agreed with the statement "An IWB makes a lesson more interesting because the presentation of material is clearer." and 86,7% agreed or strongly agreed with the statement "An IWB makes a lesson more interesting because the presentation of the material is more attractive." The majority of the teachers (66,7%) also agreed or strongly agreed with the statement "IWBs make my drawings and diagrams easier to see." The responses to these statements indicate that IWBs enhance the presentational aspects of a lesson.

With regard to lesson pace, 53,3% of the teachers agreed or strongly agreed with the statement "When I use an IWB, we move through the material at a faster pace than without it." Three teachers (20,0%) disagreed with the statement and four (26,7%) were neutral. Consistent with these results, with regard to the statement "When I use an IWB, we move through the material at a slower pace than without it.", 53,3% of the teachers disagreed or strongly disagreed, 20,0% agreed and 26,7% were neutral in their opinion. The majority of the teachers (66,7%) disagreed or strongly disagreed with the statement "Learners think we go too fast when I use the IWB." Four teachers (25,6%) were neutral in their opinions and one teacher agreed with the statement.

When considering the statement "IWBs make it easy for me to repeat, re-explain, and summarise.", 86,7% of the teachers indicated that they agreed with this statement, and the others were neutral. The majority of the teachers (66,7%) agreed or strongly agreed with the statement "Learners get to join in lessons more when I use an IWB.", while 26,7% were neutral and one teacher disagreed. Eight of the teachers (53,3%) agreed or strongly agreed with the statement "My lessons are better prepared and more organised when I use an IWB." Three teachers (20,0%) were neutral and four (26,7%) disagreed with the statement.

The majority (66,7%) of the teachers disagreed or strongly disagreed with the statements "I teach just the same with or without an IWB." and "Whether or not I use the IWB, it makes no difference to the lesson.", indicating that they believe that the IWB does have an impact on their teaching. Two teachers 13,3% agreed with the statement "I teach just the same with or without an IWB." and one teacher (6,7%) agreed with the statement "Whether or not I use the IWB, it makes no difference to the lesson."

When discussing how a lesson where an IWB is used compares with a lesson without the use of an IWB, Interviewee B indicated that use of the IWB had led to her teaching being more efficient. She also mentioned that the IWB is a source of comfort for her while she teaches, saying, "I actually find it's a safety net knowing I've got it here, quite frankly. I like the fact that I've got access to it and it's something to refer to. Rather than always just sort of trying to think what you are gonna say."

She went on to discuss the impact of the IWB on lesson pace quite extensively, saying, "…The negative side is that sometimes we are going a lot faster now than I think we used to go, because… it's already there, whereas before it would take ages to have to write it out… in fact now it's already there, and you just point to it. But I think… I don't think that with this generation that's too serious. I think that in fact that, it's something… that that's what they need, rather than going through it slowly like that."

She suggested that the presentation or introduction of a concept can go faster, enabling the teacher to introduce activities which consolidate and reinforce the theory, or illustrate practical applications sooner than in the past. She said, "[The fact that they're going faster has] allowed then for more… them to have gone through that stuff and then there's more where they can go and sit down and do more of the data response stuff, to try and engage and see whether they have done it. So maybe, with the way the subject has shifted, it actually has helped with that. 'Cause you can quickly get the content, which is not as important as it used to be… it is… I mean I believe it is important, but the focus of it, the depth that you go into… so that's what's quite nice… you've got it there. And then you go through that quite quickly and then they've got the chance to get down and do it and work how they can apply it.

"[As a department] we did mention the fact that it definitely means that you go through it quicker. But I don't think it's a problem, because now because you go through it quicker you reinforce it again, so actually possibly long term it's more effective, because you… and then they are seeing something familiar as well. But… The positive side of that is that if you've got the bulk of them doing it, and the bulk of them working on stuff… That hopefully the ones that have struggled with it you can then have a one-on-one with them. You know, so it's more of a … it has facilitated that a bit, if you think about it."

The IWB in this teacher's classroom was installed as part of a remodelling process that resulted in the layout of the classroom changing completely to include a mini lecture theatre in one half of the classroom, and a set of work stations for experiments in the other half of the classroom. She recognised the influence of the new classroom layout on the way she facilitates lessons, indicating that "in the old classroom that I was in, the board would never have helped with that, because, this… you know, right on top of each other, noisy… whereas here I tend to say, right guys, you that have done that, do go over there [points to one side of the classroom, away from the mini lecture theatre]. So in other words, if it helps, you can see although…[…] … you know, the [weaker learners] that can't cope […], whereas they can. In mixed ability classes you have to do that."

Interviewee C also commented on the impact of the IWB on the pace of his lessons, and the challenge of finding the best pace at which to teach, saying, "When you're in the classroom and you are using the IWB you tend to move at the fastest speed most of the time, […at the speed of] the fastest person coming up with the answers, so… I could have [one of my strong learners] coming up with the answers quite quickly, but [the weaker learners] are not going to ever get to that place where they've actually worked it out for themselves. So… I then might actually move on to the next thing and leave those [learners] behind. [So I think the] biggest down side of the fact is that... is to try and pick up the right sort of speed for the group, so that you don't leave the poorer students behind, but you also... you mustn't go… too slowly, that you actually disengage the

sharper guys. So… it's a very difficult balance to sort of… like work at that and you have to… you have to... you have to… it's like fishing… you have to reel in and you need to let go at stages and you've gotta… this constant sort of thing of stopping the lesson, pulling in the weaker [learners]… creating a bit of humour… you know, that sort of thing… just to get [learners] to be on the same level, but it's not easy…" In **Table 51** and **Table 52**, which follow, the teachers' responses to two groups of statements regarding lesson facilitation are presented. Within each of the tables the statements are listed in order of agreement.

Table 51: Teachers' responses to statements relating to lesson facilitation

	Statements (listed in order of agreement)	**Mean index of agreement ⩛**
1	IWBs **make it easier to repeat, re-explain and summarise teaching points**.	|. . . .|. . . .|. . . .|. . . .|. . . .|. . . .|. . . .|. ⩛. .| Strongly disagree Disagree Neutral Agree Strongly agree
2	IWBs make my **lessons more fun**.	|. . . .|. . . .|. . . .|. . . .|. . . .|. . . .|. . .⩛|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree
3	Use of the IWB enables **modelling and simulation activities to be presented more readily**.	|. . . .|. . . .|. . . .|. . . .|. . . .|. . . .|. .⩛.|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree
4	Use of the IWB creates a **more captivating learning environment**.	|. . . .|. . . .|. . . .|. . . .|. . . .|. . . .|.⩛. .|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree
5	When I use the IWB, I **engage learners more effectively** in the lesson.	|. . . .|. . . .|. . . .|. . . .|. . . .|. . . .|⩛. . .|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree
6	IWBs make **whole class teaching easier**.	|. . . .|. . . .|. . . .|. . . .|. . . .|. . . .|⩛. . .|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree
7	IWBs make my **teaching appear up to date**.	|. . . .|. . . .|. . . .|. . . .|. . . .|. . . .⩛. . . .|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree
8	The IWB allows teachers to **organise and manage information more effectively**.	|. . . .|. . . .|. . . .|. . . .|. . . .|. . .⩛|. . . .|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree
9	The IWB allows **immediate capture and analysis of pupil input** in ways not previously possible.	|. . . .|. . . .|. . . .|. . . .|. . . .|.⩛. .|. . . .|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree
10	Teaching from the front with an IWB allows me to **keep an eye on the class throughout the lesson**.	|. . . .|. . . .|. . . .|. . . .|. . . .⩛. . . .|. . . .|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree
11	My IWB has **changed how I teach**.	|. . . .|. . . .|. . . .|. . . .|. . . .⩛. . . .|. . . .|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree
12	I think IWBs **do encourage a didactic style of teaching**.	|. . . .|. . . .|. . . .|. . . .|. .⩛.|. . . .|. . . .|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree

Table 52: Teachers' responses to further statements relating to lesson facilitation

	Statements (listed in order of agreement)	**Mean index of agreement ⮟**
1	The IWB **increases teacher control and ownership** of classroom interactions.	|....|....|....|...⮟|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
2	Use of the IWB **does NOT promote interactivity** in the classroom.	|....|....|⮟...|....|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
3	Using **pre-prepared IWB resources makes it harder to improvise** when teaching.	|....|....|⮟...|....|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
4	Using the IWB **makes it difficult for me to improvise** during lessons.	|....|...⮟|....|....|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
5	The IWB **restricts my interaction with learners**.	|....|⮟...|....|....|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree

The vast majority of the respondents (92,3%) agreed or strongly agreed with the statements "Use of the IWB enables modelling and simulation activities to be presented more readily.", "Use of the IWB creates a more captivating learning environment." and "When I use the IWB, I engage learners more effectively in the lesson." In each case one person was neutral and no teacher disagreed with the statement.

When considering the statement "The IWB allows teachers to organise and manage information more effectively.", 78,6% of the teachers agreed or strongly agreed with the statement, two (14,3%) were neutral and one (6,7%) disagreed with it. Half of the respondents agreed or strongly agreed with the statement "The IWB allows immediate capture and analysis of pupil input in ways not previously possible." and the other half were neutral in their opinions.

Eight out of fourteen respondents (57,1%) agreed with the statement "My IWB has changed how I teach.", three (21,4%) felt neutral in regard to this statement, and three disagreed or strongly disagreed with it. Considering the statement "The IWB increases teacher control and ownership of classroom interactions.", half of the teachers were non-committal, indicating that they felt neutral. Three teachers agreed with the statement and four disagreed or disagreed strongly. The majority of the teachers (85,7%) disagreed with the statement "Use of the IWB does NOT promote interactivity in the classroom." One teacher agreed with it, and the other was neutral.

All of the teachers agreed or strongly agreed with the statement "IWBs make it easier to repeat, re-explain and summarise teaching points." All except one of the teachers agreed or strongly agreed with the statement "IWBs make my lessons more fun." The only respondent who did not agree, felt

neutral in this regard. The majority of the teachers (73,3%) agreed or strongly agreed with the statement "IWBs make my teaching appear up to date.", and the remaining 26,7% were neutral.

Considering the statement "IWBs make whole class teaching easier.", 80,0% of the teachers agreed with the statement, and the other 20,0% were neutral. Eight of the teachers (53,3%) agreed or strongly agreed with the statement "Teaching from the front with an IWB allows me to keep an eye on the class throughout the lesson." Three of the teachers (20,0%) disagreed and the remaining four (26,7%) were neutral. Six out of fourteen respondents (42,9%) agreed or strongly agreed with the statement "I think IWBs do encourage a didactic style of teaching.", five were neutral and three disagreed or strongly disagreed with the statement.

Two teachers (13,3%) agreed with the statement "Using pre-prepared IWB resources makes it harder to improvise when teaching." while the rest of the respondents disagreed or disagreed strongly. With regard to the IWB itself, 80,0% of the teachers disagreed or strongly disagreed with the statement "Using the IWB makes it difficult for me to improvise during lessons.", and other respondents indicated that they felt neutral. All except one of the teachers disagreed or strongly disagreed with the statement "The IWB restricts my interaction with learners." and the only respondent who did not, felt neutral.

Interviewee A commented on the impact that the IWB has on his lessons, saying, "With [an IWB] …your lesson […] can be multidimensional. It can be dynamic [and allow you to illustrate that a concept is true in general] …without them thinking it is only [true] in that specific situation, in [a] specific case. […] And what is nice in using [software specifically designed for use in Mathematics], is that… you know, its bright colours – it is stimulating in the sense in that it is a moving picture, and I think those things I find are giving me an edge over just using the ordinary, standard [whiteboard]. Also, I can just store things on my computer and I can access [them…] – I enjoy that very much… For example I can draw a particular question and it will be displayed there, on the [IWB]."

Of particular interest was a comment made by Interviewee D, who said, "I suppose if someone came and said you've got to take your [IWB] away tomorrow, it wouldn't change that much [of my teaching] because now the [IWB] has done certain things to me that I would probably carry on with anyway. I would probably still go and tap on the wall when I needed to do things until I got used to the fact that it wasn't working any more. […] So it wouldn't [be] devastating if I didn't have it anymore. It's more what it made me think about in terms of how I teach and that sort of thing."

Interviewee B provided some insight into her perspective of the impact of the IWB on learners, with particular reference to physical interaction with the IWB. She said that, "[The impact of the IWB on

interactivity]… depends on the group. The weaker ones… generally the weaker ones…I think they prefer it. But it's more chaotic, but I think possibly more effective learning is done with them, because they're coming up… and actually… and I suppose it's catering for that learning style… the kinetic ones… the ones that [volunteer] and want to come up and want to come and do it…[…]… But I find… that it doesn't always work, so not overuse of it, depending on what it is that one uses it for… So for that one definitely enhances it."

With regard to interactivity, Interviewee C indicated that the IWB does not have an impact on the level of interactivity in his lessons. He indicated that he believes the IWB is just another teaching tool for him, not necessarily providing anything unique with regard to his interactions with the learners. He said, "Given my style, I don't think… that there is any difference between my sort of sand box lessons, which are… most probably maybe more amazing than what the other ones are… [with] the IWB… because… I don't know... for boys, especially, the boys that are tactile, that have to have hands on and like to make little sand castles or just actually sit with their fingers in the sand and just play with the stuff, that is quite good, so there is tremendous interaction… so I don't see when I go to the [IWB], I don't see 'Aw jeez, now the level of interaction in my classroom has now soared because of the fact that now I have this IWB up'. I think it's just because they have so much interactivity in that class… that [the IWB] is just another thing…"

Interviewee E indicated that her current use of the IWB does not have an impact on her interactions with the learners, and that it does not lead to greater interactivity, saying that "at the moment, I think for me, something like… I throw a ball at them and that's much more effective." She suggested that the IWB does hold the potential to increase learner involvement in the lesson, saying "if you are using one of those drag things, or whatever… they are definitely all more focussed."

Interviewee B and Interviewee A were uncertain of the impact their use of the IWB has on their teaching. Interviewee B said that through the technology, "I think you feel like you're connecting with them more, because you're talking their language, what they can relate to." She went on to say that she believes the IWB does increase learner involvement in a lesson because the technology is something they relate to well. She commented on the effect of IWB use on classroom management, saying "Sometimes that sort of whole risk of allowing different learning styles to come out… the management does sometimes become a little bit more difficult. But I don't think [this is necessarily as a result of using the IWB]… I think it would be the case anyway… I think it's [this generation of children] coming through."

Interviewee A indicated that he does not believe that the IWB increases learner involvement in the lesson. He indicated that his level of interactivity with the learners has not increased with the arrival of the IWB. He went on to say, "I don't know whether it is more or less interactive than if I

didn't have [an IWB]. I do think that it is more… …certain things are, you know, easier to communicate. And in that sense I think that… there is less need for a thorough sort of… or in-depth… or more… communication in order to make things clear. It cuts back… it cuts back, because… of the… the visualisation… is replacing… the sort of in-depth kind of explanation that need to be coming from you. So there is less… you have less to do, in that sense. Whether that is necessarily a good thing, I don't know. Because, I mean… with respect to that specific issue, you know. I think that… visualisation… these days are the ways that [learners] mostly learn. Whether it would still have the same effect if one were without the [IWB] and you have to then go into …into certain depths and certain… and be more creative in terms of the examples that you put on the whiteboard and the things that you talk about… whether that would still have resulted in the same understanding amongst the boys… is questionable… I don't know."

He continued, saying, "But certainly I think there are pros and cons to the visualisation scenario. Because, while it is a natural way for them to learn now, I am not sure that they retain the same amount of information, in the same way as how people learnt in the past. I'm not sure… I think that it may be the most natural thing for them to do now, but… you know… there was a certain amount of… and I think it's probably more relevant to [the subject I teach], because [the subject I teach] requires a rigorous understanding of concepts, in most cases, and in order to develop a rigorous understanding of concepts, maybe you need less of a sort of visual input and more of a sort of reading input, and thinking input, and struggling sort of thing… maybe you need to struggle more, maybe you have to go through more pain in terms of identifying what is being displayed here or what is being said here and when things are easier in terms of the visualisation, maybe that on the other hand is destroying your potential of reaching an… …understanding."

Interviewee D suggested that "there is the potential to actually lessen [interactivity], because it could just be the teacher coming up with a whizz-bang show, you know, which… And I actually don't think there is anything terribly wrong with that, sometimes, because I think passive learning is quite good, sometimes. You know you can't have everyone active, all the time, because it's, you know… I know again myself, if I go to a conference, I don't want to go to workshops, I want to sit and listen to somebody interesting, saying something interesting, because I can learn something from them. It it's me sitting there doing stuff that somebody else is telling me to do, then I actually think, well that is actually stupid because, I could do it, but I don't want to spend 3 hours doing. I just want to be told how to do it and then I'll go away and practise on my own some other time, not waste time, you know, so… So I think that sometimes our idea of interactive is a bit ham-fisted, in terms of getting kids to do stuff when in fact they've already got it. You know, they don't actually need to do it to get it. And that in that sense passive is actually maybe more engaged, than so-called active, um...

You know, the [Grade 10 Life Orientation course we ran this year]… it was a bit of a departure for me in terms of… you know that it wasn't an ICT class so I think it did, I was a bit more interactive in terms of trying to use the IWB for engagement, and… to use it for interesting things and to sort of keep the focus in lessons and so on. But I suppose, you know, inevitably I'm always drawn away from the front of the class and in to the classroom."

He suggested that the interactions between the teacher and the learners may be influenced subtly by the presence of an IWB, saying, "I think it's sort of maybe to do with confidence in a way…[Yes], you know, so, if I have prepared something and I know it's nice and it's zippy zappy, etc. then I think coming into the lesson I would feel more confident and probably that confidence will spill over to the kids, who would then sort of, I think in a way, feel maybe safer in the lesson and therefore more able to get involved and so on…"

6.8 Chapter six in summary

This chapter explores the impact of IWBs from the perspective of the teachers. It investigates the teachers' perceptions of the impact of IWBs on learners' behaviour, attentiveness and motivation, as well as the impact on the learning process, with specific reference to understanding, retention and performance. Consideration is given to the impact teachers perceive the IWB to have on their lesson planning, preparation and resource development. The impact of the IWB on teaching styles is also investigated, with regard to the manner in which teachers facilitate their lessons, the extent to which they attempt to promote interactivity in their lessons, and the extent to which they attempt to accommodate different learning styles. The effect of the IWB on collaboration with colleagues, efficiency and quality of work is also investigated. Chapter 7 explores the challenges and needs of the teachers, from their perspective, as IWB users.

CHAPTER 7
FINDINGS SECTION 3:
THE CHALLENGES AND NEEDS OF THE TEACHERS

Research Questions

Theme 1
The extent, frequency and nature of IWB use in classrooms

1.1 How are IWBs distributed across the school, and how frequently do learners encounter them?

1.2 How frequently are the existing IWBs being used by the teachers and what factors influence their frequency of use?

1.3 What features of IWBs are being used by the teachers, and how frequently?

1.4 What resources and equipment do teachers use in combination with IWBs?

1.5 How frequently are the existing IWBs being used by the learners and what features are they using?

Theme 2
The impact of IWBs on teaching and learning as perceived by teachers

2.1 What is the general attitude of teachers towards IWBs?

2.2 What attitude do teachers perceive the learners to have with regard to the IWB?

2.3 What impact do teachers perceive IWB use to have on learners' behaviour, attentiveness, motivation and productivity?

2.4 What impact do teachers perceive IWB use to have on the learning process, specifically with regard to their effect on learners' understanding, retention and performance?

2.5 What impact do teachers perceive the IWB to have on lesson planning, preparation and resource development?

2.6 What impact do teachers perceive the IWB to have on presentation, teaching styles and classroom management?

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The focus of this chapter is theme three.

Theme 3
The challenges and needs of teachers with regard to IWB use

3.1 How competent do teachers using IWBs perceive themselves to be in their use of the IWBs, and how do they believe the learners perceive their use of the IWB?

3.2 What factors do teachers believe influence the effectiveness of their use of IWBs?

3.3 What formal training did teachers receive in the use of IWBs, and how effective was this training perceived to be?

3.4 Do teachers feel the need to improve their use of IWBs and, if so, how do they believe they could best achieve this?

3.5 What perceptions do teachers have of the resources available for use with IWBs?

3.6 How do teachers feel about integrating ICT in the form of the IWB into their teaching, as opposed to using a data projector alone, or making use of computers in a dedicated computer laboratory?

3.7 What limitations, technical or otherwise, do teachers perceive to be preventing them from using IWBs more effectively?

Theme 4
The impact of IWBs as perceived by learners

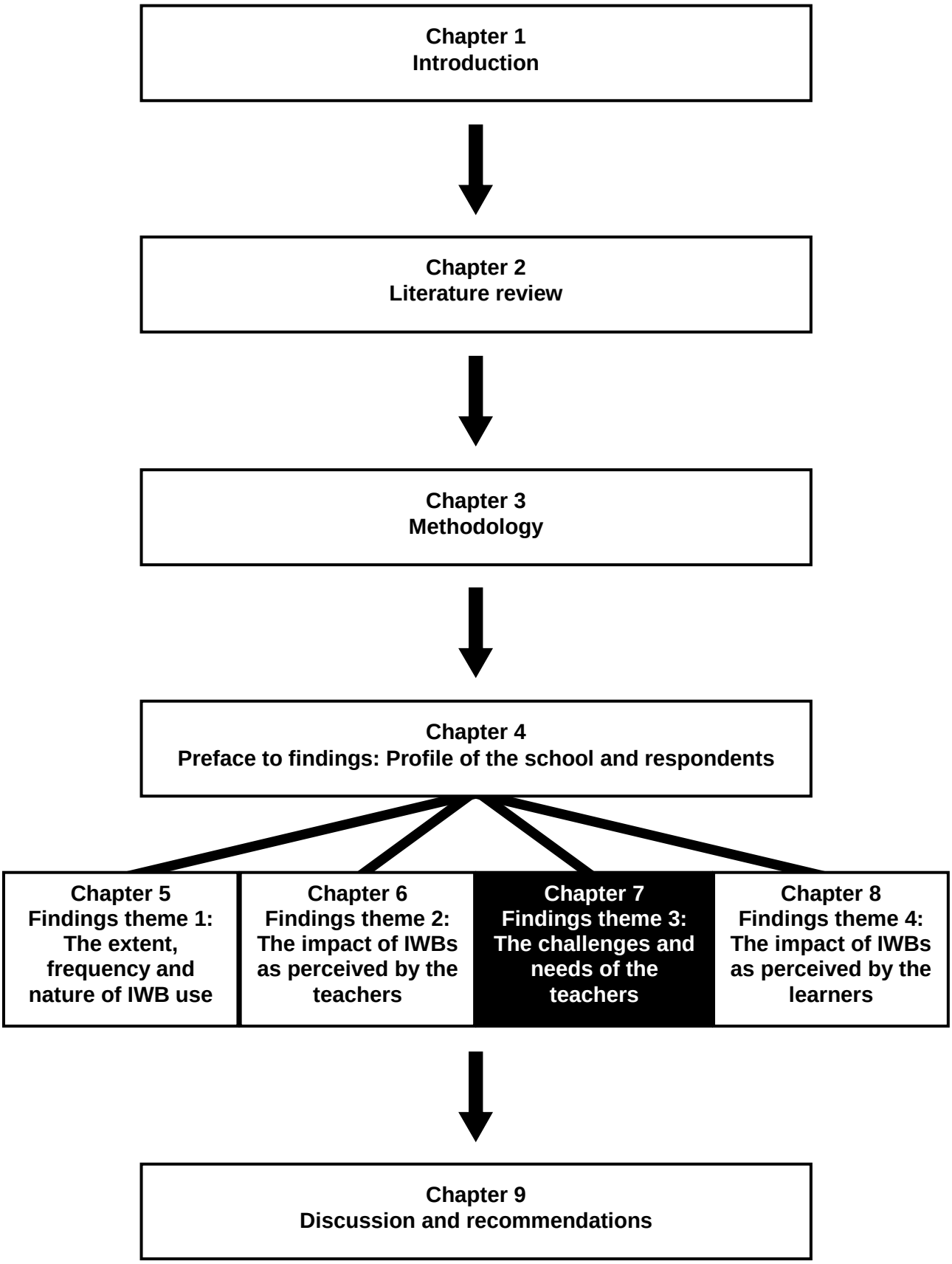
4.1 What is the learners' perception of the level of competency in IWB use amongst teachers?

4.2 What impact do learners perceive the IWB to have on their teachers and the manner in which they facilitate lessons, specifically with regard to the pace of lessons, the teacher's ability to capture and hold their attention, and the presentation and aesthetic appeal of the teacher's audiovisual aids?

4.3 What impact do learners perceive use of the IWB to have on the learning process, specifically on their understanding, retention and productivity?

4.4 What impact do learners perceive use of the IWB to have on their personal behaviour, attentiveness and motivation, and the behaviour of their fellow learners?

Outline of dissertation



Chapter 7: Findings theme 3 – Teachers' needs

7.1 Introduction

This chapter explores the challenges and needs of the teachers with regard to their use of the IWB. It attempts to determine their perception of any training they received as they learnt to use the IWB. It also attempts to determine what they perceive to be areas of concern and areas where they need assistance to improve their use of the IWB. The feedback received from teachers is analysed with a view to answering the following questions.

- How competent do teachers using IWBs perceive themselves to be in their use of the IWBs?
- How do teachers believe the learners perceive their use of the IWB?
- What factors do teachers believe influence the effectiveness of their use of IWBs?
- What formal training did teachers receive in the use of IWBs, and how effective was this training perceived to be?
- Do teachers feel the need and are they motivated to improve their use of IWBs? How do teachers believe they could best learn to improve their use of IWBs?
- What perceptions do teachers have of resources available for use with IWBs?
- How do teachers feel about using the IWB in comparison to using a data projector alone?
- How do teachers feel the IWB integrates ICT into the classroom in comparison other adoption routes, such as computers in a dedicated computer laboratory?
- What are the limitations and stumbling blocks (technical and otherwise) evident to teachers?

7.2 How competent do teachers using IWBs perceive themselves to be in their use of the IWBs, and how do they believe the learners perceive their use of the IWB?

As discussed in Chapter 5, teachers were asked to indicate which factors prevent them from using the IWB more frequently. The factors are listed in **Table 53**, in order of significance, based on the number of teachers which indicated that the factor does prevent them from using the IWB more frequently. The number of teachers (out of the 15 respondents) and the percentage which this represents is shown alongside each factor.

Table 53: Factors which prevent teachers from using an IWB more frequently

	Factors (arranged in order of significance, with the most significant at the top)	Number of teachers who indicated the factor (n=15)
1	My lack of training in the use of an IWB	10 66,7%
2	My lack of confidence in my ability to use the board	8 53,3%
3	Technical issues relating to the board	7 46,7%
4	Technical issues relating to my computer	6 40,0%
5	My fear of making mistakes in front of the learners	2 13,3%
6	Technical issues relating to my data projector	2 13,3%
7	My failure to see any advantage in working on the IWB	2 13,3%
8	My preference for normal whiteboards and / or an overhead projector	1 6,7%

As **Table 53** indicates, the factor which teachers recognise as most influential in preventing them from using the IWB more frequently is a lack of training in IWB use, which was highlighted by two-thirds of the respondents. Most likely linked to this lack of training is the second factor, a lack of confidence in their ability to use the IWB, which was recognised by eight of the fifteen (53,3%) respondents. Technical issues relating to the IWB were highlighted by seven (46,7%) respondents and technical issues relating to their computers were recognised by six of the teachers (40,0%) as influential in this regard.

The responses from the teachers suggest that the remaining factors – including technical issues relating to the data projector, fear of making mistakes, failure to see any advantage in working on the IWB and preference for normal whiteboards or an overhead projector – are relatively insignificant in general, with only one or two of the fifteen respondents recognising them as influential. However technical issues relating to the data projector did emerge as an issue during the interviews, and there is the possibility that teachers incorrectly considered technical issues related to the IWB and the data projector, such as alignment and orientation, as IWB-related only. Given the significant number of respondents (53,5%) who indicated that their lack of confidence in their ability to use the board was an issue, it is perhaps surprising that only two teachers (13,3%) indicated that their fear of making mistakes in front of the learners is an issue. One might think that the two issues could be closely linked to each other. Teachers were invited to elaborate on the points given in **Table 53**. A selection of their comments follows. The first five comments highlight the perceived shortage of time and the perceived lack of training. The desire to improve is evident,

as is the need for external input in order to improve. Technical issues emerge in and are especially apparent in the latter statements listed below.

- "All I need is **someone to explain** a few things to me re [the] IWB and **time to get going**."
- "I need some basic skills. I don't seem to have **enough time** to teach myself."
- "My **lack of training** in the use of an IWB" is the single biggest contributing factor! Added to this is **a lack of time** needed to spend on the IWB and lesson preparation."
- "We feel the need for **more thorough, systematic training**. The computer often doesn't work, especially the Internet connection. The Internet connection is too slow for frequent use of online resources."
- "I am sure I could use it more frequently and / or more productively, **if I knew more** about it. I use it often in any case, but this would be enhanced."
- With reference to "Technical issues relating to the board", "[mine is] **not properly aligned** to [the] wall, [I] have to realign [it] each time." With regard to "Technical issues relating to my computer", "[the] link between [the] computer and [the] **board often takes a long time to set up**."
- With regard to "My fear of making mistakes in front of the learners, "I didn't tick [number] 2, but [I] find it extremely irritating when [the IWB is] **not properly aligned**. [It] distracts from the lesson [and] I border on having a temper tantrum."
- With reference to the point "My preference for normal whiteboards and / or an overhead projector", "there are situations when I prefer to use the whiteboard. I often teach using the whiteboard first and then follow up with the IWB – because IWB lessons can sometimes be 'flashy' – ordinary whiteboard lessons, being slower, may be a good start."

Teachers were asked to consider statements relating to the learners' perception of their use of IWBs, specifically with regard to confidence and competence. Their responses are summarised in **Table 54**, which follows.

Table 54: Teachers' perceptions of learners' beliefs

	Statements (listed in order of agreement)	**Agreement index ⮟**
1	Learners believe that I am **comfortable** using the IWB.	|. . . . |. . . . |. . . . |. . . . |. . ⮟. |. . . . |. . . . |. . . . | Strongly disagree Disagree Neutral Agree Strongly agree
2	Learners believe that I **know how to use** the IWB **properly**.	|. . . . |. . . . |. . . . |. . . . |⮟. . . |. . . . |. . . . |. . . . | Strongly disagree Disagree Neutral Agree Strongly agree

Considering the statement "Learners believe that I am comfortable using the IWB.", seven of the teachers (46,7%) agreed or strongly agreed with the statement. Four teachers (26,7%) indicated that they were neutral in this regard and the remaining four (26,7%) disagreed or strongly

disagreed with the statement. Only five of the respondents (33,3%) indicated that they agreed or strongly agreed with the statement "Learners believe that I know how to use the IWB properly." Of the ten remaining teachers, five disagreed with the statement and five felt neutral in this regard.

So in each case, less than half of the teachers agreed or strongly agreed with the statement, suggesting that they may be concerned about the way the learners perceive their use of the IWB. It is interesting to compare the teachers' responses to these statements with the learners' responses to equivalent statements, presented in **Table 55**.

Table 55: Comparison of teacher and learner responses on teacher competence

	Statements	**Agreement index ⩛**
1	Learners believe that I am **comfortable** using the IWB.	|....|....|....|....|..⩛.|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	My teachers who have IWBs are **comfortable** using them.	|....|....|....|....|....|.⩛..|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
2	Learners believe that I **know how to use** the IWB **properly**.	|....|....|....|....|⩛...|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	My teachers who have IWBs seem to **know how to use them properly**.	|....|....|....|....|....|⩛...|....|....| Strongly disagree Disagree Neutral Agree Strongly agree

The results indicate that the majority (68,8%) of the learners agreed or strongly agreed with the statement "My teachers who have IWBs are comfortable using them." and only 11,1% disagreed or strongly disagreed with the statement. Similarly, the majority (63,8%) of the learners agreed or strongly agreed with the statement "My teachers who have IWBs seem to know how to use them properly." and only 13,4% disagreed or strongly disagreed with the statement. These results suggest that the learners' perceptions of the teachers' use of the IWB may be more favourable than the teachers believe it to be.

7.3 What factors do teachers believe influence the effectiveness of their use of IWBs?

As discussed in the previous section, teachers were asked to consider the following statements relating to effective use of an IWB. Two statements raised the issue of skill level, confidence and professional knowledge. The teachers' responses to these statements are given in **Table 56**.

Table 56: Teachers responses to statements concerning general IWB use

	Statements (listed in order of agreement)	**Agreement index** ⮟
1	The **effectiveness of an IWB** depends on the **skill level and confidence of the teacher**.	| . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . . . | . . ⮟ . | Strongly disagree Disagree Neutral Agree Strongly agree
2	The **effectiveness of an IWB** depends on the **skills and professional knowledge** of the teacher.	| . . . . | . . . . | . . . . | . . . . | . . . . ⮟ . . . . | . . . . | . . . . | Strongly disagree Disagree Neutral Agree Strongly agree

All of the teachers who responded to the statement "The effectiveness of an IWB depends on the skill level and confidence of the teacher." agreed or strongly agreed with it. In fact eleven of them (78,6%) strongly agreed with it. With regard to the statement "The effectiveness of an IWB depends on the skills and professional knowledge of the teacher." twelve of the thirteen respondents (92,3%) agreed or strongly agreed with the statement and one teacher disagreed.

Teachers were also asked to consider another set of factors, which are believed to influence the effectiveness of the use of an IWB in the learning process. They were asked to consider their own experiences and indicate the extent to which they believe each factor influences how effectively they use their IWB. The factors are described in **Table 57**, which follows, and are arranged in order of influence, with the most influential factor at the top.

As the results in **Table 57** indicate, the vast majority of the respondents (85,7%) indicated that the "Teacher's knowledge of IWB usage" has a strong influence on the effectiveness of their use of the IWB, making this the factor ranked as most influential. The results indicate that the second most influential factor is the "Teacher's confidence in use of the IWB", with eight of the fourteen respondents (57,1%) indicating that this has a strong influence, and five respondents (35,7%) indicating that this has a moderate influence.

This was closely followed by "Use of a classroom with an IWB permanently installed", which eight respondents (57,1%) indicated has a strong influence and four (28,6%) indicated has a moderate influence. One teacher indicated that this has little influence, and another indicated that it has no influence.

Table 57: Teachers' perceptions of factors which influence effectiveness of IWB use

	Factors (ranked in order of influence)	**Influence index ⮟**
1	Teacher's knowledge of IWB usage	|....|....|....|....|....|...⮟| No influence / Little influence / Moderate influence / Strong influence
2	Teacher's confidence in use of the IWB	|....|....|....|....|....⮟....| No influence / Little influence / Moderate influence / Strong influence
3	Use of a classroom with an IWB permanently installed	|....|....|....|....|...⮟|....| No influence / Little influence / Moderate influence / Strong influence
4	Teacher's knowledge of the subject	|....|....|...⮟|....|....|....| No influence / Little influence / Moderate influence / Strong influence

Considering the results in **Table 57**, it is worth noting that every teacher (with an IWB) who participated in this study has use of a classroom with an IWB permanently installed. Ranked last on this list is "Teacher's knowledge of the subject" which three of the fourteen respondents (21,4%) indicated has a strong influence, and which another three indicated has a moderate influence. Four teachers (28,6%) indicated that this factor has little influence and four indicated that this factor has no influence on the effectiveness of the teacher's IWB use.

7.3.1 Factors affecting the frequency of IWB use positively

The teachers were asked to consider a set of factors which are believed to have a positive effect on the frequency of use of an IWB by an teacher (Moss et al., 2007; Rudd, 2007). They were asked to consider their own experiences and indicate the extent to which each factor positively influences their frequency of IWB use. Considering their responses, the factors were arranged in order from strongest positive influence to weakest positive influence, as shown in **Table 58**.

As the data in **Table 58** indicate, the teachers felt that the two most influential factors which positively influence the frequency of IWB use by a teacher are the "Teacher's positive attitude towards IWB use" and the "Teacher's perception that learners feel positive about use of the IWB in lessons". The teachers also indicated that they believed "Improved attentiveness amongst learners when an IWB is used" and "Improved learner motivation when an IWB is used" are factors with a relatively strong, positive influence on the frequency of IWB use by an teacher.

There may have been some ambivalence in the statement "Teacher's confidence in his/her ability to use the IWB effectively". Two of the teachers indicated with written comments that they lacked confidence in their ability to use the IWB, and that this has a negative impact on their IWB use, rather than a positive impact.

Table 58: Influence of factors believed to positively influence frequency of IWB use

	Factors (ranked in order of influence)	**Influence index ⩛**
1	Teacher's positive attitude towards IWB use	|....|....|....|....|....⩛...| No influence / Little influence / Moderate influence / Strong influence
2	Teacher's perception that learners feel positive about use of the IWB in lessons	|....|....|....|....|....⩛....| No influence / Little influence / Moderate influence / Strong influence
3	Improved attentiveness amongst learners when an IWB is used	|....|....|....|....|...⩛|....| No influence / Little influence / Moderate influence / Strong influence
4	Improved learner motivation when an IWB is used	|....|....|....|....|.⩛..|....| No influence / Little influence / Moderate influence / Strong influence
5	Teacher's confidence in his/her ability to use the IWB effectively	|....|....|....|....|.⩛..|....| No influence / Little influence / Moderate influence / Strong influence
6	Teacher's ability to store and reuse material from lessons	|....|....|....|....|⩛...|....| No influence / Little influence / Moderate influence / Strong influence
7	Teacher's ability to save and refer to previous lessons	|....|....|....|....⩛....|....| No influence / Little influence / Moderate influence / Strong influence
8	Good IWB resources for use in lessons	|....|....|....|...⩛|....|....| No influence / Little influence / Moderate influence / Strong influence
9	Improved learner behaviour when an IWB is used	|....|....|....|...⩛|....|....| No influence / Little influence / Moderate influence / Strong influence

The results presented in **Table 58** reflect that the teachers believe that the ability to store and reuse material, and the ability to save and refer to previous lessons also had a significant positive influence on their frequency of IWB use. As **Table 58** indicates, the teachers believe the least influential positive factors to be "Good IWB resources for use in lessons" and "Improved learner behaviour when an IWB is used". The teachers were invited to list other factors which positively influence the frequency with which they use their IWB. None of the teachers listed any additional factors.

7.3.2 Factors affecting the frequency of IWB use negatively

The teachers were asked to consider various factors, which are believed to have a negative effect on the frequency of use of an IWB by an teacher (Moss et al., 2007; Rudd, 2007). They were asked to consider their own experiences and indicate the extent to which each factor negatively influences their frequency of IWB use. Considering their responses, the factors were arranged in order from strongest negative influence to weakest negative influence, as shown in the **Table 59**.

Table 59: Influence of factors believed to negatively influence frequency of IWB use

	Factors (ranked in order of influence)	**Influence index ⩛**
1	Teacher's lack of confidence in his/her ability to use the IWB effectively	|. . . . | . . . . | . . . . | . . . ⩛ | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
2	A lack of suitable IWB resources	|. . . . | . . . . | . . . . | ⩛ . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
3	Problems relating to alignment/orientation of the image on the board	|. . . . | . . . ⩛ | . . . . | . . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
4	Environmental factors, such as lighting	|. . . . | . ⩛ . . | . . . . | . . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
5	Problems relating to the data projector	|. . . . ⩛ . . . . | . . . . | . . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
6	Problems relating to connecting and activating the IWB	|. . . . ⩛ . . . . | . . . . | . . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
7	Teacher's negative attitude towards the IWB	|. . ⩛ . | . . . . | . . . . | . . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
8	Teacher's perception that learners have a negative attitude towards the IWB	| ⩛ . . . | . . . . | . . . . | . . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence

As the data in **Table 59** indicate, the two factors which teachers believe are most influential are the "Teacher's lack of confidence in his/her ability to use the IWB effectively" and "A lack of suitable IWB resources". The influence index for each of these factors suggests that teachers believe these two factors are significantly more influential than the any of the other factors listed. Three teachers indicated that "Problems relating to alignment / orientation of the image on the board" had a moderate or strong influence on their frequency of IWB use, and four teachers indicated that "Environmental factors, such as lighting" had a moderate or strong influence.

The responses from the teachers suggest that "Problems relating to the data projector" and "Problems relating to connecting and activating" may have some influence on the frequency of IWB use. The results suggest that any negativity the teachers may feel towards IWBs, or negativity they perceive amongst learners does not influence the frequency with which they use the IWB. These data may suggest that the vast majority of the teachers do not feel any negativity towards the IWBs, and that they do not perceive there to be any negativity amongst the learners.

The teachers were invited to list other factors which negatively influence the frequency with which they use their IWB. Two teachers mentioned insufficient time as a factor, one mentioned a lack of training, and another teacher mentioned problems with sound as a factor, but suggested that this

may be "possibly more linked to communications technology". One respondent indicated that she agreed with the statement "IWB's don't often break down." and wrote beside the statement "It's just me."

7.4 What formal training did teachers receive in the use of IWBs, and how effective was this training perceived to be?

Teachers were asked to indicate their perception of any training that they received when their IWB was initially installed. They were also asked to indicate if they were not offered any formal training. The results are presented in **Table 60**.

Table 60: Teachers' perceptions of initial training at the time of installation of the IWB

Perception of initial training	Number of respondents (n=15)
Training was very useful	1 6,7%
Training was moderately useful	3 20,0%
Training was of limited use	5 33,5%
Training was of no use	–
No training was offered	6 40,0%

The results in **Table 60** show that only nine (60,0%) of the respondents received training when their IWBs were initially installed. And of these nine teachers, only one found the training very useful, three found it moderately useful and five indicated that it was of limited use. One respondent, who indicated that the training was of limited use, wrote that it was "very informal".

At the end of the section of the questionnaire dealing with the challenges and needs of the teachers, respondents were invited to write any comments they felt were relevant. The comments from respondents follow.

- "The tool [IWB] is **very difficult (too much) to learn in one session** – one needs to play with it and learn much by trial and error."
- "Personally, the **lack of time** to reinforce, …practise [and] develop skills is an issue. Departmental training [would be] useful, if [a] time is available when all can be there."
- "Training would be most useful if this is **subject-specific** [i.e.] use of [the] IWB in the subject!"
- "We would appreciate **formal, structured training** ,…not [on a] need-to-know, trial-and-error [basis, because there is] no time [and this is] off putting."
- Another wrote "**too little, too quickly**", with reference to the training he/she had received.

Teachers were asked to consider various IWB-related skills and features taken from Moss et al. (2007), and listed in **Table 61**. In each case they had to indicate whether or not they are able to complete the task or utilise the feature, and then indicate whether or not they received any formal training or assistance from a member of the ICT Department in this regard. They were asked to consider the fact that if they indicate that they are able to do a particular task, but that have not received formal training or assistance, that implies that they have developed these skills through trial-and-error, or based on previously acquired knowledge and skills, or through informal interaction with a colleague.

Table 61: Teachers' ability and training with regard to IWB-related skills and features

IWB-related skills and features*			I am currently able to do this.		I received formal training on this.	
			YES	NO	YES	NO
IWB basic features	1	Connecting a computer to the IWB and operating the projector	**15 100%**	–	6 40,0%	**9 60,0%**
	2	Familiarisation with IWB key tools	**11 73,3%**	4 26,7%	5 33,3%	**10 66,7%**
	3	Solving more common technical difficulties	6 40,0%	**9 60,0%**	1 7,1%	**13 92,9%**
IWB resources	4	Familiarisation with IWB dedicated software	3 20,0%	**12 80,0%**	2 15,4%	**11 84,6%**
	5	Familiarisation with IWB subject specific resources	5 33,3%	**10 66,7%**	–	**13 100%**
Using the Internet with IWB resources	6	Book-marking resources from the internet	3 21,4%	**11 78,6%**	1 7,7%	**12 92,3%**
	7	Importing images, sounds and video into own text	6 40,0%	**9 60,0%**	1 7,1%	**13 92,9%**
	8	Downloading video clips	3 20,0%	**12 80,0%**	–	**13 100%**
Pedagogical training	9	Supporting mixed learning styles with IWBs	1 6,7%	**14 93,3%**	1 7,7%	**12 92,3%**
	10	Reinforcing learning with IWBs	**11 73,3%**	4 26,7%	1 8,3%	**11 91,7%**
	11	Enhancing learner motivation with IWBs	**9 60,0%**	6 40,0%	–	**12 100%**
	12	Encouraging interactive teaching style	**11 73,3%**	4 26,7%	1 7,7%	**12 92,3%**
Planning with IWBs	13	Recap on previous lessons	**10 66,7%**	5 33,3%	1 7,7%	**12 92,3%**
	14	Creating lesson sequences and diagrams	6 40,0%	**9 60,0%**	1 7,7%	**12 92,3%**
	15	Making a school-based resource bank	2 13,3%	**13 86,7%**	–	**13 100%**

*Skills and features described by Moss et al., 2007.

As the results in **Table 61** indicate, the majority of the teachers who participated in this study received no formal training to assist them in acquiring the skills and learning to use the features listed here. The only skills or tasks on which a significant number of teachers received formal

training were "Connecting a computer to the IWB and operating the projector", where six of the fifteen respondents (40,0%) received training, and "Familiarisation with the basic tools", where five respondents (33,3%) received formal training.

When considering their own ability to carry out the tasks or make use of the features listed here, the only tasks or features with which the majority of the respondents indicated they are competent were "Connecting a computer to the IWB and operating the projector" (100% of the respondents), "Familiarisation with IWB key tools" (73,3% of the respondents), "Reinforcing learning with IWBs" (73,3% of the respondents), "Enhancing learner motivation with IWBs" (60,0% of the respondents), "Encouraging interactive teaching style" (73,3% of the respondents) and "Recap on previous lessons" (66,7% of the respondents). With regard to all the other skills and features, more than half of the respondents indicated that they are currently unable to make use of the feature, or do not possess the particular skill.

Teachers were asked to consider a list of IWB-related skills and features which are specifically linked to pedagogical training and planning. They were asked to indicate whether or not they received any training / assistance in this regard, either formally or informally, whether they were self-taught, or actually lacking ability, if they felt unable to accomplish the task described. Their responses are presented in **Table 62**.

Table 62: Teachers' acquisition of IWB-related skills

	IWB-related skills and features (linked to pedagogical training and planning)	Lacking ability	Self-taught	Informally trained	Formally trained
1	Supporting mixed learning styles with IWBs	**12 80,0%**	1 6,7%	2 13,3%	–
2	Reinforcing learning with IWBs	4 26,7%	**9 60,0%**	2 13,3%	–
3	Enhancing pupil motivation with IWBs	4 26,7%	**10 66,7%**	1 6,7%	–
4	Encouraging interactive teaching style	4 26,7%	**10 66,7%**	1 6,7%	–
5	Recapping on previous lessons	5 33,3%	**8 53,3%**	2 13,3%	–
6	Creating lesson sequences and diagrams	**9 60,0%**	4 26,7%	2 13,3%	–
7	Making a school-based resource bank	**12 80,0%**	2 13,3%	1 6,7%	–

Consistent with the teachers' responses to other similar questions, the data in **Table 62** indicate that none of the teachers received formal training to assist them with acquiring the skills or making use of the features listed here. Considering the skills or features in which the majority of the respondents believe they are incompetent, the data in **Table 62** indicate that twelve of the fifteen respondents (80,0%) believe they lack the ability to support mixed learning styles with an IWB. Similarly, twelve respondents (80,0%) indicated that they lack the ability to make a school-based

resource bank. Nine of the respondents (60,0%) indicated that they are unable to create lesson sequences and diagrams.

With regard to the remaining skills and features, "Reinforcing learning with IWBs", "Enhancing pupil motivation with IWBs", "Encouraging an interactive teaching style" and "Recapping on previous lessons", the majority of the teachers indicated that they believe they have taught themselves.

7.5 Do teachers feel the need to improve their use of IWBs and how do they believe they could best achieve this?

All of the interviewees indicated that they would like to increase and improve their use of the IWB. They indicated different ways in which they would like to improve their use of the IWB. Interviewee C suggested that it is important for individuals to be proactive. He suggested that there is limited use in attending courses, because too much is covered in a short space of time, and you do not necessarily have the opportunity to practise and reinforce what you have learnt. He said, "I think as you evolve with things […] we've got people like [the head of IT] who's very much into this whole thing, and it's better for me to actually go and say to him, 'OK, now how did you do that?' or 'I wanna put graphs up… and I wanna do all this with the graphs and I wanna add that and… do that… now how can we do this thing? Is it possible?' And then, because I'm a sort of hands-on learner, so… having a guest speaker come to speak to us is just straight going over my head, because I'm not… I'm not that learning style. So I need to be able to have hands on, so if [the head of IT] comes to me and says, 'OK, this is how you do it and press this button and press that… do that.' […] Then it starts to work, and then I can get it. And then you must initiate those things, you know, and go out and push yourself and make your job interesting. Otherwise if you don't make your job interesting it becomes boring quite quickly."

Interviewee E said, "I think [the school management team and those involved in ICT training] need to recognise different learning styles, because all of us don't like to just …we don't love technology and just sit and play with it 'til it comes right. Most of us just want it to do the job, and we're not interested in playing to discover how to do it. We just want to know, in a structured way, how to do it… so a proper thing, not just a sort of casual, ad hoc… you know, 'get-the-person-who's-walking-by-in-the-corridor-to-help-you-out thing"… 'cause you're much more likely to use it if you've been properly… for me, my learning style… I want it taught to me properly, I don't want to just discover… and some people like technology …[but in my department] we're not going to sit for hours, just playing, clicking on buttons […] I want to go through it in a structured way, and learn to use it."

She went to say that she would like "A structured training session and then a follow up later… So some sort of… where you actually go through the features [of the IWB] in a systematic way, maybe

with some notes, or something, and then you go away and try things, and then… some sort of follow up… but I don't… for me it doesn't work, however well meant, it doesn't work for me… a very casual, informal, unstructured way, because otherwise I never get around to doing it, because at the moment it's entirely up to me to sit and play and work out how to use it, and so therefore… [the school] is busy. If I weren't busy maybe I would sit down and play, but I don't."

Interviewee B said, "I find [the head of IT] is excellent… in terms of when I have gone down there… like for example a nice interactive [thing, we got from a neighbouring school] the boys could go through at there own pace on the evolution of man… and I basically needed to download it, and didn't know how to did it for me. He managed to download and put in on the intranet for me so the boys could come in with their [headphones] and listen to it… nice, different way… they could go at their own pace."

She went on to say that what she needs is "the time to sit and put together some stuff… but then I'm impatient…I'm not a trial-and-error learner. I like to have someone there on hand, if something is not working, then to be able to… that's a luxury, I don't know if that is possible… but you know how it is when you are sitting with somebody, and they are… teaching you how to do it, basically at your pace… that, versus just experimenting… I'm not that type of person….mainly because of time… if something goes wrong and then you get frustrated."

With regard to the possibility of attending a formal training session, she said, "I would, but again I hesitate, because it's always time here. That's the frustrating thing. And a time when we can all be together... you know, and I think we have tried that once before… when we tried to put together some stuff, and we did get some stuff together, but the reality is that… to get all of your department together is almost physically impossible… unless it's a holiday thing… […] …perhaps come back a day earlier…

And with regard to use of the IWB, and the possibility of attending a formal training session she said, "…I know I'm underutilising it. At the moment it works for me like it is, but I know… it's like… just the tip of the iceberg. I could probably be using it a lot more, basically. So yes, I would, if there was time."

Teachers were asked to consider a list of potential ways of learning to use an IWB and indicate their perception of the effectiveness of the particular way of learning for them, personally. Their responses are shown in **Table 63**, which follows.

Table 63: Teachers' preference for different methods of learning to use an IWB

	Potential ways of learning (listed in order of perceived usefulness)	**Usefulness index** ⮟
1	Internal training on subject software (organised by our ICT department)	|....|....|....|....|....|....|...⮟|....| Of no use / Of limited use / Moderately useful / Useful / Very useful
2	Internal training on technical skills (organised by our ICT department)	|....|....|....|....|....|....|..⮟.|....| Of no use / Of limited use / Moderately useful / Useful / Very useful
3	Asking colleagues	|....|....|....|....|....|....⮟....|....| Of no use / Of limited use / Moderately useful / Useful / Very useful
4	Initial teacher training (at the time of installation)	|....|....|....|....|....|.⮟..|....|....| Of no use / Of limited use / Moderately useful / Useful / Very useful
5	Trial-and-error on my own	|....|....|....|....|....⮟....|....|....| Of no use / Of limited use / Moderately useful / Useful / Very useful
6	Departmental (IEB) training	|....|....|....|....|....⮟....|....|....| Of no use / Of limited use / Moderately useful / Useful / Very useful

As the results in **Table 63** show, the method of learning for which teachers showed the greatest preference was internal training on subject software, organised by the school's ICT department. Eight of the fifteen respondents (53,3%) indicated that this would be very useful and five respondents indicated that this would be useful, for them personally. This was closely followed by internal training on technical skills, organised by the school's ICT department, which six of the fifteen respondents (40,0%) indicated would be very useful, and seven (46,7%) indicated would be useful.

Five of the fifteen respondents (33,3%) indicated that they would find asking colleagues very useful, and another five indicated that they would find this useful. Three teachers (20,0%) indicated that the initial teacher training they received when their IWB was installed was very useful, and five (33,3%) indicated that this was useful. One of the teachers who indicated that this was moderately useful wrote "I didn't reinforce enough at the time."

Two teachers indicated that they found learning alone, through a process of trial-and-error very useful, and five indicated that this was useful. Three teachers (20,0%) indicated that departmental training by the Independent Examinations Board would be very useful, and seven (46,7%) indicated that they would find this useful.

Teachers with IWBs were asked to consider a list of six potential training sessions suggested by Moss et al. (2007) on the use of IWBs and indicate how relevant each session would be for them

personally in the light of their current needs. The training sessions are described in **Table 64**, where they are arranged in order of priority, based on the teachers' responses, with the most important training session listed at the top. The results suggest that the teachers recognise value in what each of the training sessions would offer them. In every case at least eleven teachers indicated that they viewed the particular training session as a medium or high priority.

Table 64: Teachers' perceptions of potential training sessions

	Training areas* (arranged in order of priority)	Already undertaken	Low priority	Medium priority	High priority	Mean index of priority [out of 3]
1	*Building confidence in the use of IWB technology* Including familiarisation with the key tools; use of "flipchart" access and navigation; and introduction to a range of software applications	–	3 20,0%	3 20,0%	**9** **60,0%**	**2,40** **(n=15)**
2	*The appropriate use of IWBs to support subject teaching and learning* Including how IWBs can enhance subject teaching; the opportunity to plan and make your own classroom activities and/or materials suitable for use in the classroom; pedagogical guidance on using available resources to support specific curriculum topics	–	2 13,3%	5 33,3%	**8** **53,3%**	**2,40** **(n=15)**
4	*Using IWBs to support pupils with learning difficulties* Including how to support mixed learning styles – visual, aural and kinetic – with IWB resources; reinforcing learning and enhancing pupil motivation through making learning fun	–	4 26,7%	3 20,0%	**8** **53,3%**	**2,27** **(n=15)**
3	*Using internet and multi-media resources with IWBs* Including technical and pedagogical guidance on using resources from the internet: how to create, annotate and save IWB files; import images, sound and video; download video clips, synchronise web pages and add hyperlinks	1 6,7%	1 6,7%	6 40,0%	**7** **46,7%**	**2,27** **(n=15)**
5	*Efficient planning with IWBs* Including how to use IWBs to develop centralised departmental resources; audit pupil learning; re-cap on previous lessons by saving and archiving notes, lesson sequences and diagrams	–	4 26,7%	5 33,3%	**6** **40,0%**	**2,13** **(n=15)**
6	*Developing a more interactive whole class teaching style with IWBs* Including how to exploit the interactive potential of IWBs by developing teaching materials and strategies which involve children as active participants during lesson time	–	3 20,0%	**8** **53,3%**	4 26,7%	**2,07** **(n=15)**

*Training areas described by Moss et al.(2007)

As the results in **Table 64** show, the session entitled "Building confidence in the use of IWB technology" was marked as a high priority for nine of the fifteen respondents (60,0%), and as medium priority by another five (33,3%). According to the given description, this training session would focus on the use of key IWB tools, including the basic IWB notebook (flipchart) software, as well as an introduction to other software applications. In other words, this training course would focus on the basics of IWB use. The responses from teachers suggest that they recognise a need for help with the basics of IWB use. This is consistent with the fact that six of the fifteen

respondents (40,0%) indicated that they had not received any training when their IWBs were installed, and another five respondents (33,3%) indicated that the training they did received was of limited use.

The results in **Table 64** show that of equally high priority to the teachers was the session entitled "The appropriate use of IWBs to support subject teaching and learning", the aim of which would be to enhance teaching through subject specific training in the use of the IWB, enable teachers to develop their own IWB-specific resources, and guide teachers in their use of existing resources. Thirteen of the fifteen respondents (86,7%) indicated this type of training as medium priority or high priority. This is another session that effectively focuses on the basics of IWB use, and the teachers' responses indicate that a significant number of them may be lacking the skills required to develop their own materials and make effective use of subject-specific software available.

When considering the session entitled "Using IWBs to support pupils with learning difficulties" eleven of the fifteen respondents (83,3%) indicated that this was a medium or high priority for them. The session "Using internet and multi-media resources with IWBs" was regarded by thirteen of the fifteen (86,7%) respondents as a medium or high priority. Of the fifteen respondents, eleven (73,3%) indicated that they regard the session entitled "Efficient planning with IWBs" as a medium or high priority. Twelve of the fifteen respondents (80,0%) indicated that they regard the session entitled "Developing a more interactive whole class teaching style with IWBs" as a medium or high priority.

7.6 What perceptions do teachers have of the resources available for use with IWBs?

Teachers were asked to consider the statement "GOOD resources for IWBs are hard to find." and indicate the extent to which they agree with it. Their responses are presented in **Table 65**.

Table 65: Teachers' responses to "GOOD resources for IWBs are hard to find."

Response	Number of teachers (n=14)
Strongly agree	1 7,1%
Agree	6 42,9%
Neutral	4 28,6%
Disagree	2 14,3%
Strongly disagree	1 7,1%
|. . . . |. . . . |. . . . |. . . . |. . . . |. . . . |. . . . | Strongly disagree Disagree Neutral Agree Strongly agree	

The responses presented in **Table 65** indicate that seven of the fourteen respondents (50,0%) agreed or strongly agreed with the statement. Four teachers (28,6%) were neutral, and only three (21,4%) disagreed or strongly disagreed with the statement.

In another set of questions, teachers were asked to indicate how easy it is to find suitable IWB resources and how easy it is to make use of suitable IWB resources. Their responses are presented in **Table 66**.

Table 66: Teachers' perceptions of finding and using suitable IWB resources

		Difficulty index ⮟
1	How easy is it to **find** suitable IWB resources?	| . . . . | . . . . | . . . . | . ⮟ . . | . . . . | . . . . | . . . . | . . . . | Very difficult / Relatively difficult / I am undecided / Relatively easy / Very easy
2	How easy is it to **make use of** suitable IWB resources?	| . . . . | . . . . | . . . . | . . . . | ⮟ . . . | . . . . | . . . . | . . . . | Very difficult / Relatively difficult / I am undecided / Relatively easy / Very easy

The results presented in **Table 66** reflect the fact that only four of the respondents (28,6%) believe it is relatively easy to find suitable IWB resources. This is reasonably consistent with the fact that three teachers disagreed or strongly disagreed with the statement "Good resources for IWBs are hard to find." Six teachers (42,9%) indicated that finding suitable IWB resources is relatively difficult or very difficult which is reasonably consistent with the fact that seven teachers agreed or strongly agreed with the statement "Good resources for IWBs are hard to find." Four teachers were undecided in this regard. When considering how easy it is to make use of suitable IWB resources, five teachers (35,7%) indicated that they believe it is very easy or relatively easy, and four teachers (28,6%) indicated that they believe it is relatively difficult or very difficult. Five teachers were undecided in this regard.

The teachers were asked to consider various factors, which may restrict their access to good IWB resources. They were asked to consider their own experiences and indicate the extent to which each factor restricts their access to IWB resources. Considering their responses, the factors were arranged in order from strongest influence to weakest influence, as shown **Table 67**.

The results in **Table 67** indicate that a lack of time is a major issue for teachers, with eleven of the fifteen respondents indicating that "Limited time to search for resources" has a strong influence, and the remaining four teachers (26,7%) indicating that this has a moderate influence. This factor was recognised the most influential factor by a significant margin.

Table 67: Teachers' perceptions of factors restricting access to good IWB resources

	Factors (ranked in order of influence)	**Influence index ⮟**
1	Limited time to search for resources	|. . . . | . . . . | . . . . | . . . . | . . . . | . ⮟ . . | No influence / Little influence / Moderate influence / Strong influence
2	Problems encountered downloading resources (from the Internet)	|. . . . | . . . . | . . . . | . ⮟ . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
3	Limited material for my subject	|. . . . | . . . . | . . . ⮟ | . . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence
4	Problems encountered loading resources from my computer for use on the IWB	|. . . . | . . . . | ⮟ . . . . | . . . . | . . . . | . . . . | No influence / Little influence / Moderate influence / Strong influence

As **Table 67** indicated, four teachers (26,7%) indicated that "Problems encountered downloading resources (from the Internet)" have a strong influence and another four indicated that such problems have a moderate influence. Three teachers (21,4%) indicated that "Limited material for my subject" was a strong influence, four indicated that this was a moderate influence, three indicated that this has little influence and four indicated that this has no influence.

Apparently least influential are "Problems encountered loading resources from my computer for use on the IWB" which four teachers (28,6%) indicated have no influence, and which five (35,7%) teachers indicate have little influence. Four teachers indicated that such problems have a moderate influence in restricting their access to good IWB resources and only one teacher indicated that such problems have a strong influence.

7.7 How do teachers feel about using integrating ICT in the form of the IWB into their teaching, as opposed to using a data projector alone, or making use of computers in a dedicated computer laboratory?

"…certainly…having the [IWB] has really changed the way I have perceived the [data] projector."
Interviewee D

As part of the investigation into teachers' perceptions of how the IWB integrates ICT into the classroom, they were asked to indicate how they have made use of the data projector without the IWB. They were asked to consider various options, and were provided with space to elaborate or describe other uses not covered by the given options. Their responses are presented in **Table 68**, which follows.

Table 68: Teachers' use of data projectors without an IWB

	How teachers have used the data projector <u>without the IWB</u> (in order of overall popularity)	Number of teachers with an IWB (n=15)	Number of teachers without an IWB (n=8)	Total number of respondents (n=23)
1	I have projected scanned or downloaded documents.	13 86,7%	7 87,5%	20 87,0%
2	I have shown movies or movie clips.	11 73,3%	5 62,5%	16 69,6%
3	I have projected scanned or downloaded pictures or diagrams.	12 80,0%	4 50,0%	16 69,6%
4	I have projected web pages.	9 60,0%	3 37,5%	12 52,2%
5	I have projected interactive software or teaching aids.	7 46,7%	3 37,5%	10 43,5%
6	I have not.	1 6,7%	–	1 4,3%

Considering use of a data projector specifically without an IWB, the results shown in **Table 68** indicate that the majority of teachers (87,0%), with and without IWBs, have used the data projector to project scanned or downloaded documents. Most of the teachers who have IWBs (73,3%) and most of those who do not (62,5%) have shown movies or movie clips. The majority of the teachers who have IWBs (80,0%) have projected scanned or downloaded pictures or diagrams, as have half (50,0%) of the teachers without an IWB.

Nine of the fifteen teachers who have IWBs (60,0%) have projected web pages, while only three of the teachers without IWBs (37,5%) have done the same. Seven of the fifteen teachers who have IWBs (46,7%) have projected interactive software or teaching aids and three of the teachers without IWBs (37,5%) have done the same.

With regard to the use of the data projector, the interviewees made some pertinent comments. Interviewee E suggested that most of the potential benefits she saw with regard to accommodating different learning styles in her subject, a language, actually lie in "the projector, because potentially to use video clips …is fantastic… because there are things in those programmes where you have a clip with someone speaking. And then you know you could do it, so instead of just a straight listening exercise, it could be listening where you actually visually see people doing things and… no, it's huge, the potential."

Teachers were asked to indicate how they have made use of the data projector in combination with a normal whiteboard. They were asked to consider various options, and were provided with space to elaborate or describe other uses not covered by the given options. Their responses are present in **Table 69**, which follows.

Table 69: Teachers use of data projectors in combination with a normal whiteboard

	How teachers have used the data projector in combination with a normal whiteboard (in order of popularity)	Number of teachers with an IWB (n=15)	Number of teachers without an IWB (n=8)	Total number of respondents (n=23)
1	I have annotated documents projected on to the whiteboard.	6 40,0%	6 75,0%	12 52,2%
2	I have annotated pictures or diagrams projected on to the whiteboard, writing on the projected image.	6 40,0%	3 37,5%	9 39,1%
3	I have written notes pertaining to the projected image on the whiteboard (not actually on the projected image).	4 26,7%	4 50,0%	8 34,8%
4	I have not.	6 40,0%	2 25,0%	8 34,8%

The results in **Table 69** indicate that six of the teachers who have IWBs (40,0%) and six of those who do not (75,0%) have annotated documents projected on to a normal whiteboard. Six of the teachers who have IWBs (40,0%) have annotated pictures or diagrams projected on to a normal whiteboard, actually writing on the projected image. Only three of the teachers who do not have IWBs have done the same. Four of the teachers who have IWBs (26,7%) and four of the teachers without (50,0%) have written notes pertaining to the projected image on a normal whiteboard, not actually on the projected image. Six teachers who have IWBs (40,0%) and two who do not have not used the data projector in combination with a normal whiteboard.

Teachers were asked to describe other ways in which they have used a data projector without an IWB. There responses follow.

- "Multimedia Science School, images, class notes"
- "Animations", "PowerPoint" and "Slideshows"
- "Lots of films… but only on dark days: need darker blinds"
- "To show videos"
- "Projected poems, grammar – made notes while teaching these sections"

Teachers with a data projector, but no IWB were asked what ICT equipment has had the most significant impact on their teaching. Three of these teachers indicated that believe the data projector has had the most impact on their teaching. Two cited their laptops as most influential, and one teacher indicated that each of the remaining three options, "PowerPoint and movies", "Laptop and projector" and "Individual computers with access to the Internet", was most influential.

These teachers with a data projector but no IWB were asked if there were any ICT resources that would like to acquire ahead of an IWB. Four of the eight respondents did not write anything in the space provided and two wrote "none". The seventh wrote "Internet available to be used with the data projector." and the eighth wrote "more desktops in my classroom."

Teachers were asked whether they have taken a class to one of the computer labs during the course of the year, between January and August. All of the fifteen teachers who have an IWB indicated that they had taken a class to the computer labs during this time. Seven of the eight teachers without an IWB (87,5%) indicated that they had also taken a class to the computer labs at some stage during the course of the year. Teachers were asked how frequently, in general, they take a class to the computer labs. Their responses are reported in **Table 70**, which follows.

Table 70: General frequency with which teachers take a class to the computer labs

General frequency	Number of teachers with IWBs (n=15)	Number of teachers without IWBs (n=7)	Total number of respondents (n=22)
More than once a week	2 13,3%	–	2 9,1%
Once a week	3 20,0%	1 14,3%	4 18,2%
Once every fortnight	**5** **33,3%**	–	5 22,7%
Once a month	3 20,0%	1 14,3%	4 18,2%
Less than once a month	2 13,3%	**5** **71,4%**	7 31,8%

The results in **Table 70** suggest that teachers with IWBs are more inclined to take a class to the computer labs. Only one teacher without an IWB generally takes a class to the computer labs once a week, and another does so once a month. Five of the seven teachers without IWBs (71,4%) indicated that they generally take a class to the computer labs less that once a month, whereas only two of the fifteen teachers with IWBs (13,3%) take a class to the computer labs as seldom as this. Of the remaining teachers with IWBs, two (13,3%) generally take a class to the labs more than once a week, three (20,0%) generally take a class to the labs once a week, five do so once every fortnight and three do so less than once a month.

Teachers were asked to consider the following statement and determine the extent to which they agreed with it. Their responses to the statement are presented in **Table 71**, which follows.

> "I think that a lesson where the learners are each able to use a computer in one of our labs and work independently is generally more effective than a lesson involving my use of the interactive whiteboard."

Table 71: Teachers' responses to the statement comparing a lesson in the computer labs with a lesson using the IWB

	Response groups	Agreement index ⮟
1	Teachers with IWBs (n=15)	|. . . . |. . . . |. . . . |. . .⮟|. . . . |. . . . |. . . . |. . . . | Strongly disagree Disagree Neutral Agree Strongly agree
2	Teachers without IWBs (n=8)	|. . . . |. . . . |. . . . |.⮟. . |. . . . |. . . . |. . . . |. . . . | Strongly disagree Disagree Neutral Agree Strongly agree
3	All respondents (n=23)	|. . . . |. . . . |. . . . |. .⮟. |. . . . |. . . . |. . . . |. . . . | Strongly disagree Disagree Neutral Agree Strongly agree

The interviewees were asked to indicate how they believe a lesson in the computer laboratories compares with a lesson in a normal classroom, where an IWB is used. Interviewee C said that when using technology in the class, "not everybody gets a chance to… be in the sand box or to use the IWB. In the lab everybody has got their own computer so therefore they can research at their own speed, which is quite nice, the [learners] quite like that. When you're in the classroom and you are using the IWB you tend to move at the fastest speed most of the time."

Interviewee E expressed similar sentiments, saying, "I think you'd have a place for both, because, when you go to the computers they all are involved, all the time, whereas with the [IWB] they're all keen to come up and do it… they all jump about in their seats and want to learn, but it's only one at a time that's actually coming up, so if you're in the labs – I can see the potential more in terms of if you introduced it in the classroom and then they do it, you might get them to use the lab more effectively, because you've demonstrated how you should do it properly, because they tend to whip through the programme too fast and they don't do everything properly. So that's a potential thing. So I think you could do both."

The idea of the computer laboratory allow independent work was also mentioned by Interviewee A and Interviewee B, who both commented on the value the computer laboratory offers when it comes to the application of knowledge in interactive activities, or investigative work and research projects, allowing learners to work individually and explore the topic in question, with access to software or resources such as the Internet, where necessary.

Interviewee D commented on the fact that in a computer laboratory the computers may be a powerful distraction, especially for weaker learners. He indicated that such learners need to be managed very carefully in the computer laboratory and that at times it is difficult to keep learners on track in that environment.

Teachers were asked how they believe the school's ICT resources compare with those of other South African high schools. Their responses are presented in **Table 72**.

Table 72: Teachers' perceptions of the standard of the school's ICT resources

	Statement (arranged in order of popularity)	Percentage of teachers with an IWB (n=15)	Percentage of teachers without an IWB (n=8)
1	Our ICT resources are **better** than most secondary schools.	**14 93,3%**	**8 100%**
2	Our ICT resources are **the same** as most secondary schools.	1 6,7%	–
3	Our ICT resources are **not as good** as most secondary schools.	–	–

The results in **Table 72** show that all of the respondents, except one of the teachers who has an IWB, believe that the school's ICT resources are better than most secondary schools. The teacher who did not share this opinion indicated that he/she believes that the school's ICT resources are the same as most secondary schools.

7.8 What limitations, technical or otherwise, do teachers perceive to be preventing them from using IWBs more effectively?

It appears that a lack of training, a lack of time for experimentation and resource development, and inadequate technical support are the three main issues that the teachers in this study believe are restricting their use of IWBs. This sentiment is well captured in the following comment, from Interviewee E: "I really am glad to have [an IWB], and I really want to use it, but the first problem is just that [the school] is so busy – we are always under pressure, and we do need… there's some very good technological support, but the reality of it isn't… isn't… it isn't great, the support at [the school]. There are good intentions, but it's not actually… good."

With regard to technical problems and management issues, one teacher wrote, with regard to his IWB, "I have had permanent access to [the IWB since 2006] except when there is a problem, which usually takes a few weeks to be repaired. There is often a debate as to whose budget should fund the repairs."

Another teacher wrote that "time and lack of training" restricts his use of the IWB, and he went on to write, "All I need is someone to explain a few things to me [regarding] the IWB and time to get going."

With regard to simply using the basic features of the IWB so that it becomes a natural part of the lessons, in order to facilitate exploration of the IWBs potential, Interviewee E said, "I would agree [that this is important], because otherwise I feel like I can't be bothered to waste the time, because

even today I came in and something had… I think it had… hadn't been switched off yesterday afternoon and then the computer had gone into some mode or whatever and then it was too long to get it to come up. I started but… you've got the class waiting, so I didn't want to be fiddling at the computer, switching it on and off and… you know, so then I just don't use it."

With regard to ICT technical support in general she said she would like it if, "if things were resolved more quickly… and you weren't always given the impression that it was in some way your inadequacy and fault that it's not working. Because even when the wires had been connected wrongly, it always somehow seems to be implied that it was your inadequacy, even when it's proved that they were actually all connected wrongly, and that's why it didn't work …you are imposing on people by asking them to come and fix it, because they don't make any distinction between the many times when it is your own incompetence, and there is an easy solution… but sometimes there isn't and it is actually a problem. And they… you are made to feel bad either way."

With regard to ICT support and training from the school management team she indicated that there appeared to have been no action in response to requests in the past, for example when it was suggested that training in the use of electronic mark sheets would be useful. She went on to say, "…If the school is going to invest in those whiteboards, we do need actually to also offer us, you know, training to use it properly, because then you can't say to us you haven't used it."

Concerning stumbling blocks preventing greater use of the IWB during lessons, she referred to the difficulty of struggling with the technology in front of the class, saying, "I don't really mind feeling stupid in front of the boys, 'cause they just think, oh it's a woman. But …it does impact on it… and even [one of the other teachers in my department] commented on that, it… especially if you are struggling with it, with discipline, you don't want to look stupid… and then your whole… you are trying to do something and then it all disappears, or… you can't get it to come up. And that's very off putting because if you're… it's OK if you're secure and even I've noticed with myself, I started using it first, with my smallest, easiest class, because they are helpful, and …they sort of get all… kind male, and help you out… heroic… and that's fine, I don't mind, as long they teach me how, but it's not easy, if it's a difficult class, to make yourself vulnerable in that way, and I'm sure that's at the bottom of why a lot of people don't use it."

On the topic of staff training and development Interviewee D said, "It just worries me that we… as a staff we are not really a learning community… so, I sort of feel bad about the fact that I'm not doing more training, and etc. etc. but on the other hand, well (a) my own time, but (b) other peoples' time for doing that is just really not there. You know everybody is just sort of flying by the seat of their pants kind of and it's probably part of the new curriculum and all the rest of it. But I think we are

not really allowing ourselves the chance to learn new technologies and to really think about how we use them and so on."

When asked to consider how the school could best help her improve her use of the IWB, Interviewee B suggested that they should address "the areas that I have been frustrated about… if those could be fine-tuned, so that I get self-sufficient to be able to do it. I suppose a bit training would have to come into that… I find there is nothing more frustrating than something not going right… [It would be great if things were] more streamlined, so that we [could]… utilise [the IWB] to the best of our ability."

With regard to training she said, "I'm personally a one-on-one person… although… one-on-one maybe… within the department…'cause then we… will learn from each other… although sometimes seeing what other subjects are using with it… So maybe having somebody showing us this is all the possible stuff you could do with it… that would help… and then an opportunity to practise it… so that we could do it properly rather, than inefficiently…"

With specific reference to her IWB, Interviewee B said, "…Firstly, I'd likely everything to work, that's the main thing. I don't know whether it's possible for that [bottom of IWB] fixed [attached to the wall]? You see it moves so much. Look, I know that you have to align, but I think that makes it worst. Possibly in summer with the fans on… [they] throw [the data projector out of alignment]. My laptop is getting a bit slow… and it's old. And I think if had… possibly that if I had one that is faster, I would use it more. If it meant having one [a desk top] that worked better and was more efficient and faster, and had [the student management database] on it here, then I would like that. 'Cause that is one of the things I would like… quick access to email… you can answer things quickly… it's brilliant … streamlined and efficient. [Having to set up the laptop each day] is a bit irritating… that is what slows it down… if it were almost set up and fixed to the table…"

And again with regard to the IWB, she said, "The design of these is not good, in terms of sounds and speakers…[…]… In other words, if you are projecting something… whether it's a visual, or a DVD, ideally it would be a nice way to show a snippet of something, rather than traipse a whole class down…[..to the lecture theatre…]… irritating… That's one of my frustrations… the technological support…[…I put in a…]… request for speakers to be fixed… they have not been working for half a year…[…]… [There is a problem with] my projector… […]…but I don't want it to be taken away and fixed before the end of the term… it's just got a black line that's coming across there…[…]… thought it was the bulb, but it's not… […]… so just to have everything working…"

7.9 Chapter seven in summary

This chapter explores the challenges and needs of the teachers with regard to their use of the IWB. It attempts to determine their perception of any training they received as they learnt to use the IWB. It also attempts to determine what they perceive to be areas of concern and areas where they need assistance to improve their use of the IWB. Chapter 8 investigates the learners' perceptions of the impact of IWBs on teaching and learning and it presents a comparison of the learners' perceptions with those of the teachers.

CHAPTER 8
FINDINGS SECTION 4:
THE IMPACT OF IWBS AS PERCEIVED BY THE LEARNERS

Research Questions

Theme 1
The extent, frequency and nature of IWB use in classrooms

1.1 How are IWBs distributed across the school, and how frequently do learners encounter them?

1.2 How frequently are the existing IWBs being used by the teachers and what factors influence their frequency of use?

1.3 What features of IWBs are being used by the teachers, and how frequently?

1.4 What resources and equipment do teachers use in combination with IWBs?

1.5 How frequently are the existing IWBs being used by the learners and what features are they using?

Theme 2
The impact of IWBs on teaching and learning as perceived by teachers

2.1 What is the general attitude of teachers towards IWBs?

2.2 What attitude do teachers perceive the learners to have with regard to the IWB?

2.3 What impact do teachers perceive IWB use to have on learners' behaviour, attentiveness, motivation and productivity?

2.4 What impact do teachers perceive IWB use to have on the learning process, specifically with regard to their effect on learners' understanding, retention and performance?

2.5 What impact do teachers perceive the IWB to have on lesson planning, preparation and resource development?

2.6 What impact do teachers perceive the IWB to have on presentation, teaching styles and classroom management?

continued/...

.../continued

Theme 3
The challenges and needs of teachers with regard to IWB use

3.1 How competent do teachers using IWBs perceive themselves to be in their use of the IWBs, and how do they believe the learners perceive their use of the IWB?

3.2 What factors do teachers believe influence the effectiveness of their use of IWBs?

3.3 What formal training did teachers receive in the use of IWBs, and how effective was this training perceived to be?

3.4 Do teachers feel the need to improve their use of IWBs and, if so, how do they believe they could best achieve this?

3.5 What perceptions do teachers have of the resources available for use with IWBs?

3.6 How do teachers feel about integrating ICT in the form of the IWB into their teaching, as opposed to using a data projector alone, or making use of computers in a dedicated computer laboratory?

3.7 What limitations, technical or otherwise, do teachers perceive to be preventing them from using IWBs more effectively?

The focus of this chapter is theme four.

Theme 4
The impact of IWBs as perceived by learners

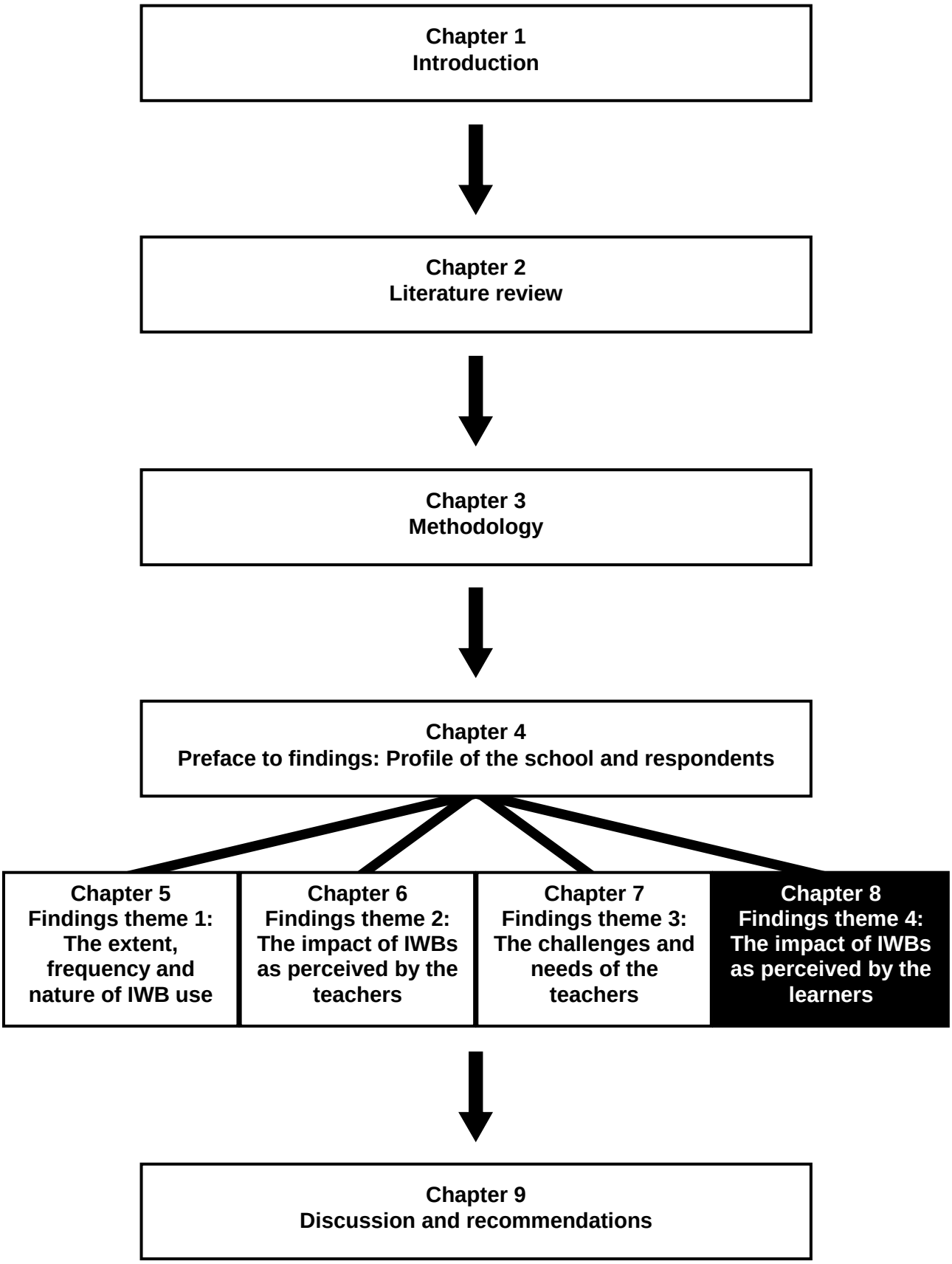
4.1 What is the learners' perception of the level of competency in IWB use amongst teachers?

4.2 What impact do learners perceive the IWB to have on their teachers and the manner in which they facilitate lessons, specifically with regard to the pace of lessons, the teacher's ability to capture and hold their attention, and the presentation and aesthetic appeal of the teacher's audiovisual aids?

4.3 What impact do learners perceive use of the IWB to have on the learning process, specifically on their understanding, retention and productivity?

4.4 What impact do learners perceive use of the IWB to have on their personal behaviour, attentiveness and motivation, and the behaviour of their fellow learners?

Outline of dissertation



Chapter 8: Findings theme 4 – Learners' perceptions

8.1 Introduction

This chapter explores the impact of IWBs as perceived by the learners, and compares the learners' perspective with that of the teachers. The feedback received from the learners is analysed with a view to answering the following questions.

- What is the learners' perception of the level of competency in IWB use amongst teachers?
- What impact do learners perceive the IWB to have on their teachers and the manner in which they facilitate lessons, specifically with regard to the pace of lessons, the teacher's ability to capture and hold their attention, and the presentation and aesthetic appeal of the teacher's audiovisual aids?
- What impact do learners perceive use of the IWB to have on the learning process, specifically on their understanding, retention and productivity?
- What impact do learners perceive use of the IWB to have on their personal behaviour, attentiveness and motivation, and the behaviour of their fellow learners?

The learners were presented with 26 statements, and they were asked to indicate the extent to which they agreed with each statement. As described in the chapter on methodology, for each statement, the response options were structured as a Likert item, allowing the learner to choose one of five options, as shown below in **Figure 24**. The response to each Likert item was equated to a five-point scale on a truncated number line, ranging from –2 through to +2, as shown below in **Figure 24**. Each response from each participant was assigned the corresponding integral value (–2, –1, 0, 1 or 2). For each item (statement) the arithmetic mean of these values (n = 221±3) was calculated and this provided a relative measure of agreement, the agreement index. **Figure 24**, which follows, indicates how an agreement index of 1,3 will be represented graphically.

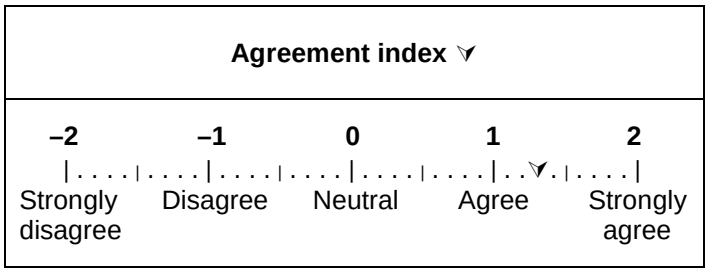


Figure 24: Graphic representation of agreement index 1,3

The 26 statements, which were presented to the learners, are given in **Table 73**. They are arranged in order of decreasing agreement. The statement with which the learners agreed most strongly (according to the agreement index) is at the top of the table and the statement with which the learners disagreed most strongly is at the bottom of the table. **Table 73** shows the breakdown

of the responses from the learners. For each descriptor, the number of learners who chose that descriptor is given, together with the percentage which that represents.

The 26 statements were randomly arranged in the questionnaires. Once the results had been collected, the statements were placed in groups, based on seven common themes, which were aligned to the seven research sub-questions in this section on the learners' perspective. Certain statements were deemed to address more than one theme, and thus appear in more than one group.

- **Theme 1:** Teacher competence in IWB use
- **Theme 2:** The teaching process
- **Theme 3:** Lesson interest
- **Theme 4:** Presentation
- **Theme 5:** The pace of the lesson
- **Theme 6:** The learning process
- **Theme 7:** Learner concentration and behaviour

In the tables numbered from 74 to 80 the statements which addressed each of these themes are presented, together with the agreement index based on the learners' responses and the agreement index based on the teachers' responses in the row below that. In each statement, the phrase which is of particular relevance to this theme is underlined and in bold font. In the original questionnaires these words or phrases were not emphasised in any way.

In each case the set of statements is followed by a brief discussion of the learners' responses to each statement, as well as a discussion of the learners' responses to the group of statements as a whole, a commentary on the theme in question. In the descriptive analysis of the results, little distinction is made between "Agree" and "Strongly agree". Likewise, little distinction is made between "Disagree" and "Strongly disagree".

Once each question has been answered from the learners' perspective, an attempt is made to answer the question "Do the teachers and learners agree on this?" At this point the learners' responses to the relevant statement are compared to the teachers' responses to an equivalent statement, which appeared on their questionnaire. The mean index of agreement for the teachers is compared with that of the learners and the comparative results are discussed.

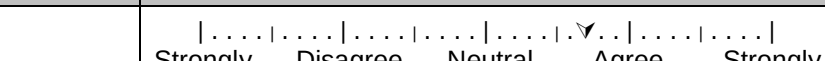
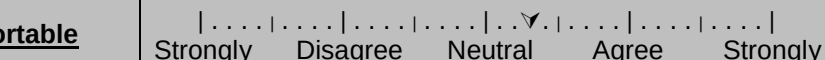
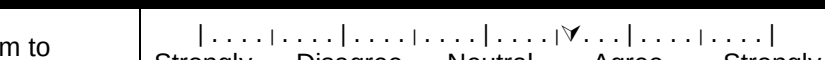
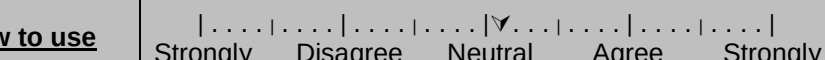
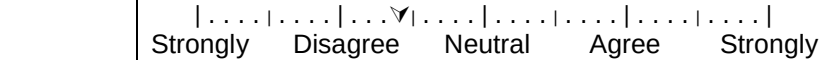
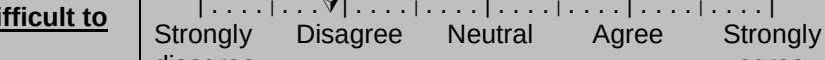
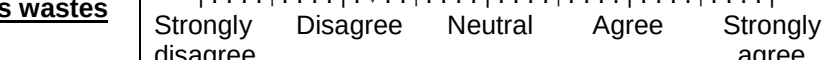
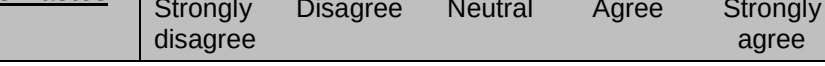
Table 73: Summary of learner responses to statements, arranged in order of agreement

	Statements (listed in order of agreement)	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Index
1	IWBs make it easy for the teacher to repeat, re-explain, and summarise.	–	3 1,3%	26 11,7%	124 55,6%	70 31,4%	**1,17** **(n=223)**
2	I think IWBs make the teacher's drawings and diagrams easier to see.	3 1,4%	18 8,1%	41 18,6%	86 38,9%	73 33,0%	**0,94** **(n=221)**
3	IWBs make learning more interesting and exciting.	1 0,5%	10 4,5%	44 19,9%	119 53,8%	47 21,3%	**0,91** **(n=221)**
4	An IWB makes a lesson more interesting because the presentation of material is clearer.	2 0,9%	15 6,8%	50 22,6%	102 46,2%	52 23,5%	**0,85** **(n=221)**
5	I think teachers' lessons are better prepared and more organised when they use an IWB.	2 0,9%	16 7,2%	64 28,7%	108 48,4%	33 14,8%	**0,69** **(n=223)**
6	An IWB makes a lesson more interesting because the presentation of the material is more attractive.	1 0,5%	21 9,5%	59 26,6%	106 47,7%	35 15,8%	**0,69** **(n=222)**
7	My teachers who have IWBs are comfortable using them.	7 3,1%	18 8,0%	45 20,1%	122 54,5%	32 14,3%	**0,69** **(n=224)**
8	I prefer lessons which are taught with an IWB.	2 0,9%	13 5,8%	88 39,5%	87 39,0%	33 14,8%	**0,61** **(n=223)**
9	My teachers who have IWBs seem to know how to use them properly.	12 5,4%	20 9,0%	48 21,7%	112 50,7%	29 13,1%	**0,57** **(n=221)**
10	When my teacher uses the IWB, I find the lesson more interesting.	1 0,5%	25 11,4%	80 36,5%	84 38,4%	29 13,2%	**0,53** **(n=219)**
11	I learn more when my teacher uses an IWB.	–	9 4,0%	109 48,7%	87 38,8%	19 8,5%	**0,52** **(n=224)**
12	It is easier to understand the work when my teacher uses an IWB.	3 1,4%	16 7,3%	108 49,3%	67 30,6%	25 11,4%	**0,43** **(n=219)**
13	I find it easier to remember what I have learnt during a lesson if my teacher used the IWB.	5 2,2%	36 16,1%	100 44,6%	63 28,1%	20 8,9%	**0,25** **(n=224)**
14	I concentrate better in class when an IWB is used.	4 1,8%	35 15,8%	111 50,0%	57 25,7%	15 6,8%	**0,20** **(n=222)**
15	When my teacher uses an IWB, we move through the material at a faster pace than without it.	2 0,9%	46 20,6%	98 43,9%	66 29,6%	11 4,9%	**0,17** **(n=223)**
16	We get to join in lessons more when my teacher uses an IWB.	12 5,4%	47 21,0%	78 34,8%	68 30,4%	19 8,5%	**0,16** **(n=224)**
17	Teachers teach just the same with or without an IWB.	9 4,0%	71 31,8%	67 30,0%	55 24,7%	21 9,4%	**0,04** **(n=223)**
18	I think learners behave better in lessons with IWBs.	18 8,1%	46 20,7%	92 41,4%	50 22,5%	16 7,2%	**0,00** **(n=222)**
19	My behaviour during the lesson is better if my teacher uses the IWB.	13 5,8%	43 19,2%	107 47,8%	52 23,2%	9 4,0%	**0,00** **(n=224)**
20	Whether or not my teacher uses the IWB, it makes no difference to the lesson.	17 7,6%	66 29,6%	74 33,2%	44 19,7%	22 9,9%	**–0,05** **(n=223)**
21	I would work harder if my teacher used the IWB more often.	8 3,6%	57 25,6%	112 50,2%	39 17,5%	7 3,1%	**–0,09** **(n=223)**
22	When my teacher uses an IWB, we move through the material at a slower pace than without it.	11 4,9%	102 45,7%	63 28,3%	40 17,9%	7 3,1%	**–0,31** **(n=223)**
23	I think teachers go too fast when they use an IWB.	14 6,3%	116 52,3%	71 32,0%	16 7,2%	5 2,3%	**–0,53** **(n=222)**
24	I think IWBs are difficult to use.	30 13,5%	102 45,9%	68 30,6%	20 9,0%	2 0,9%	**–0,62** **(n=222)**
25	IWBs often break down and this wastes time.	51 23,0%	99 44,6%	48 21,6%	18 8,1%	6 2,7%	**–0,77** **(n=222)**
26	I dislike going out to the front to use the IWB.	51 23,4%	88 40,4%	66 30,3%	11 5,0%	2 0,9%	**–0,80** **(n=218)**

8.2 Learners' perceptions of teacher competence in IWB use

Table 74 presents the breakdown of the learners' and teachers' responses to the statements relating specifically to teachers' use of the IWB and the perception of the learners. In each case the statement from the learner questionnaire is given first, together with a graphic representation of the agreement index based on the responses from the learners. This is followed, in the next row of the table, by the equivalent statement from the teacher questionnaire, together with a graphic presentation of the agreement index based on the responses from the teachers.

Table 74: Statements pertaining to teacher competence in IWB use

	Statement	Agreement index ⮟
1	My teachers who have IWBs are **comfortable using them**.	
	Learners believe that I am **comfortable** using the IWB.	
2	My teachers who have IWBs seem to **know how to use them properly**.	
	Learners believe that I **know how to use** the IWB **properly**.	
3	I think IWBs are **difficult to use**.	
	Learners think that IWBs are difficult to use.	
4	IWBs **often break down and this wastes time**.	
	IWBs **often break down and this wastes time**.	

8.2.1 Analysis of the learners' responses

The data in **Table 74** reflect that the majority of the learners (68,8%) agreed with the statement "My teachers who have IWBs are comfortable using them." A small percentage (11,1%) disagreed or strongly disagreed with this statement. Consistent with their opinions of this statement, the majority of the learners (63,8%) agreed or strongly agreed with the statement "My teachers who have IWBs seem to know how to use them properly." Once again a small percentage (14,4%) disagreed or strongly disagreed with this statement.

The majority of learners (67,6%) disagreed or strongly disagreed with the statement "IWBs often break down and this wastes time." A small percentage of learners (9,9%) agreed or strongly agreed with this statement. These results are consistent with the opinions expressed by the learners with regard to the first two statements in the table. If the teachers were not comfortable using IWBs, and did not know how to use them properly, one may presume that they would struggle with technical difficulties that would waste time during lessons. Disregarding the link between teacher competency and learners' opinions of this statement, the results may be regarded as an indication of the reliability of the technology.

The majority of learners (59,4%) disagreed or strongly disagreed with the statement "I think IWBs are difficult to use." Disregarding any possible links to teachers' use of the IWB, this may be a reflection of the learners' opinion of the technology. The learners are generally technologically competent, with a high degree of computer literacy. Given that most of the IWB use experienced by learners is with their teachers using one, it is likely that the perception which learners have of the IWB may be influenced by the manner in which their teachers use the IWB. Their responses to this statement could also serve indirectly as an indication of their perception of teacher competence. These results suggest that, in general, learners perceive teachers to be competent and comfortable in their use of the IWBs, and that they perceive IWBs to be reliable and easy to use.

8.2.2 Do the teachers and learners agree on this?

The majority of the learners (63,8%) indicated that their teachers who have IWBs seem to know how to use them properly. A small percentage (14,4%) disagreed or strongly disagreed with this statement. Teachers were divided in their opinions of the learners' perceptions.

Consistent with the opinions they expressed in regard to teacher competent, the majority of the learners (68,8%) indicated that their teachers who have IWBs are comfortable using them. A small percentage (11,1%) disagreed or strongly disagreed with this statement. Teachers were once again divided in their opinions of the learners' perceptions of their own, personal use of the IWBS. Seven of the fifteen (46,7%) agreed or strongly agreed that the learners believe them to be comfortable using the IWB.

The majority of learners (67,6%) and teachers (66,7%) disagreed or disagreed strongly with the statement that IWBs often break down and this wastes time. The majority of learners (59,4%) disagreed or strongly disagreed with the statement that IWBs are difficult to use, and the majority of teachers (80%) agreed or strongly disagreed with the statement that learners think that IWBs are difficult to use. The perception of the learners may be a function of their own technological skill

and knowledge, and it may be influenced by the manner in which their teachers use the IWB. These results suggest that learners perceive teachers to be competent in their use of the IWBs, and that their general opinion is more favourable than the teachers believe. Both learners and teachers appear to view the IWB in a favourable light as far as reliability is concerned.

8.3 Learners' perceptions of the impact the IWB has on their teachers and the manner in which they present lessons

Table 75 presents the breakdown of the learners' responses to the statements relating specifically to the teaching process. In each statement, the phrase which is of particular relevance to the theme is underlined and in bold font.

Table 75: Statements pertaining to the teaching process

	Statement	Agreement index ⩛
1	IWBs make it easy for the teacher to **repeat, re-explain, and summarise**.	Strongly disagree | Disagree | Neutral | Agree | Strongly agree
	IWBs make it **easy for me to repeat, re-explain, and summarise**.	Strongly disagree | Disagree | Neutral | Agree | Strongly agree
2	I think **teachers' lessons are better prepared and more organised** when they use an IWB.	Strongly disagree | Disagree | Neutral | Agree | Strongly agree
	My **lessons are better prepared and more organised** when I use an IWB.	Strongly disagree | Disagree | Neutral | Agree | Strongly agree
3	We get to **join in lessons more** when my teacher uses an IWB.	Strongly disagree | Disagree | Neutral | Agree | Strongly agree
	Learners get to **join in lessons more** when I use an IWB.	Strongly disagree | Disagree | Neutral | Agree | Strongly agree
4	Teachers **teach just the same with or without** an IWB.	Strongly disagree | Disagree | Neutral | Agree | Strongly agree
	I **teach just the same** with or without an IWB.	Strongly disagree | Disagree | Neutral | Agree | Strongly agree
5	Whether or not my teacher uses the IWB, it **makes no difference** to the lesson.	Strongly disagree | Disagree | Neutral | Agree | Strongly agree
	Whether or not I use the IWB, it **makes no difference** to the lesson.	Strongly disagree | Disagree | Neutral | Agree | Strongly agree

8.3.1 Analysis of the learners' responses

Table 75 indicates that the vast majority of learners (87,0%) agreed or strongly agreed with the statement "IWBs make it easy for the teacher to repeat, re-explain and summarise." Out of the 26 statements presented to the learners in the questionnaire, this was the statement with which the learners agreed most strongly.

The majority of learners (63,2%) agreed or strongly agreed with the statement "I think teachers' lessons are better prepared and more organised when they use an IWB." Most of the remaining learners were neutral in their opinion of the statement, and only 8,1% of the respondents disagreed or strongly disagreed.

Considering their own involvement in the lesson, 38,9% of the learners agreed or strongly agreed with the statement "We get to join in lessons more when my teacher uses an IWB.", while 26,4% of the learners disagreed or strongly disagreed with the statement and 34,8% were undecided.

With regard to the statements "Teachers teach just the same with or without an IWB." and "Whether or not my teacher uses the IWB, it makes no difference to the lesson.", the learners were almost equally divided in their opinions. There was marginal bias (too small to be evident in the graphic representation) towards agreeing with the former statement and a slight bias towards disagreeing with the latter statement.

In this set of results there seems to be a contradiction between how the learners responded to the statement "I think teachers' lessons are better prepared and more organised when they use an IWB." and their responses to the statement "Whether or not my teacher uses the IWB, it makes no difference to the lesson." It would seem that the group of learners (63,2%) who agreed that the lessons are better prepared and more organised, should disagree with this statement, because they believe that use of the IWB makes a positive difference. However, only 37,2% of the learners disagreed or strongly disagreed with this statement.

Similarly, the responses of the learners to the statement "Teachers teach just the same with or without an IWB." may seem to contradict their responses to the statement "I think teachers' lessons are better prepared and more organised when they use an IWB." It may be that the learners interpreted this statement to be referring to the teacher's actual presentation style, in which case the lessons with an IWB could certainly be better prepared and more organised, but the teaching style could be exactly the same as without an IWB.

The learners' responses to the last three statements in **Table 75** are more congruent with each other, given that one might expect the group of learners (38,8% of the respondents) who agree or

strongly agree with the statement "We get to join in lessons more when my teacher uses an IWB." should disagree or strongly disagree with the statements "Whether or not my teacher uses the IWB, it makes no difference to the lesson." and "Teachers teach just the same with or without an IWB."

Considering all of the statements in this group, the results indicate that learners perceive the IWB to have a positive impact on teaching. The majority of the learners agreed that the IWB makes it easy for the teacher to repeat, explain and summarise material, and that lessons are better prepared and more organised when the teacher uses an IWB. The data show that learners are divided in their opinions over whether or not the IWB makes a difference to the lesson and how a teacher teaches.

8.3.2 Do the teachers and learners agree on this?

The majority of teachers (66,7%) agreed or strongly agreed that learners were able to join in lessons more when an IWB was used. Learners were less convinced of this, with only 38,9% agreeing or strongly agreeing, and 34,8% undecided. The vast majority of learners (87,0%) and teachers (86,7%) agreed or strongly agreed that IWBs make it easier for the teacher to repeat, re-explain and summarise during lessons.

While the majority of the teachers (66,7%) disagreed or strongly disagreed with the statement that use of the IWB makes no difference to the lesson, the learners were divided in their opinions, and there was slight bias towards disagreeing or strongly disagreeing with the statement, with 37,2% of the learners indicating these opinions. Consistent with their opinions on the statement that use of the IWB makes no difference to the lesson, the majority of teachers (66,7%) disagreed or strongly disagreed with the fact that they teach just the same with or without an IWB. Learners were once again divided in their opinions, with a slight bias towards agreeing with the statement. The majority of learners (63,2%) agreed or strongly agreed that teachers' lessons are better prepared and more organised when they use an IWB. A smaller majority of the teachers (53,3%) concurred with the learners, indicating that they agreed or strongly agreed that their own, personal lessons were better prepared and more organised when they used an IWB.

These results indicate that teachers and learners perceive the IWB to have an impact on teaching. Learners are divided in their opinions over whether or not the IWB makes a difference to the lesson and how a teacher teaches. Teachers believe more strongly than learners that use of the IWB allows the learners to be more involved in the lesson. Both learners and teachers agree quite strongly that the IWB enables the teacher to repeat, explain and summarise material more easily. Learners believe more strongly than teachers that lessons are better prepared and more organised when the teacher uses an IWB.

8.4 Learners' perceptions of the impact of IWB use on interest levels

Table 76 presents the breakdown of the learners' responses to the statements relating specifically to the impact of IWBs on lesson interest. In each statement, the phrase which is of particular relevance to the theme is underlined and in bold font. As shown in the table, there were six statements which dealt with this particular theme, directly or indirectly.

Table 76: Statements pertaining to lesson interest

	Statement	Agreement index ⩛
1	IWBs make learning **more interesting and exciting**.	|....|....|....|....|....|...⩛|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	Learners believe that IWBs make learning **more interesting and exciting**.	|....|....|....|....|....|....|⩛...|....| Strongly disagree Disagree Neutral Agree Strongly agree
2	An IWB makes a lesson **more interesting** because the presentation of material is clearer.	|....|....|....|....|....|...⩛|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	An IWB makes a lesson **more interesting** because the presentation of material is clearer.	|....|....|....|....|....|....|..⩛.|....| Strongly disagree Disagree Neutral Agree Strongly agree
3	An IWB makes a lesson **more interesting** because the presentation of the material is more attractive.	|....|....|....|....|....|.⩛..|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	An IWB makes a lesson **more interesting** because the presentation of the material is more attractive.	|....|....|....|....|....|....|⩛...|....| Strongly disagree Disagree Neutral Agree Strongly agree
4	I **prefer lessons** which are taught with an IWB.	|....|....|....|....|....|⩛...|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	Learners prefer lessons which are taught with an IWB.	|....|....|....|....|....|....⩛....|....| Strongly disagree Disagree Neutral Agree Strongly agree
5	When my teacher uses the IWB, I find the lesson **more interesting**.	|....|....|....|....|....⩛....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	When I use the IWB, **learners find the lesson more interesting**.	|....|....|....|....|....|....|⩛...|....| Strongly disagree Disagree Neutral Agree Strongly agree
6	I dislike going out to the front to **use the IWB**.	|....|....|.⩛..|....|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	Learners dislike going out to the front to use the IWB.	|....|.⩛..|....|....|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree

8.4.1 Analysis of the learners' responses

Considering the four statements which directly address the issue of whether or not learners believe that use of an IWB makes a lesson more interesting, the results in **Table 76** indicate that a high percentage of learners (75,1%) agreed or strongly agreed with the statement "IWBs make learning more interesting and exciting." and, similarly, a high percentage of the learners (69,7%) agreed or strongly agreed with the statement "An IWB makes a lesson more interesting because the presentation of material is clearer." A high percentage of the learners (63,5%) also agreed or strongly agreed with the statement "An IWB makes a lesson more interesting because the presentation of the material is more attractive."

In view of the learners' strong positive response to the statement "IWBs make learning more interesting and exciting", it is perhaps surprising that only 51,6% of the learners agreed or strongly agreed with the statement, "When my teacher uses the IWB, I find the lesson more interesting". A significant percentage (36,5%) of the learners were non-committal, indicating that they felt neutral with regard to this statement. This may suggest that the learners regard the IWB technology itself as interesting and exciting, or that they recognise the potential for the IWB to make learning more interesting and exciting. They may see the IWB technology to be making the learning process more interesting and exciting, but they do not necessarily find lessons more interesting when an IWB is used. This may be as a result of the lesson content being uninteresting, or it may be that the learners find the teachers' use of the IWB does not make the lesson more interesting. Their responses may have been influenced by their perceptions of the teachers, rather than their perceptions of the board, although this is unlikely, given that they were not asked to consider specific teachers.

Considering the second of the indirect statements, **Table 76** indicates that a little more than half (53,8%) of the learners agreed or strongly agreed with the statement "I prefer lessons which are taught with an IWB." A relatively high percentage of the learners (39,5%) were non-committal in this regard, and only 6,7% of the respondents disagreed or strongly disagreed with the statement.

The majority of learners (63,8%) disagreed or strongly disagreed with the statement that they dislike going out to the front of the class to use the IWB, which suggests that they enjoy using the IWB. A very small percentage of the respondents (5,9%) indicated that they agreed or agreed strongly with the statement "I dislike going out to the front to use the IWB." This suggests that teachers do need to be aware of the fact that some learners prefer not to use the IWB in front of their fellow learners. This may be as a result of a fear of being the centre of attention, rather than an aversion to using the IWB itself. Further investigation would be required to ascertain what the aversion to IWB use should be attributed to.

Considering the learners' responses to all six statements, these results suggest that learners prefer lessons which are taught with an IWB, that they find lessons more exciting and more interesting when the teacher uses the IWB, and that they are not averse to using the IWB.

8.4.2 Do the teachers and learners agree on this?

A high percentage of learners (75,1%) agreed or strongly agreed with the statement that IWBs make learning more interesting and exciting. The teachers who participated in this study recognised this fact, and the results of the questionnaire indicated that all except one of the teachers who responded agreed or strongly agreed that learners believe that IWBs make learning more interesting and exciting. One teacher did not respond to this statement.

In view of the learners' responses to Statement 5, it is perhaps surprising that only half of the learners (51,6%) agreed or strongly agreed that they find the lesson more interesting and exciting when the teacher uses the IWB. A significant percentage (36,5%) of the learners were non-committal, indicating that they neither agreed nor disagreed with the statement. The teachers' responses to this statement were consistent with their responses to Statement 5.

Just more than half (53,8%) of the learners indicated that they prefer lessons which are taught with an IWB. A relatively large proportion of the learners (39,5%) were non-committal. Only 6,7% disagreed or disagreed strongly with the statement. Thirteen of the fifteen teachers agreed that learners prefer lessons which are taught with an IWB.

The majority of learners (63,8%) disagreed or strongly disagreed with the statement that they dislike going out to the front of the class to use the IWB. Thirteen of the fifteen teachers disagreed or strongly disagreed with the statement. This suggests that learners enjoy using the IWB, and that teachers recognise this.

These results indicate that learners find a lesson more exciting and more interesting when the teacher uses the IWB. Learners indicate a preference for lessons where the IWB is used, although this preference is perhaps not as strong as teachers perceive it to be. Learners are not averse to using the IWB, and teachers recognise this.

8.5 Learners' perceptions of the impact of IWB use on presentation

Table 77, which follows, presents the breakdown of the learners' responses to the statements relating specifically to the presentation of material during a lesson. In each statement, the phrase which is of particular relevance to the theme is underlined and in bold font.

Table 77: Statements pertaining to presentation

	Statement	Agreement index ⩛
1	I think IWBs make the teacher's **drawings and diagrams easier to see**.	|. . . .|. . . .|. . . .|. . . .|. . . .|. . .⩛|. . . .|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree
	IWBs make **my drawings and diagrams easier to see**.	|. . . .|. . . .|. . . .|. . . .|. . . .|. . .⩛|. . . .|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree
2	An IWB makes a lesson more interesting because **the presentation of material is clearer**.	|. . . .|. . . .|. . . .|. . . .|. . . .|. . .⩛|. . . .|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree
	An IWB makes a lesson more interesting because **the presentation of material is clearer**.	|. . . .|. . . .|. . . .|. . . .|. . . .|. . . .|. .⩛.|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree
3	An IWB makes a lesson more interesting because **the presentation of the material is more attractive**.	|. . . .|. . . .|. . . .|. . . .|. . . .|.⩛. .|. . . .|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree
	An IWB makes a lesson more interesting because **the presentation of the material is more attractive**.	|. . . .|. . . .|. . . .|. . . .|. . . .|. . . .|⩛. . .|. . . .| Strongly disagree Disagree Neutral Agree Strongly agree

8.5.1 Analysis of the learners' responses

The results presented in **Table 77** indicate that a large majority of the learners (71,9%) agreed or strongly agreed with the statement "I think IWBs make the teacher's drawings and diagrams easier to see." and a similarly high percentage of the learners (69,7%) agreed or strongly agreed with the statement, "An IWB makes a lesson more interesting because the presentation of material is clearer." Although the index of agreement for the statement "An IWB makes a lesson more interesting because the presentation of the material is more attractive." was lower, the majority of the learners (63,5%) agreed or strongly agreed with this statement.

For all three of these statements the mean index of agreement was strong, placing them in the five statements with which the learners agreed most strongly. The responses to the three statements together suggest that learners perceive the IWB to have a significant, positive impact on the presentation of material during the lesson. They agree that it enhances the clarity and attractiveness of the material, and makes the drawings and diagrams easier to see. Given the wording of the statements, the learners' responses suggest that the improved presentation makes the lessons more interesting for the learners.

8.5.2 Do the teachers and learners agree on this?

A large number of learners (69,7%) agreed or strongly agreed with the statement that an IWB makes a lesson more interesting because the presentation of material is clearer. Fourteen of the fifteen teachers (93,3%) agreed or strongly agreed with the statement.

A similarly large proportion of the learners (63,5%) agreed or strongly agreed with the statement that an IWB makes a lesson more interesting because the presentation of the material is more attractive. Thirteen of the fifteen teachers (86,7%) agreed or strongly agreed with the statement. A relatively small percentage of learners (10,0%), and one teacher, disagreed with this statement.

A large majority of the learners (71,9%) agreed with the statement that IWBs make the teacher's drawings and diagrams easier to see. Ten of the fifteen teachers (66,7%) agreed or agreed strongly with the statement that IWBs make their own, personal drawings and diagrams easier to see, while four were undecided and one disagreed with the statement.

These results indicate that learners and teachers perceive the IWB to have a positive impact on the presentational aspects of the lesson, enhancing the clarity and attractiveness of the material, as well as making the drawings and diagrams easier to see.

8.6 Learners' perceptions of the impact of IWB use on lesson pace

With regard to the impact of IWB use on lesson pace, the learners were presented with three statements, which are listed in **Table 78**. The first two statements were formulated as neutral statements, while the third, "I think teachers go too fast when they use an IWB." was worded to create a negative association with an increase in pace, resulting from use of the IWB.

The table shows the agreement index calculated using the learners' responses to these statements. In each statement, the phrase which is of particular relevance to the theme is underlined and in bold font. This formatting (to create emphasis) was not present in the questionnaires. In each case, the index calculated from the teachers' responses to the equivalent statement is given in the second row aligned with the statement number.

Table 78: Statements pertaining to the pace of lessons

	Statement	Agreement index ⮟
1	When my teacher uses an IWB, we move through the material at a **faster pace** than without it.	|....|....|....|....|.⮟..|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	When I use an IWB, we move through the material at a **faster pace** than without it.	|....|....|....|....|....⮟....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
2	When my teacher uses an IWB, we move through the material at a **slower pace** than without it.	|....|....|....|.⮟..|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	When I use an IWB, we move through the material at a **slower pace** than without it.	|....|....|....⮟....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
3	I think **teachers go too fast** when they use an IWB.	|....|....|....⮟....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	Learners think we go too fast when I use the IWB.	|....|....|..⮟.|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree

8.6.1 Analysis of the learners' responses

Table 78 indicates that 34,5% of the learners agreed or strongly agreed, with the statement "When my teacher uses an IWB, we move through the material at a faster pace than without it.", while 43,9% were neutral in their opinion and 21,5% disagreed or strongly disagreed with the statement.

Approximately half of the learners (50,6%) disagreed or strongly disagreed with the statement "When my teacher uses an IWB, we move through the material at a slower pace than without it." while 28,3% of the learners were neutral and 21,0% of them agreed or strongly agreed with the statement.

If one considers the responses to these two statements, which are diametrically opposed to each other, and which were placed far apart in the questionnaire, analysis of the data suggests that the same learners (bar one) who disagreed or strongly disagreed with the first statement, agreed or strongly agreed with the second statement, which is logical. If it is assumed that the learners who agreed or strongly agreed with the first statement logically disagreed or strongly disagreed with the second, then the results suggest that 36 learners (16,1%) who were neutral in regard to the statement "When my teacher uses an IWB, we move through the material at a faster pace than without it." disagreed or strongly disagreed with the statement "When my teacher uses an IWB, we move through the material at a slower pace than without it." This suggests that these learners,

while uncertain as to whether or not IWB use increases the pace of the lesson, believe that it certainly does not slow the lesson down. The data suggest that this group of learners do not perceive a significant change in the pace of the lesson, but they are inclined to believe that if the IWB does have any effect, it is to speed up the lesson, rather than slow it down.

The results in **Table 78** indicate that the majority of learners (58,6%) disagreed or strongly disagreed with the statement "I think teachers go too fast when they use an IWB." Of the remaining learners, 32,0% were undecided and only 9,5% of the learners agreed or strongly agreed with the statement.

The responses to these three statements suggest that the majority of the learners are aware of a change in the pace of the lesson when an IWB is used. Most of the learners who recognise a change in lesson pace suggest that the pace of the lesson increases when an IWB is used. The data suggest that this increase in pace is perceived by the learners to be relatively small and, perhaps to most of them, quite insignificant. The results also suggest that the majority of learners do not think that any increase in pace which does occur is detrimental to the learning process.

8.6.2 Do the teachers and learners agree on this?

Approximately half of the learners (50,6%) and half of the teachers (53,3%) disagreed with the statement that the class moves through material at a slower pace with the IWB, than without it, while 21,0% of the learners and 26,7% of the teachers agreed or strongly agreed with the statement.

The majority of learners (58,6%) disagreed or strongly disagreed with the statement that teachers go too fast when they use an IWB and 32,0% were undecided. Ten of the fifteen teachers (66,7%) disagreed or strongly disagreed with the statement that learners think the class goes too fast when using an IWB.

These results suggest that teachers are aware of an increase in the pace of the lesson when an IWB is used. This increase in pace is also recognised by the learners, but to a lesser extent. It appears that the majority of learners do not think that the increase in pace is detrimental to the learning process.

8.7 Learners' perceptions of the impact of IWB use on learning

Table 79 presents the breakdown of the learners' responses to the statements relating to specific aspects of the learning process, namely understanding and retention. In each statement, the phrase which is of particular relevance to the theme is underlined and in bold font.

Table 79: Statements pertaining to the learning process

	Statement	Agreement index ⩛
1	I **learn more** when my teacher uses an IWB.	|....|....|....|....|....⩛....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	The learners **learn more** when I use an IWB.	|....|....|....|....|....|...⩛|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
2	It is **easier to understand the work** when my teacher uses an IWB.	|....|....|....|....|...⩛|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	Learners find it **easier to understand the work** when I use an IWB.	|....|....|....|....|....|.⩛..|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
3	I find it **easier to remember what I have learnt** during a lesson if my teacher used the IWB.	|....|....|....|....|..⩛.|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	Learners find it **easier to remember what they have learnt** during a lesson if I used the IWB.	|....|....|....|....|....⩛....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree

8.7.1 Analysis of the learners' responses

Table 79 indicates that 47,3% of the learners agreed or strongly agreed with the statement "I learn more when my teacher uses an IWB.", while 48,7% indicated that their feelings were neutral. Only 4,0% of the learners disagreed with the statement.

Approximately half (49,3%) of the learners were also undecided in their opinion of the statement "It is easier to understand the work when my teacher uses an IWB.", while 42,0% agreed or strongly agreed that they do find it easier.

When considering the statement, "I find it easier to remember what I have learnt during a lesson if my teacher used the IWB.", 37,0% of the learners agreed or strongly agreed, while 44,6% of them were undecided.

With regard to each of these three statements, nearly half of the learners were non-committal and chose to remain neutral in their opinion of the statement. In each case the majority of the remaining learners agreed or strongly agreed with the statement. These results suggest that the majority of the learners do not perceive the IWB to have a negative effect on their learning.

A significant percentage of the learners perceive the IWB to have a positive impact on the cognitive aspects of the learning process in broad terms, agreeing that it helps them "learn more". When asked to consider more specific aspects of the learning process, the learners appear to be less certain of the positive impact of the IWB. The learners' responses suggest that they believe the IWB helps them understand their work more easily. They are less certain of their belief that IWB use helps them more easily remember the work covered during lessons.

8.7.2 Do the teachers and learners agree on this?

The majority of teachers (73,3%) agreed or strongly agreed that learners learn more when an IWB is used. Learners were less convinced of this fact, with 47,3% of them agreeing or strongly agreeing, while 48,7% were undecided.

Approximately half (49,3%) of the learners were undecided as to whether they find it easier to understand the work when the teacher uses an IWB, while 42,0% agreed or strongly agreed that they do find it easier. The majority of the teachers (60,0%) agreed or strongly agreed that learners find it easier to understand the work when an IWB is used.

When considering whether the use of an IWB makes it easier to remember what they have learnt during a lesson, 37,0% of the learners agreed or strongly agreed that it does, while 44,6% of them were undecided. Responses from the teachers indicated that 46,7% agreed or strongly agreed that learners find it easier to remember what they have learnt when an IWB is used, while 40,0% were undecided.

These results suggest that both learners and teachers perceive the IWB to have a positive impact on the cognitive aspects of the learning process: that it helps the learners learn more, learn more easily, and more easily remember the work covered during lessons. Teachers were more convinced of this than the learners. A significant number of learners and teachers appeared uncertain as to whether or not the IWB is having a positive impact on the learning process. A comparatively small number of learners and teachers did not agree that the IWB has a positive impact on the learning process.

8.8 Learners' perceptions of the impact of IWB use on behaviour, attentiveness and motivation

Table 80 presents the breakdown of the learners' responses to the statements relating specifically to the concentration and behaviour of the learners. In each statement, the phrase which is of particular relevance to the theme is underlined and in bold font.

Table 80: Statements pertaining to the concentration and behaviour of the learners

	Statement	Agreement index ⮟
1	I **<u>concentrate better</u>** in class when an IWB is used.	|....|....|....|....|.⮟..|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	Learners **<u>concentrate better</u>** in class when an IWB is used.	|....|....|....|....|....|..⮟.|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
2	I think **<u>learners behave better</u>** in lessons with IWBs.	|....|....|....|....⮟....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	<u>Learners behave better</u> in lessons with IWBs.	|....|....|....|....|....|⮟...|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
3	**<u>My behaviour during the lesson is better</u>** if my teacher uses the IWB.	|....|....|....|....⮟....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	Learners' **<u>behaviour during the lesson is better</u>** when I use the IWB.	|....|....|....|....|....|⮟...|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
4	**<u>I would work harder</u>** if my teacher used the IWB **<u>more often</u>**.	|....|....|....|...⮟|....|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree
	<u>Learners would work harder</u> if I used the IWB **<u>more often</u>**.	|....|....|....|....|..⮟.|....|....|....| Strongly disagree Disagree Neutral Agree Strongly agree

8.8.1 Analysis of the learners' responses

Three of the statements shown in **Table 80** refer to personal behaviour, concentration and work ethic, while the fourth statement refers to general learner behaviour. The results indicate that with regard to the three more personal statements, approximately half of the learners chose to remain neutral. When considering the fourth statement, regarding general learners' behaviour, the percentage of neutral learners dropped somewhat.

Exactly half of the learners were neutral in their opinions of the statement "I concentrate better in class when an IWB is used.", while 32,5% agreed or strongly agreed with the statement and 17,6% disagreed or disagreed strongly with the statement.

Considering their own, personal behaviour, 27,2% of learners agreed or strongly agreed with the statement, "My behaviour during the lesson is better if my teacher uses the IWB." 47,8% of the learners were neutral and a significant number (24,6%) disagreed, suggesting that they believe the use of an IWB has no impact on their behaviour, or that it may be worse when an IWB is used.

Approximately half (50,2%) of the learners remained neutral in their opinion of the statement "I would work harder if my teacher used the IWB more often." Most of the remaining learners (29,2% of the whole group) disagreed or strongly disagreed with the statement, suggesting that an increase in the frequency of IWB use would not have a significant, positive impact on the manner in which the learners approach their work.

Considering general learner behaviour, 29,7% of the learners agreed or strongly agreed with the statement "I think learners behave better in lessons with IWBs.", while 28,8% disagreed or strongly disagreed, and 41,4% were neutral in this regard.

Where concentration and behaviour were considered, approximately half of the learners were neutral, and the remainder were divided in their opinions, expressing both agreement and disagreement with various statements on these issues. The results suggest that learners believe that the IWB may help them to concentrate better in class, but this impact is recognised by a minority of the learners. The results suggest that learners do not perceive the IWB to have a significant impact on their personal concentration and behaviour, nor do they perceive the IWB to have a significant impact on the behaviour of their classmates. The results suggest that increased use of the IWB would not have a significantly positive impact on productivity in the classroom.

8.8.2 Do the teachers and learners agree on this?

The majority of teachers (73,3%) agreed or agreed strongly that learners concentrate better in class when an IWB is used. Learners were less convinced, with half of the learners (50,0%) undecided, while 32,5% agreed or strongly agreed that they do concentrate better when an IWB is used.

With regard to the behaviour of learners during lessons, 53,3% of the teachers agreed or strongly agreed that the behaviour of the learners is better when an IWB is used. Two of the teachers were undecided, and two disagreed with the statement. Considering their own, personal behaviour, 27,2% of learners agreed or strongly agreed that their own behaviour is better when an IWB is

used, and 47,8% were neutral in this regard. A significant number (24,6%) disagreed, suggesting that they believe the use of an IWB has no impact on their behaviour, or that it may be worse when an IWB is used.

Considering learner behaviour more generally, 29,7% of the learners agreed or strongly agreed that learners behave better in lessons with IWBs, while 28,8% disagreed or strongly disagreed, and 41,4% were neutral. Consistent with their responses to the other statement on learner behaviour, teachers were more positive, with eight of the fifteen (53,3%) agreeing or strongly agreeing that learners behave better in lessons with IWBs, and only two disagreeing.

Approximately half (50,2%) of the learners were undecided as to whether or not they would work harder if their teacher used the IWB more often. Most of the remaining learners (29,2% of the whole group) disagreed or strongly disagreed with the statement. The majority of the teachers (66,7%) were undecided, with four of the fifteen (26,7%) indicating that they agreed or strongly agreed that the learners would work harder if the IWB were used more often, and one indicating that he/she disagreed.

Where concentration and behaviour were considered, approximately half of the learners were neutral in their opinions, and the remainder were divided in expressing both agreement and disagreement on this issue. These results suggest that learners do not perceive the IWB to have a significant impact on their personal concentration, behaviour and productivity, nor do they perceive the IWB to have a significant impact on the behaviour of their classmates.

Teachers expressed more favourable opinions on the impact of the IWB on learner behaviour and concentration, indicating that they believed the learners' concentration and behaviour were better when an IWB was used. The majority of the teachers were uncertain as to whether increased use of the IWB would lead to learners working harder.

8.9 Chapter eight in summary

This chapter investigates the impact of IWBs as perceived by the learners, and compares the learners' perspective with that of the teachers. The feedback received from the learners is analysed with a view to exploring the themes of teacher competence in IWB use, the impact of the IWB on the teaching process, lesson interest, presentation, the pace of the lesson, the learning process itself and finally, learner concentration and behaviour. Chapter 9, the final chapter of this research report, presents a discussion of the findings, together with the conclusions and various recommendations which stem from analysis of the findings.

CHAPTER 9
DISCUSSION AND RECOMMENDATIONS

Research Questions

Theme 1
The extent, frequency and nature of IWB use in classrooms

1.1 How are IWBs distributed across the school, and how frequently do learners encounter them?

1.2 How frequently are the existing IWBs being used by the teachers and what factors influence their frequency of use?

1.3 What features of IWBs are being used by the teachers, and how frequently?

1.4 What resources and equipment do teachers use in combination with IWBs?

1.5 How frequently are the existing IWBs being used by the learners and what features are they using?

Theme 2
The impact of IWBs on teaching and learning as perceived by teachers

2.1 What is the general attitude of teachers towards IWBs?

2.2 What attitude do teachers perceive the learners to have with regard to the IWB?

2.3 What impact do teachers perceive IWB use to have on learners' behaviour, attentiveness, motivation and productivity?

2.4 What impact do teachers perceive IWB use to have on the learning process, specifically with regard to their effect on learners' understanding, retention and performance?

2.5 What impact do teachers perceive the IWB to have on lesson planning, preparation and resource development?

2.6 What impact do teachers perceive the IWB to have on presentation, teaching styles and classroom management?

continued/...

.../continued

Theme 3
The challenges and needs of teachers with regard to IWB use

3.1 How competent do teachers using IWBs perceive themselves to be in their use of the IWBs, and how do they believe the learners perceive their use of the IWB?

3.2 What factors do teachers believe influence the effectiveness of their use of IWBs?

3.3 What formal training did teachers receive in the use of IWBs, and how effective was this training perceived to be?

3.4 Do teachers feel the need to improve their use of IWBs and, if so, how do they believe they could best achieve this?

3.5 What perceptions do teachers have of the resources available for use with IWBs?

3.6 How do teachers feel about integrating ICT in the form of the IWB into their teaching, as opposed to using a data projector alone, or making use of computers in a dedicated computer laboratory?

3.7 What limitations, technical or otherwise, do teachers perceive to be preventing them from using IWBs more effectively?

Theme 4
The impact of IWBs as perceived by learners

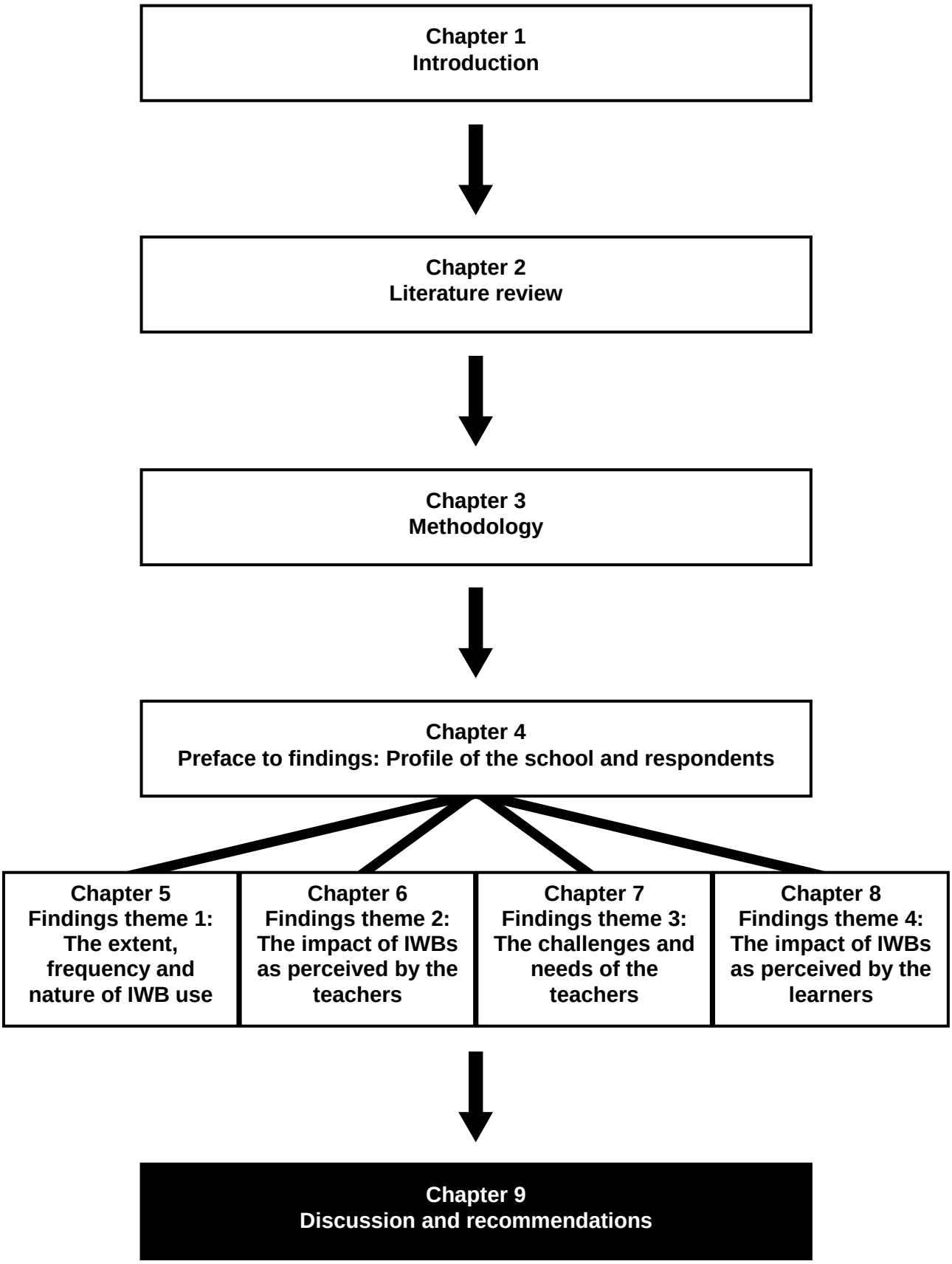
4.1 What is the learners' perception of the level of competency in IWB use amongst teachers?

4.2 What impact do learners perceive the IWB to have on their teachers and the manner in which they facilitate lessons, specifically with regard to the pace of lessons, the teacher's ability to capture and hold their attention, and the presentation and aesthetic appeal of the teacher's audiovisual aids?

4.3 What impact do learners perceive use of the IWB to have on the learning process, specifically on their understanding, retention and productivity?

4.4 What impact do learners perceive use of the IWB to have on their personal behaviour, attentiveness and motivation, and the behaviour of their fellow learners?

Outline of dissertation



Chapter 9: Discussion and recommendations

9.1 Introduction

In this chapter the key findings of this study are discussed and compared with the findings reported in other studies of a similar nature, most of which appear to have been conducted in schools in the United Kingdom. The implications of this study are presented, including suggestions of what potential the findings may hold for informing future studies and decision-making processes, both at school level and, more broadly, within the context of South African education. An ICT adoption strategy is proposed, specifically for South African schools that may be considering investing in IWBs, bearing in mind the financial implications of such an investment in the current economic climate. The ICT adoption strategy is geared towards preparing teachers to embrace IWB technology in the longer term, if the school believes it will enhance the teaching-learning experience.

9.2 Theme one: The extent, frequency and nature of IWB use

9.2.1 How are IWBs distributed across the school, and how frequently do learners encounter them?

The results of this study indicate that, at the time this study was conducted, 42,0% of the regular teaching venues in the school were equipped with IWBs, providing 38,2% of the staff in the school with permanent access to an IWB in all of their lessons. This prevalence of IWBs was consistent with the responses from the learners, which revealed that, on average, a learner encounters an IWB in 41,9(±12,2)% of his lessons.

The results indicated that every senior learner (in grades 10, 11 or 12), who participated in the study, encountered an IWB in at least one of his seven subjects, and in at most six of his subjects. Furthermore, a senior learner was *most* likely to encounter an IWB in three of his seven subjects. Every junior learner (in grades 8 or 9) who participated in the study encountered an IWB in at least two of his twelve subjects, and in at most seven of his subjects. Furthermore a junior learner was *most* likely to encounter an IWB in five of his twelve subjects. The literature reviewed for this study did not appear to provide comparable data on the frequency with which learners encounter IWBs during the course of their school day.

All, except one, of the 23 teachers who completed a questionnaire in this study indicated that they believe that the school's ICT resources are *better* than those of other South African high schools. At the time this study was conducted, the ratio of learners to IWBs at the school was approximately

26:1. By comparison, in their report on London schools, in which IWBs were being deployed, Moss et al. (2007) reported ratios of learners to IWBs ranging from more than 60:1 down to approximately 40:1. They reported, perhaps not surprisingly, that there appeared to be a link between the teachers' perceptions of ICT provision at their schools, and the number of IWBs at the school. At schools where the majority of the teachers indicated that their ICT provision was *not* as good as other schools, the mean ratio of learners to IWBs was greater than 60:1. At schools where the majority of the teachers indicated that they believed their ICT provision was the same as other schools, the learner to IWB ratio was between 50:1 and 60:1 and at schools where the majority of teachers believed that the ICT provision was *better* than most schools, the mean ratio of learners to IWBs was between 40:1 and 50:1.

In the school which was the focus of this study, the subject department with the most IWBs was the Mathematics department, which had seven units installed, and the reason most commonly recognised by the staff for this being the case, was that the curriculum covered in Mathematics makes *this* the department most likely to benefit from the use of IWBs. The Mathematics department (with seven IWBs) and the Geography departments (with four IWBs), were the only subject departments where every teacher in the department had permanent access to an IWB. The other subject departments, where more than one IWB was present, were the Physical Sciences and Life Sciences departments, each of which had three IWBs. In each of these departments, one teacher was without an IWB for all or some of his lessons.

In their study of schools in London, Moss et al. (2007) considered IWB prevalence in the UK's three key National Curriculum subject departments, namely Science, Mathematics and English. The authors reported that 25% of the IWBs in use were in Science departments (a mean of 4,68 per school), 22% of the IWBs in use were in Mathematics departments (a mean of 4,25 per school) and 15% of the IWBs in use were in English departments (a mean of 2,81 per school). They reported that the majority of the remaining IWBs (38% of all IWBs) were in use in ICT and Design and Technology departments. In the schools where there was at least one IWB in the respective key National Curriculum subject departments, the number of IWBs per subject was generally higher than the general mean (for all schools in the study). In these schools, the mean prevalence of IWBs in Mathematics departments was 5,3 IWBs per school. In the Science departments the mean number of IWBs was 5,8 and in the English departments the mean number of IWBs was 3,8. Moss et al. reported that schools tended to have more Science classrooms than Mathematics classrooms, and so it may have been that the percentage of Science classrooms equipped with IWBs was lower than the percentage of Mathematics classrooms. In comparison, a Becta survey, also conducted in the UK, reported that Mathematics departments have approximately 30% more IWBs than Science and English Departments (Becta, as cited in Moss et al., 2007, p. 101).

With regard to the reasons, recognised by teachers, for IWBs being more prevalent in particular subject departments compared to others, this study found that the most popular reason, which accounted for 39,3% of the responses, was that the curriculum covered by the particular subject department made this the department most likely to benefit from the use of IWBs. The second most popular reason, which accounted for 21,4% of the responses, was that the staff in the particular subject department were best able to make good use of the IWBs. The other two reasons that attracted a significant number of responses (14,3% each) were that the department in question was the first to invest in IWBs, and the teachers in the department were skilled in their use of ICT and showed initiative prior to the installation of IWBs.

In this study, the subject department which the majority of teachers (correctly) believed to have the most IWBs was the Mathematics department, and the most popular reason (accounting for 32,1% of all responses), indicated by teachers, was that the Mathematics curriculum makes it the subject most likely to benefit from the use of IWBs. A further 14,3% of the responses suggested that the Mathematics department had the most IWBs because the staff in the department were best able to make good use of the IWBs and another 14,3% of the responses suggested that it was because this was the first subject department to invest in IWBs. A total of 14,3% of the responses indicated that the Physical Sciences department had the most IWBs because the Science curriculum makes *it* the subject most likely to benefit from the use of IWBs.

Comparing these findings to those of other studies, in the schools which were the subject of the study conducted by Moss et al. (2007), the most common reason indicated for a particular subject department receiving IWBs was that the curriculum in that particular subject was most likely to benefit from the use of IWBs. This was the reason given by 27% of the schools involved in the survey. These authors reported that the teachers managing the integration of IWBs in the schools in their study tended to be of the opinion that IWBs are best suited to the Mathematics and Science curriculum, and that having IWBs was more important in Mathematics and Science, than in English.

The data recorded by Moss et al. (2007) also implied that some Mathematics and Science departments were now equipped with IWBs in every classroom, and that, of the three key curriculum subject departments, English was the *least* well equipped. These authors also reported that 16% of the schools indicated that preference was given to fully equipping a subject department that was already partially equipped, and 16% indicated that they wanted to enhance an already successful department. In 15% of the schools it was believed that staff in the subject that was given preference would make the best use of the IWBs.

9.2.2 How frequently are the existing IWBs being used by the teachers and what factors influence their frequency of use?

Feedback from the learners and the teachers suggested that overall (across all subjects where an IWB is present) IWBs are typically used by the teacher in *some* lessons or in *most* lessons. Further analysis of the data indicated that the responses received from teachers were reasonably consistent with the responses received from the learners. With regard to general use of IWBs across all subjects (with IWBs) in this study, the teachers' responses (n=15) yielded a frequency index of 2,53, which was very similar to the index of 2,49 calculated from the learners' responses (n=222 responses, based on 797 classes). Amongst the teachers, 60,0% of the respondents reported use of the IWB in *most* lessons or in *every* lesson, whilst amongst the learners, 55,0% of the responses indicated that the IWB was used in *most* lessons or in *every* lesson. The findings of this study were compared with the large scale survey conducted by Moss et al. (2007) in London schools. The frequency of use in certain subjects in this study is comparable with that reported by Moss et al., but, overall, the use of IWBs in this study is lower.

Moss et al (2007) reported findings based on data collected from subject department heads, subject teachers and learners. Amongst the subject department heads, 57,6% of the respondents reported use of the IWB in *most* lessons or *every* lesson, and the data yielded a frequency index of 2,62. Amongst the subject teachers (n=113), 67,3% of the respondents reported the equivalent frequency of use, which yielded a higher frequency index of 2,94.

In this study the learners' responses were used to evaluate the frequency of use in each subject, and the frequency index ranged from 1,20 (for French) to 3,23 (for Information Technology). In English, the frequency index was 2,97, in Mathematics it was 3,01, in the Physical Sciences department it was 1,31, and in the Life Sciences department it was 2,38.

In this study, any comparison between subject departments had to take into consideration the number of IWBs present and the number of teachers who had access to the IWB. Learners indicated that the subject department in which the teacher was making the most frequent use of the IWB was the Information Technology department, which was equipped with a single IWB, used by one teacher. Analysis of the data revealed that 81,3% of the respondent learners reported that this teacher uses this IWB in *most* lessons or in *every* lesson.

The next most frequently used IWBs were those in Mathematics, English and Geography classes, where frequency of use was comparable in each case, with between 70% and 75% of the learners indicating that the IWBs in these subject departments were used in *most* lessons or in *every* lesson. Cognisance needs to be taken of the fact that in the English Department this represents use of an individual IWB by a single teacher. In the Mathematics Department, this represents the

use of seven IWBs by eight different teachers and, in the Geography Department, this represents the use of four IWBs by five different teachers.

The use of the three IWBs in Life Sciences was somewhat lower, with learners indicating that they are generally used in *some* lessons. With regard to the remaining IWBs, the learners reported the frequency of use of the IWB in French to be the lowest of all subject departments, with similarly low frequencies reported in Life Orientation and Physical Sciences, where the IWBs are hardly ever used.

As a comparison, the results reported by Moss et al. (2007) in their study of UK schools were considered. Their report focussed on the frequency of IWB use in the three key curriculum subjects: English, Mathematics and Science. Their data was collected from subject department heads, teachers and learners. Moss et al. (2007) indicate that the frequency of IWB use reported by subject department heads may not be representative of actual usage, having been skewed by the fact that the respondents may have observed relatively few lessons. Analysis of the learner responses reported by Moss et al. (2007) yielded frequency indices of 2,20 for English, 3,40 for Mathematics and 2,81 for Science, as well as an overall frequency index of 2,80 for these three subjects. In this study, the equivalent frequency index was 2,50 including Physical Sciences and Life Sciences.

Comparing the data in this study, with the data collected by Moss et al (2007), the subject in which the frequency of IWB use in the two studies was *most* similar, was Mathematics. Moss et al. found that for Mathematics, 63% of the subject heads and 86% of learners reported use of the IWB in *most* lessons or in *every* lesson. In this study 72% of the learners reported that in Mathematics the IWBs are used in *most* lessons or in *every* lesson.

One cannot justify a comparison of the use of the single IWB present in the English department in this study, with the frequency of use reported by 131 different respondents in the study by conducted by Moss et al. (2007). In this study, 75% of learners reported that the English teacher uses the IWB in *most* lessons or in *every* lesson and this yielded a frequency index of 2,97. Suffice to say that the teacher was using his IWB more frequently that average English teacher in the London study (where the mean frequency of use equated to a frequency index of 2,40), where 50% of learners reported that IWBs present in English classes were used in *most* lessons or in *every* lesson.

In the study conducted by Moss et al. (2007), 61% of subject heads reported the use of IWBs in Science in *most* lessons or in *every* lesson (frequency index 2,67) and 67% of the learners reported similar usage frequencies (frequency index 2,81). By comparison, in this study the

learners' responses yielded a frequency index of 2,38 for the IWBs in Life Sciences (44% reported use in *most* lessons or in *every* lesson). The data collected from learners yielded a frequency index of 1,31 for Physical Sciences, with only 21% of the learners reporting use of IWBs in *most* lessons or in *every* lesson.

The results indicate that the factors which teachers believe are most influential in *increasing* the frequency with which they use their IWBs are having a positive attitude towards IWB use, the perception that the learners feel positive about IWB use, improved attentiveness and motivation amongst learners when the IWB is used, the teacher's confidence in his/her ability to use the IWB and the ability to save lesson material and then refer to or reuse material from previous lessons.

The factors which teachers identified as most influential in *decreasing* the frequency with which they use their IWBs are a lack of confidence in one's ability to use the IWB effectively and a lack of suitable IWB resources. Elsewhere, lack of training and lack of confidence were highlighted as most influential, followed by technical issues relating to the IWB and the computer.

The results suggest that the factors which teachers believe have the strongest *positive* influence on the frequency with which they use IWBs are their own attitude and the perception that learners feel positive about the use of IWBs. Teachers indicated that they were also strongly influence by improved attentiveness amongst learners and improved motivation amongst learners. The factors with the weakest positive influence appear to be improved learner behaviour and good IWB resources.

When considering possible factors which prevent teachers from using their IWBs more frequently, two thirds of the teachers indicated that they believed their lack of training is an issue and, linked to this, just over half of the teachers indicated that their lack confidence in their personal ability to use the IWB is an issue. The other two significant issues were technical issues relating to the IWB (mentioned by nearly half of the teachers), and technical issues relating to their computers (mentioned by 40,0% of the teachers).

The factors which teachers indicated have the strongest *negative* influence on the frequency with which they use IWBs (by a significant margin) were their lack of confidence in their personal ability to use the IWB effectively and a lack of suitable IWB resources. In addition to these two factors, 60,0% of the teachers indicated that problems relating to alignment and orientation of the IWB have some influence and 40,0% of the teachers indicated that environmental factors, such as lighting, negatively influence their frequency of use of the IWBs. The vast majority of teachers indicated that a negative attitude on their part, or the perception that learners have a negative attitude towards the IWB, had *no* negative influence on the frequency with which they use the IWB.

The findings of this study are consistent with those reported by Jones (2004) in his review of literature dealing with barriers to the uptake of ICT by teachers. He reported that confidence and access to quality resources were major factors in determining the extent to which teachers engaged with ICT. He also found that the occurrence of technical faults, or the expectation that technical faults are likely to occur, tends to have a negative impact on a teacher's confidence, resulting in the teacher being more likely to avoid using ICT in the future.

9.2.3 What features of IWBs are being used by the teachers, and how frequently?

The only feature or aspect of IWB technology which more than half of the teachers in this study indicated they use in *most* lessons or in *every* lesson was "downloaded images or sounds". The profile of IWB use amongst the respondents in this study suggests that they are not taking advantage of the benefits particular to the IWB itself, but that most of the benefits of the technology which they recognise, *and* actually utilise regularly, stem from the use of the data projector. This is consistent with the findings of researchers in the UK (Moss et al., 2007) and in South Africa (Slay et al. 2008b).

Although 60% of the teachers with IWBs (nine out of fifteen respondents) indicated that they use their IWBs in *most* lessons or in *every* lesson, only one respondent indicated that he recalls content or saves IWB content in *most* lessons or in *every* lesson. The infrequent use of these features of IWB software is consistent with the fact that less than half of the teachers indicated that the ability to store and reuse material strongly influenced the frequency with which they used the IWB.

With regard to "revisiting materials", 40% of the respondents in this study indicated that they *frequently* revisit material, compared to 31% reported by Moss et al. (2007). Given that the teachers generally do not save IWB content, these results suggest that they are simply re-accessing old material that is stored on their computers, or on the network.

Elsewhere in the questionnaire, 20% of the teachers indicated that they annotate and save material in *most* lessons or in *every* lesson, compared to 32% reported by Moss et al. (2007), while only one of the fifteen respondents in this study indicated that he makes use of the feature "dragging or hiding labels or images", compared to 42% of teachers in the study conducted by Moss et al. (2007). Only two of the fifteen respondents in this study indicated that they make frequent use of the feature "using colour, shading and lighting", compared to 42% reported by Moss et al. and only two (13%) of the respondents in this study reported frequent use of "movement or animation", which is similar to the infrequent use reported by Moss et al., who found

that only 13% of the teachers involved in their study used movement or animation in most lessons or in every lesson.

9.2.4 What resources and equipment do teachers use in combination with IWBs?

In this study, the most popular resources used by teachers were downloaded images or sounds, which 62% of the respondents indicated they were using frequently. In the study conducted by Moss et al. (2007), only 34% of the respondents reported that they made frequent use of downloaded images or sounds, which made it the fourth most popular resource or feature.

After downloaded images and sounds, the next most popular resource amongst teachers in this study was "preloaded pages", which six (40%) of the teachers in this study reportedly access in *most* lessons or in *every* lesson. This frequency of use is similar to the use reported by Moss et al. (2007), who found that 44% of the teachers reported frequent use of preloaded pages as a resource.

Only two (13%) of the teachers in this study indicated that they were regularly using material downloaded from the school network, in spite of the fact that every respondent had a network connection in their classrooms. Moss et al. (2007) reported that 26% of the respondents regularly accessed material downloaded from the school network. The percentage of teachers who reported using the other resources frequently is comparably low in both of the studies.

The findings of this study suggest that, with regard to sourcing IWB resources, the trends amongst teachers are similar to those reported by Moss et al. (2007). The results indicate that, relatively speaking, teachers use their own resources most frequently, ahead of Internet websites, with resources created by a colleague and commercial software used least often.

The majority of the teachers (87%) reported that they have used resources they have created, with 73% reporting that they do so in *some* or *most* lessons, when they use the IWB. Similarly, 87% reported using Internet websites, with 67% reporting that they do so in *some* or *most* lessons, and 86% reported using resources created by a colleague, with 57% reporting that they do so in *some* or in *most* lessons. The majority of the teachers (80%) reported that they had use of commercial software, but only 54% reported doing so with any regularity.

In their study of London teachers, Moss et al. (2007) found that 78% of the teachers had created their own IWB resources, 64% had used Internet websites, 45% had used resources created by a colleague and 42% had used commercial software. The authors suggest that this indicates that, within subject departments, teachers' use of the IWB is generally taking place independently, and that there is not much in the way of collaboration and shared resource development. The authors

go on to say that this is to be expected, given the stage of the IWB implementation cycle the schools had reached at the time they conducted the study.

With regard to ICT equipment which may be used in conjunction with an IWB, Moss et al. (2007) reported that relatively few of the teachers in their study had access to any peripheral devices for their IWBs, apart from electronic pens, which 64% of the teachers in their study had reportedly used.

In *this* study, none of the IWBs used by the teachers require electronic pens. The pens simply serve as a means to interface with the touch-sensitive IWB surface. However the researcher included the pens as an item for consideration, in order to provide an indication of the interaction of the teachers with the IWB surface, as opposed to simply projecting on to it. In this study, the most popular peripheral device was the set of IWB pens. Amongst the teachers who participated in this study, all except one indicated that they used the IWB pens in at least *some* lessons, with 80% of the respondents indicating that they use the IWB pens in *most* or *every* lesson, where the IWB is used.

The second most frequently used item of ICT equipment, based on the teachers' responses, was the laptop, which was used by all except one of the teachers, with 71% of them reportedly using a laptop in at least *some* lessons, and 47% reportedly using one in *every* lesson. Third most popular on the list of equipment and resources was the school network, used by all except two of the respondents. The results indicated that 73% of the teachers reportedly access the school network in at least *some* lessons, with 27% of the respondents using the school network in *most* or *every* lesson. The Internet and sound systems (speakers) were jointly the next most frequently used ICT resource or item, with 80% of the teachers reporting use of each of these in at least *some* lessons.

Moss et al. (2007) reported that the Internet was the ICT resource most popular amongst teachers, with 84% reporting that they had used it. The school network was the next most popular with 76% of the teachers reporting that they had used it, and speakers were third most popular, with 68% reporting that they had used them. Electronic pens were used by 64% of the teachers, laptops by 46% of the teachers and the printer by 42% of the teachers. The use of voting pads, slates or tablets and learners laptops was reported by no more than 5% of the respondents.

9.2.5 How frequently are the existing IWBs being used by the learners and what features are they using?

Although the results of this study indicate that on average a learner will encounter an IWB in 41,9(±12,2)% of his subjects, the data indicate that any particular learner is most likely to

experience use of the IWB by his classmates in only 13,2(±12,2)% of his subjects. This is equivalent to 31,8(±29,5)% of all the lessons during which a learner is in a class with an IWB in the room (across all subjects). In other words, it suggests that less than a third of the teachers with an IWB invite learners to use the IWB during lessons. Although the use of IWBs by learners is discussed in existing literature, there does not appear to be quantitative data that may be compared directly with what is reported here in this study.

The frequency with which learners use the IWBs is highest amongst the junior learners. Amongst the junior learners, a learner is most likely to experience use of the IWB by learners in one or two of his twelve subjects, while amongst senior learners a learner is most likely to experience use of the IWB by learners in none of his subjects or in one of his subjects. The higher frequency of use by junior learners may be indicative of the fact that teachers feel more inclined to allow time for varied activities in the junior classes, whereas the volume of work covered in senior grades imposes time pressure, which prevents this. The higher frequency of use by junior learners may also be indicative of the fact that teachers find they respond positively to the use of the IWB, whereas the senior learners may be more restrained in their expression of enthusiasm for the technology. At the time this study took place, all of the senior learners would have been exposed to IWB technology at the school since they started their first year of high school. Thus the novelty of the technology may have worn off, and they may have been less inclined to want to use the IWB.

The results indicate that the aspect or feature of IWB that is *most* frequently used by the learners is writing on the IWB, with particularly frequent reference to doing so in Mathematics to explain a solution. Use of the IWB to do presentations was the next most popular use of the IWB, followed by use of the drag-and-drop feature.

9.3 Theme two: The impact of IWBs as perceived by the teachers

9.3.1 What is the general attitude of teachers towards IWBs in teaching?

Where teachers were asked to consider the general impact of the IWB on teaching, their responses indicate that those with and without IWBs generally believe the IWB enhances their own teaching and that of their colleagues, at least somewhat. The majority of the teachers in this study showed a positive attitude towards IWBs, indicating that they believe that an IWB allows them to capture the attention of the learners more effectively than traditional teaching media. This sentiment was stronger amongst the teachers with IWBs than amongst those without. While most of the teachers were satisfied that the cost of an IWB could be justified within the context of the

school, and educational institutions in general, they were not convinced that this cost could be justified in the more general context of South African schools.

Teachers with IWBs agreed that use of the IWB creates a more captivating learning environment, makes lessons more fun, and helps to make whole-class teaching easier. They also agreed that use of the IWB makes their teaching appear up to date and that competence in IWB use would help them further their teaching careers.

Teachers with data projectors, but no IWB, did not express a particularly strong desire to acquire an IWB. Five of the eight teachers with access to a data projector, but no IWB, indicated that the need for an IWB was a *medium* priority, and the other three teachers indicated that it was a *low* priority. Teachers currently without access to IWBs felt that most of what they could achieve with an IWB, they could actually achieve with a data projector alone. The teachers with IWBs tended towards disagreeing with this sentiment, although not very strongly. This is consistent with the findings which indicate that the teachers are not making regular use of the features and capabilities unique to IWB technology.

9.3.2 What attitude do teachers perceive the learners to have with regard to the IWB?

The results indicate that the teachers who participated in this study are of the opinion that learners believe an IWB makes lessons more interesting and exciting, and that learners prefer lessons where an IWB is used. The teachers indicated that they believe learners are not averse to coming out to the front of the class to use the IWB, and that learners do not believe that IWBs are difficult to use. Similar perceptions have been reported in many previous studies (e.g. Levy, 2002)

9.3.3 What impact do teachers perceive IWB use to have on learners' behaviour, attentiveness, motivation and productivity?

Analysis of the results shows that amongst the teachers there was a strong belief that use of the IWB creates a more captivating learning environment, and improves the focus and concentration of the learners, increasing their attention spans.

Teachers were less certain about the impact of the IWB on learner motivation and behaviour. The results suggest that teachers believe that the IWB may improve learner motivation and behaviour. With regard to productivity, the majority of teachers were not convinced that increased use of the IWB would result in learners working harder.

9.3.4 What impact do teachers perceive IWB use to have on the learning process, specifically with regard to learners' understanding, retention and performance?

Teachers agree that the IWB makes it easier for them to repeat explanations and summarise work, and that the interactive features of the IWB enhance the learning process. This is somewhat surprising, given the limited use of the interactive, IWB-specific features reported by the teachers. Teachers also expressed the belief that the IWB allows learners to have a greater tactile connection with the learning content but, by all accounts, they seldom give learners the opportunity to use the IWB themselves. Most of the teachers agreed that, when they use the IWB, the learners find it easier to understand the work and they learn more. However, the majority of teachers were *less* convinced that use of an IWB results in learners finding it easier to remember what they learn.

9.3.5 What impact do teachers perceive the IWB to have on lesson planning, preparation and resource development?

Opinion was divided on the issue of whether or not the IWB has changed how teachers teach. Most of the teachers agreed that the IWB had changed their teaching to *some* extent. Teachers generally agreed that preparation of lessons involving the incorporation of the IWB requires more time, but they agreed that building up a bank of IWB resources, which they can share with colleagues, will save time in the long run. However, at the time this study took place, it appeared that the creation or collection of resources was not happening to a significant degree. The Life Sciences department was the only subject department where reference to collaboration and the use of shared resources was made.

Teachers agreed that an IWB allows them to organise and manage information more effectively. There was some uncertainty as to whether use of the IWB resulted in lessons being better prepared and more organised. Half of the teachers agreed that IWB use *does* improve these aspects of their lessons. Teachers do not believe that the use of pre-prepared IWB resources restricts their freedom and reduces their ability to improvise during lessons. Most of them indicated that they do not feel the need to accommodate the possibility of having problems with the IWB by preparing alternative resources as a backup for their IWB-based lessons. These responses could be interpreted in various ways. Responses to the latter statement could be interpreted as a vote of confidence from the teachers in the technical support offered at the school. However, comments made elsewhere on the technical support at the school suggest otherwise.

Considering the teachers' responses to both of the above statements in combination with other data analysed in this study, it would appear that the majority of teachers have not fully embraced IWB technology, and that it is not yet an integral part of their planning, nor instrumental in helping them achieve their aims during the course of a lesson.

9.3.6 What impact do teachers perceive the IWB to have on presentation, teaching styles and classroom management?

The majority of the teachers believe that use of the IWB does have an impact on lessons and the way they teach. Eight of the fifteen participants agree that the IWB has changed how they teach, and that their lessons are better prepared and more organised when they use an IWB. There was unanimous agreement that the effectiveness of IWB use depends on the skill level and confidence of the teacher, and all teachers, except one, agreed that professional knowledge was a critical determinant of the effectiveness of IWB use.

Teachers agreed that an IWB makes lessons more interesting because it enhances the material, making it clearer and more attractive. Most agreed that the IWB makes their drawings and diagrams easier to see. There was the strong belief amongst the teachers that the IWB makes it easier for them to repeat, re-explain and summarise material.

With regard to the impact of the IWB on lesson pace, opinion was divided. This may be a reflection of the manner in which individual teachers use the IWB. Four of the fifteen participants indicated that lesson pace is *reduced* when the IWB is used, while eight participants agreed that use of the IWB results in an *increase* in lesson pace. Only one teacher indicated that lesson pace increased too much when an IWB was used.

9.4 Theme three: The challenges and needs of the teachers

9.4.1 How competent do teachers using IWBs perceive themselves to be in their use of the IWBs, and how do they believe the learners perceive their use of the IWB?

With regard to how learners perceive their use of the IWB, teachers' opinions varied. Nearly half of the teachers agreed that learners believe they are comfortable using the IWB, and only a third of the respondents agreed that learners believe they know how to use an IWB properly. Interestingly, these results appeared to contrast somewhat with the feedback from the learners. Approximately two thirds of the learners agreed that their teachers who have IWBs are comfortable using them and know how to use them properly. It thus appears that the learners' perceptions are more favourable than teachers believe them to be.

Two-thirds of the teachers indicated that their lack of training in IWB use prevented them from using the IWB more frequently. Approximately half of the respondents indicated that their lack of confidence in their personal ability to use the IWB prevented them from using it more frequently, and just less than half of the respondents indicated that technical issues relating to the IWB or the

computer prevented them from using the IWB more frequently. Teachers indicated that one of the major issues which prevent them from improving their use of the IWB, is a lack of time. This was mentioned spontaneously by three of the teachers as part of additional comments they wrote in their questionnaires. Two staff members mentioned the need for more training, and two mentioned that technical difficulties were a problem.

9.4.2 What factors do teachers believe influence the effectiveness of their use of IWBs?

Teachers recognise that the effectiveness of IWB use is influenced by the skill level, professional knowledge and confidence of the teacher. Of four factors generally believed to influence the effectiveness of IWB use (Moss et al. 2007, Rudd et al. 2007), teachers indicated that they believe the *most* important factor is the teacher's knowledge of IWB usage. Linked to this is the factor which they recognised as being the second most influential: the teacher's confidence in use of the IWB. This was followed closely by use of a classroom with an IWB permanently installed. They rated a teacher's knowledge of the subject as the *least* important of the four factors.

With regard to the frequency of IWB use, teachers believe that having a positive attitude towards IWB use is the *most* important factor which *positively* influences the frequency with which a teacher will use an IWB. Of similar importance, is a teacher's perception that the learners in the class feel positive about the use of the IWB. Also of significant influence were improved attentiveness amongst learners and improved learner motivation. This was followed by the teacher's confidence in his/her ability to use the IWB effectively. Least influential were the teacher's ability to save and refer to previous lessons, good IWB resources for use in lessons and improved learner behaviour.

With regard to factors which are believed to have a *negative* influence on the frequency with which a teacher uses an IWB, teachers believe that the *most* influential factor is a teacher's lack of confidence in his/her ability to use the IWB effectively . The factor recognised by teachers as the second most influential is a lack of suitable IWB resources.

Of relatively little influence were problems relating to alignment of the projector and the IWB, and environmental factors. Similarly, problems relating to the data projector and IWB connection and activation are believed to have minimal influence on the frequency of IWB use. This group of teachers was of the opinion that, in the context of this school, a negative attitude towards IWBs on their part and their perception that learners may have a negative attitude towards the IWB have *minimal* influence on their use of the IWB.

9.4.3 What formal training did teachers receive in the use of IWBs, and how effective was this training perceived to be?

The results reflect that the teachers perceive the training they received initially, at the time their IWBs were installed, and subsequently, as inadequate. Six of the fifteen respondents indicated that they had not received *any* training at the time their IWBs were installed. In the additional comments written in the questionnaire, the teachers indicated the need for more time to be spent on training. Three of the comments implied that training had been too rushed. Other comments alluded to the need for more formal, structured training than what had been offered. The need for subject-specific training was also mentioned.

It was apparent from the comments made by the teachers that there is a need for differentiated training, based on the different skill levels and learning styles of the teachers. While one teacher commented on the value of learning by trial and error, another expressed frustration in regard to training taking place informally, on a need-to-know basis, and commented on the need for more formal, structured training, especially in light of the time pressure experienced by teachers at the school.

Where teachers were asked to consider various IWB-related skills and features, in most cases the majority of the teachers indicated that they did not possess the skill nor ability in question. The majority of teachers indicated that they were familiar with the key IWB tools and that they were able to connect the computer to the IWB and operate the projector. They also indicated that they believed they were able to enhance learner motivation and reinforce learning with an IWB, and that they felt able to develop a more interactive teaching style through their use of the IWB. The vast majority of teachers indicated that they had *not* received training in the use of any of the skills or features apart from the key IWB tools. Where the key tools were concerned, one-third of the staff indicated that they had received formal training.

9.4.4 Do teachers feel the need to improve their use of IWBs and, if so, how do they believe they could best achieve this?

The need and desire to improve their use of the IWB came through very strongly in the interviews with the teachers. When teachers were presented with various possible themes for training sessions, the vast majority recognised all of the training areas as being of *medium* or *high* priority. Two-thirds of the respondents recognised that increasing confidence in the use of IWB should be a *high* priority, and more than half of the teachers indicated that training in the appropriate use of IWBs to support subject-specific use of the IWB should be a *high* priority. More than half of the teachers also recognised that using IWBs to support learners with learning difficulties should be prioritised. Interestingly, in spite of the fact that teachers reported using the IWB quite extensively

for projecting downloaded images and sounds, 47% of them indicated their belief that training in the use of the Internet and multi-media resources with IWBs should be a *high* priority.

With regard to potential approaches to training, teachers indicated that they believed internal training (facilitated by staff from within the school) on subject-specific software would be most useful, and this was closely followed by internal training on technical skills. They also indicated their belief that asking colleagues was a useful way to learn and that initial training, at the time the IWBs were installed, was potentially useful. The responses suggested that the staff viewed trial-and-error on their own and training facilitated by the education department as *least* useful, although they still deemed these approaches to be somewhat useful.

9.4.5 What perceptions do teachers have of the resources available for use with IWBs?

The results indicate that teachers tend to believe it is hard to find good resources for use with the IWB, and their opinions were divided on the issue of whether or not suitable IWB resources are easy to use. Teachers recognised the lack of time to search for resources as the most influential of the factors which may be restricting their access to good IWB resources. They indicated that this issue has a *strong* influence.

Problems encountered while downloading resources from the Internet were recognised as *moderately* influential. Limited material available for their particular subjects was considered to have *little* influence in restricting teachers' access to good resources, as was the case with problems encountered when accessing resources on the computer connected to the IWB.

9.4.6 How do teachers feel about integrating ICT in the form of the IWB into their teaching, as opposed to using a data projector alone, or making use of computers in a dedicated computer laboratory?

Responses from the teachers indicate that they believe there is certainly room for different approaches to ICT use and integration. With regard to use of a data projector without an IWB, the vast majority of the teachers indicated that they have projected either scanned or downloaded documents. Just over two-thirds of the teachers indicated that they have shown movies and projected pictures or diagrams, which they had scanned or downloaded. Half of the teachers indicated that they have projected web pages and just less than half indicated that they have projected interactive software and teaching aids, without making use of the IWB. Data projector use by the teachers with IWBs differed in certain respects from the manner in which teachers without IWBs used the technology. Teachers with IWBs were more inclined to have shown movies or movie clips, and project pictures, diagrams and web pages than those with only the data

projector. One similarity was that, in both groups, about 87% of the teachers indicated that they have projected documents which they scanned or downloaded.

Where teachers gave consideration to use of the data projector in combination with a normal whiteboard, half of them indicated that they had annotated documents projected on to the whiteboard, and approximately 40% indicated that they have either annotated a projected picture or diagram. Just over a third of the teachers indicated that they have written notes pertaining to a projected image on the traditional whiteboard, *beside* the image. Once again the usage pattern differed in the two groups of teachers. Not surprisingly, those *without* an IWB were more likely to have annotated a document projected on to the traditional whiteboard. Those without an IWB were *also* more inclined to have written notes pertaining to a projected image on the whiteboard, and *not* on the image itself.

With regard to taking learners to the computer laboratory, teachers with IWBs were more inclined to take learners to the computer laboratories, *and* more often than those with only a data projector. Amongst the teachers with IWBs, two-thirds indicated that they tended to take a class to the computer laboratories at least once every fortnight, while the majority of the teachers without IWBs indicated that they generally take a class to the computer laboratories less than once a month.

Teachers were asked to consider whether a lesson in the computer laboratories was generally more effective than a lesson involving use of the IWB. Opinions were divided and overall the teachers felt quite neutral in this regard. During the interviews, teachers were asked to compare use of the IWB with taking a class to a computer laboratory. Interviewees indicated that they recognised the value of each as a way in which ICT may enhance the teaching-learning experience.

9.4.7 What limitations, technical or otherwise, do teachers perceive to be preventing them from using IWBs more effectively?

The three main issues which teachers appear to believe are restricting their use of IWBs appear to be a lack of training, a lack of time for experimentation and inadequate technical support. These issues were prominent in the answers to the questions with structured responses, and they appeared in the written comments, which teachers added in various sections of the questionnaire. They were also highlighted by the interviewees. Other studies have recognised these issues as critical in determining the extent to which the integration of ICT, and more specifically IWB technology, is successful within the school environment (Jones, 2004; Miller, et al., 2006; Slay et al., 2007).

The interaction between these issues and other factors, such as teacher confidence, internal belief and motivation, the willingness to change pedagogical practice, and the influence of educational leaders within the school environment, is complex (Jones, 2004). It is difficult to address particular issues or factors in isolation. If ICT, and more specifically, IWB integration strategies are to be successful, it is critical that the overall picture is taken into consideration when any intervention is being planned.

9.5 Theme four: The impact of IWBs as perceived by learners

The statements presented to the learners in the questionnaire in this study were, for the most part, based on the statements which Moss et al. (2007) used in their study. Additional statements were added at the discretion of the researcher, as the research approach was finalised and the research questions were operationalised. The fact that the learner questionnaire was based on the questionnaire used by Moss et al. means that useful comparisons can be made between the results of the two studies. All of the statements which appeared in the learner questionnaire were also presented in a section of the questionnaire which teachers with access to IWBs completed. This allows for a direct comparison between the opinions of learners and teacher in this study.

In general, the results indicate that learners view IWBs favourably, which is consistent with other studies. Overall learners find a lesson more exciting and interesting when the teacher uses the IWB and they do indicate a preference for lessons where an IWB is used, but this preference does not appear to be as strong as teachers perceive it to be. Analysis of the responses revealed that 54% of the learners and 87% of the teachers agreed or strongly agreed that learners prefer lessons where an IWB is used, compared to 74% of the learners in the study conducted by Moss et al. (2007). What follows is a discussion of learners' perceptions of various aspects of IWB use and the impact they believe IWB technology has on the teaching-learning process.

9.5.1 What is the learners' perception of the level of competency in IWB use amongst teachers?

The majority of learners who participated in this study agree that their teachers are competent in their use of IWBs and appear comfortable using the technology. In general, the perceptions of the learners are more favourable than the teachers believe them to be. Nearly two-thirds of the learners indicated that they agree or strongly agree that their teachers who do have access to an IWB know how to use it properly. Only a third of the teachers indicated that they agreed or strongly agreed that the learners believe they know how to use the IWB properly. Approximately two-thirds of the learners also agreed or strongly agreed that the teachers using IWBs are comfortable doing so, while just less than half of the teachers indicated that they believed the

learners perceived them to be comfortable using the IWB. In the literature reviewed, there did not appear to be data which could be compared to these findings.

The learners responses to statements relating to the reliability of IWB technology, and the ease with which an IWB may used, could be considered as an indirect indication of teacher competency, because, if a teacher is incompetent in his/her use of the IWB, learners may perceive the technology to be unreliable, or difficult to use. Consistent with the results reported by Moss et al (2007), the majority of learners indicated that they do not believe that IWB technology is unreliable, nor that IWBs are difficult to use. These results do not necessarily serve as confirmation of a vote of confidence in the teachers. It is worth noting that, in the study conducted by Moss et al. (2007), 30% of the learners agreed or strongly agreed that IWBs often break down, which results in time wasting, while only 11% the learners involved in this study expressed a similar sentiment.

9.5.2 What impact do learners perceive the IWB to have on their teachers and the manner in which they facilitate lessons, specifically with regard to the pace of lessons, the teacher's ability to capture and hold their attention, and the presentation and aesthetic appeal of the teacher's audiovisual aids?

Learners generally show a preference for lessons where an IWB is used, although, in certain respects, this preference is not as strong as teachers believe it to be. Learners agree with teachers on the fact that the IWB does have an impact on teaching, but they are divided in their opinions on whether or not the IWB makes a difference to the lesson and the manner in which the teacher facilitates the lesson.

The vast majority (87%) of learners indicated that they agree or strongly agree that the IWB enables the teacher to repeat, explain and summarise material easily. Co-incidentally, Moss et al. (2007) also reported that 87% of the learners involved in *their* study agreed or strongly agreed with this sentiment, and in both studies, this was the statement with which learners showed strongest agreement. The teachers who participated in this study showed similarly strong agreement – in fact 87% of the teachers also agreed or strongly agreed with the sentiment.

In this study, learners believe more strongly than teachers that lessons are better prepared and more organised when a teacher uses the IWB. The results indicate that 63% of the learners and 53% of the teachers agreed or strongly agreed the sentiment, compared to 85% of the learners in the study reported by Moss et al. (2007).

Three-quarters of the learners who participated in this study agreed or strongly agreed that use of the IWB makes a lesson more interesting and exciting, compared to 81% in the study conducted by Moss et al. (2007). Analysis of the responses suggests that this appears to be largely as a

result of the *visual* impact of the IWB. Learners agree that IWBs make a lesson more interesting because the presentation of material is clearer and more attractive, and that the IWB makes a teacher's drawings and diagrams easier to see. In this study, 72% of the learners and 67% of the teachers agreed that IWBs make drawings and diagrams easier to see, compared to 76% of the learners in the study conducted by Moss et al.

When considering whether lessons are more interesting when an IWB was used, as a result of the presentation of the material being clearer and more attractive, learners showed stronger agreement than when they were considering whether lessons are more interesting simply because the teacher used the IWB. Analysis of the responses to the various statements suggests that the potential which learners believe IWB technology holds for making a lesson more interesting is not necessarily realised when teachers use the IWB. This hypothesis is supported by the learners' ambivalence with regard to the statements suggesting that use of the IWB makes *no* difference to the manner in which their teachers teach.

This ambivalence may be as a result of various factors, and further research would be necessary before more definitive explanations could be proposed with any certainty. It may be that, for example, a particular teacher is in the habit of using the IWB in every lesson, and the learners have thus not experienced enough of his/her teaching *without* use of the IWB to allow a fair comparison. It may also be the case that the ambivalence, and the high proportion of learners who chose to remain neutral, was as a result of variations in IWB use and, more generally, teaching methods, amongst their teachers.

With regard to learner involvement in the lesson, teachers believe more strongly than learners that use of the IWB increases learner involvement in the lesson. In this study, 39% of the learners and 67% of the teachers agreed that IWB use leads to greater learner involvement, compared to 64% of the learners in the study conducted by Moss et al. (2007).

Where the pace of the lesson is concerned, learners tend to believe that the class progresses through material *faster* when an IWB is used, although they are less certain of this than the teachers appear to be. In this study, 35% of the learners and 53% of the teachers agreed that the pace of lessons increases when an IWB is used.

Consistent with the results reported by Moss et al. (2007), neither learners nor teachers believe that learners find the pace *too* fast when the teacher uses an IWB. Significantly, 21% of learners and 27% of teachers involved in this study indicated that they believe that use of the IWB results in *slower* progress during lessons.

Also consistent with the results reported by Moss et al. (2007), the results of *this* study indicate that the vast majority of learners are *not* averse to going out in front of the class to use the IWB, and the teachers recognise this.

9.5.3 What impact do learners perceive use of the IWB to have on the learning process, specifically on their understanding, retention and performance?

Overall, the findings of this study indicate that learners and teachers agree, to some extent at least, that the IWB helps learners learn more, that it helps them to understand work more easily and that it helps them to remember more easily the work covered during a lesson. Teachers are more convinced of this than the learners.

Although a significant percentage of both learners and the teachers were neutral in their opinion of the impact of the IWB on the learning process, the balance of the respondents in both groups tended to agree that the IWB has a *positive* impact on the cognitive aspects of the learning process. This is consistent with the results reported by Moss et al. (2007), who found that 70% of the learners involved in their study agreed or strongly agreed that they learn more when a teacher uses an IWB. In *this* study, nearly half of the learners agreed with this sentiment. Only 42% of the learners involved in this study agreed or strongly agreed that use of the IWB makes it easier for them to understand the work, while Moss et al. (2007) reported that 77% of the learners involved in their study agreed with this sentiment.

9.5.4 What impact do learners perceive use of the IWB to have on their personal behaviour, attentiveness and motivation, and the behaviour of their fellow learners?

Approximately half of the learners were non-committal in expressing their opinions on the impact of the IWB on concentration and behaviour, which is consistent with what Moss et al. (2007) reported about learners being “cautious about the impact of IWBs on behaviour.” Amongst the learners in this study, who *did* express agreement or disagreement with the relevant statements, opinion was divided. Overall, it appears that the learners do *not* perceive the IWB to have a significant impact on their personal behaviour, nor on the behaviour of their classmates. In this study, 30% of the learners agreed or strongly agreed that learners behave better in lessons with IWBs, which compares favourably with the results reported by Moss et al. (2007), who found that 29% of learners agreed with this sentiment. The results of this study indicate that teachers, on the other hand, are more convinced (than the learners) that the behaviour of the learners improves when an IWB is used.

The results of this study indicate that learners generally do not perceive the IWB to have a significant impact on their concentration. Only a third of respondents agreed or strongly agreed

that they concentrate better when an IWB is used, compared to 47% in the study conducted by Moss et al. (2007). In contrast, 83% of the teachers involved in this study agreed or strongly agreed that concentration and attentiveness amongst learners improves when an IWB is used. Learners generally believe that the IWB does *not* have a significant impact on their productivity, which is consistent with the results reported by Moss et al. (2007), who found that only 29% of learners agreed that they would work harder if their teachers used an IWB more often. In this study, the majority of teachers were uncertain as to whether increased use of the IWB would lead to an increase in productivity.

9.6 Conclusions and recommendations

9.6.1 IWB integration at the school

At the time this study commenced, it had been nearly five years since IWB technology was first introduced into classrooms at the school. A review of other studies suggests that, where IWB integration is concerned, five years is a relatively long time (Moss et al. 2007). The findings of this study suggest that, in spite of the wealth of resources, financial and otherwise, available at the school, IWB integration has not been progressive, but rather quite slow and erratic. There is little evidence of any centrally co-ordinated planning and management of the integration process. Teachers have been expected to integrate IWB technology into their teaching without substantial training and without clear aims linked to a strategic vision for ICT use in the school in the future.

Results indicate that the frequency and nature of IWB use across the school varies greatly between subject departments and from one teacher to the next, within subject departments. In comparison to IWB use in other schools, as reported in the literature (Moss et al., 2007), the general IWB utilisation at the school in question was found to be relatively infrequent and superficial in nature, with only the basic features and capabilities being widely utilised.

In terms of the models for IWB integration which have been considered in this study, the profile of general IWB use in the school is typical of the first and second stages of the synthesised model of progression. The school as a whole has not advanced beyond the apprentice user stage described by Beauchamp (2004). In fact, the findings suggest that many of the teachers have not truly advanced beyond the first stage of each of the respective models. While a few teachers appear to be quite advanced in their use of the IWB, the vast majority use the IWB in a manner that places them in the *infusion stage* (Burden, 2002), the *blackboard substitution stage* (Beauchamp, 2004) or the *supported didactic stage* (Glover et al., 2005) of the respective models.

This study has attempted to determine why such a well-resourced school has not progressed further with the integration of IWBs in the five years that have passed since IWB technology was first introduced there. Considering the factors which influence ICT and IWB integration (Jones, 2004; Miller et al., 2006; Slay et al., 2007), the relatively slow progression through the phases of integration, which is evident at the school, cannot be attributed to limited access to ICT facilities, limited exposure to ICT nor a lack of resources. A lack of basic computer literacy skills does not appear to be a major causative factor either. All the teachers appear to be willing to embrace new technology and try new ideas, to a greater or lesser extent, so resistance to change at the individual user level does not appear to be the main reason for slow progress.

The results reflect that the teachers with regular access to IWBs are of the opinion that the initial training offered at the time their IWBs were installed was inadequate. Little training has been offered subsequently, seemingly on an informal basis. This lack of effective training appears to have played a major role in retarding the progression of the staff. Another major factor, identified by several teachers, has been the lack of time available to explore the potential of IWB technology and build up a bank of useful resources. The issue of severe time constraints is a recurring theme throughout the findings.

Staff appear to be frustrated by the inadequacy of the training they have received and their inability to find time to improve their use of the IWB, through informal experimentation or by attending formal training sessions. It appears that the school management team has not created the time and space necessary for teachers to develop their skills. It seems that there has been the expectation that teachers should simply embrace IWB technology and incorporate it into their existing practice, without receiving comprehensive training in use of the technology and the potential it holds for effecting pedagogical changes in the classroom. In addition to this, the situation appears to have been compounded by what several staff perceive to be inadequate technical support, which has undermined staff confidence in ICT and, specifically, IWB technology.

The findings suggest that the school management team has been somewhat short-sighted and narrow-minded in its approach to ICT. Where ICT and, more specifically IWB, integration is concerned, it appears that the management team has not encouraged experimentation nor innovation amongst the teaching staff, neither directly, by actively promoting it, nor indirectly, by recognising it when it occurs spontaneously, or by freeing up staff to engage in resource and skill development on an individual basis.

It appears that the management team has displayed a marked lack of vision in this regard and that it has not formulated a strategic plan to guide the integration of ICT into teaching at the school. ICT-related staff development and training has not been prioritised over the last five years. It

seems that little consideration has been given to the future of ICT in education, which is particularly surprising for a school that believes it is at the forefront of high school education in the country and comparable with the best high schools in the world.

9.6.2 Recommendations

In searching for a plan of action that will allow the school to harness the potential of IWB technology more effectively, it is worthwhile considering the Theory of Planned Behaviour (Ajzen, 1991), which Miller et al. (2006) suggest provides a model that is useful for explaining the influence of various factors on the integration of ICT into teaching. The Theory of Planned Behaviour (TPB) holds that the major influences on human behaviour are behavioural beliefs, normative beliefs and control beliefs (Ajzen, 2002). These three sets of beliefs together influence the formation of a person's behavioural intention. If a person's intention is strong enough, and circumstances are such that the person has sufficient control over the situation, then it is expected that he/she will execute the intended behaviour when an opportunity presents itself.

For the purposes of this discussion, it is worth considering the TPB in more detail, and looking at how it may be applied to the integration of ICT and, more specifically, IWB technology into high school classrooms. In this context, *behavioural* beliefs relate to a teacher's attitude towards the likely outcomes of IWB use in the classroom and his/her personal evaluation of these potential outcomes. Behavioural beliefs are those which determine whether a teacher's attitude towards IWB use, in general, is positive or negative. *Normative* beliefs relate to perceived social pressure and the expectations of others (subjective norms) with regard to IWB use and the extent to which a teacher feels motivated to meet these expectations. Normative beliefs determine whether or not teachers perceive there to be an expectation that they make use of IWB technology in their teaching. *Control* beliefs relate to a teacher's perceived level of control over the IWB technology and the extent to which teachers believe that they are able to carry out their intentions. Control beliefs thus relate to a teacher's confidence, skill level and competence in IWB use, as well as general ICT skills and the ability to solve general technical problems that may arise during lessons.

The Theory of Planned Behaviour provides a useful framework for an IWB integration strategy. Where more detailed planning and implementation of such a strategy are concerned, it is worthwhile considering the factors which Scrimshaw (2004) identified as most effective in overcoming the barriers which restrict use of ICT by teachers, and thus encourage ICT integration in the classroom. These are the factors which are believed to be most influential in determining the extent to which teachers are willing and able to incorporate ICT use into their teaching. These enablers include *internal*, school-based strategies and *external* support bases.

Scrimshaw (2004) highlights the fact that, within the school, effective leadership plays a critical role in enabling teachers to experiment with innovative ideas. Proper planning, which incorporates the formulation of a vision statement, a comprehensive needs assessment and the formulation of a school development plan, is vital in ensuring successful ICT integration. Collaboration throughout the school is important, and this should incorporate the sharing of resources, as well as sensitivity to the actual needs of individuals, and the fact that these needs may change over time. Reliable technical support, that is well co-ordinated and effective, is vital.

Collaboration between schools helps teachers to identify successful practice and provides them with the motivation to attempt new ideas (*ibid*.). Co-operation with local communities is also important, because it has the potential to allow teachers to provide more authentic, contextualised learning opportunities for the learners. Continuous professional development is preferable to intensive up-front training at the time ICT is introduced. It is vital that training is differentiated based on the needs and expertise of teachers, so that it is deemed useful and beneficial by the teachers. Involvement in projects beyond the confines of the school, both locally and nationally is recognised as being helpful in promoting the using of ICT. Scrimshaw (2004) concludes that allowing for variation and innovation within a clearly defined overarching strategy is more effective than adopting a narrow, specific approach to ICT integration.

Also of particular relevance to this discussion are the seven critical factors which Miller et al. (2006) believe to be most influential in determining the extent to which an ICT integration programme succeeds. The authors distinguish between *school*-level factors and *teacher*-level factors. The school-level factors they identify are technical support, accessibility of ICT, lack of resources and influence of educational leaders. The teacher-level factors they highlight are internal belief and motivation, adequate knowledge and, finally, time.

Miller et al. (2006) highlight three key themes underpinning the seven critical success factors they identified in their study. These three themes relate to the three sets of beliefs which form the basis of the Theory of Planned Behaviour (Ajzen, 1991). The first key issue, which Miller at al. (2006) highlight, is that teachers need to have a positive attitude towards the use of ICT in teaching. This links to *behavioural* beliefs in the TPB. Secondly, the authors indicate that it is important that a culture of ICT use is promoted amongst teachers, and that teachers believe that they are expected to integrate ICT into their teaching. This corresponds to *normative* beliefs in the TPB. The third theme Miller et al. highlight is the provision of skills, resources and support for teachers, in order to enable them to incorporate ICT into their teaching. This links to the *control* beliefs in the TPB.

Considering, more specifically, the integration of IWB technology itself, it is worth reflecting on the seven criteria recognised by local authors Slay et al. (2007) as having a profound influence on the integration of IWBs in teaching environments. These authors indicate that teachers obviously

require a basic level of ICT literacy, because an IWB is essentially an extension of the computer. Consistent with the finding published by other researchers (e.g. Miller et al., 2006), they highlight the fact that teachers require access to ICT facilities and exposure to ICT, as well as administrative support and technical support. Furthermore, they indicate that it is critical for teachers to be given time to experiment with the IWB technology. The factor which Slay et al. (2007) believe is *most* critical in determining whether or not IWB integration is successful, is willingness amongst teachers to change their thinking and consider changes in their pedagogical practice.

As the old adage goes, "Where there's a will, there's a way." With regard to the school which was the focus of this investigation, the results of this study suggest that the teachers at the school recognise the need to improve their use of IWB technology, and that they are willing to participate in the training required to achieve this, if presented with the opportunity to do so. It would appear that the future of ICT and, more specifically, IWB technology, at the school, lies largely in the hands of the management team. If they take the initiative to formulate a comprehensive strategic plan for improving ICT integration at the school, and implement this plan effectively, the findings of this study suggest that they will have the support of the teachers and the learners.

9.7 Proposed ICT integration strategy for South African schools

9.7.1 Overview

In conclusion, this research report proposes a strategy for the integration of ICT into high schools, with a view to promoting the integration of IWBs in the long term. The strategy is specifically geared towards schools in the South African education system, in the context of the current economic climate. The key factors considered in the formulation of this proposal are financial restrictions, current classroom practice, time constraints and the pressure imposed by the school curriculum, as well as limited human resources and restricted access to training opportunities and technical support in South African schools. This proposal also recognises the vital role which teacher confidence and a culture of expectation play in the integration of ICT into teaching (Miller et al., 2006).

In formulating this proposed ICT integration strategy, careful consideration was given to the results of this study and the findings reported by Slay et al. (2008b), in their study of IWB use in schools in the Eastern Cape Province. Of particular significance was the fact that the interactive capacity of the IWB technology was recognised, but generally disregarded by the teachers during the study. The authors found that, when reflecting on the introduction of IWB technology into classrooms at their schools, teachers and learners highlighted the visual nature of the technology. The features which the teachers recognised and actually *used* were in fact features of the data projector and

computer combination, rather than features of the interactive hardware and software itself. These included the large screen display, enhanced visibility and easy access to a wide range of multimedia. Teachers also reported the use of technology per se, rather than any associated *interactivity*, improved interest and motivation amongst the learners.

Also of relevance to this proposal is the fact that, while most of the benefits of the technology recognised by the teachers arose from the use of the data projector in combination with a computer, Slay et al. (2008b) reported that the problems, or negative aspects of the IWB technology, which the teachers highlighted in their study, related specifically to the interactive components themselves. These issues included the lack of technical skills required to allow teachers to utilise the IWB competently and confidently, the cost of the interactive hardware and the problem of security measures required to prevent theft of the hardware. All of these aspects relate to the interactive hardware itself. The authors conclude that most of the *benefits* recognised by the teacher and learners may be attributed to the use of a computer with a data projector, and most of the *problems* identified by the teachers were linked to the use of the interactive technology.

Where the practical use of ICT is concerned, the essence of this proposal is that teachers make use of a data projector (connected to a laptop or desktop computer) which projects an image on to a conventional whiteboard, thus allowing the teacher to annotate the projected image. Initial training would involve assisting teachers in the creation of paper-based resources in a basic word processing programme. The resources would be photocopied as handouts for the learners and also used as visual aids during the lesson, projected on to the whiteboard. Where appropriate, the teachers would be expected to refer to the project pages and annotate them. In this way, teachers would be encouraged to make regular use of the technology, without being completely dependent on it.

Remote manipulation of the projected image could be achieved through the use of a wireless keyboard and mouse, which would allow the teacher to be positioned in the front of the class, adjacent to the whiteboard. Through appropriate, differentiated, ongoing training and professional development, the ICT skills of the teachers could be developed so that they grow in confidence in their use of ICT and progress to the use of more advanced software and ultimately *interactive whiteboard* hardware, if this is deemed to hold potential for further enhancing the teaching-learning process.

The ICT integration strategy, which is proposed here, is formulated with a view to encouraging the integration of IWB technology in the long term, if it is deemed that an IWB would enhance a teacher's use of ICT once s/he has become confident in the use of various features of less advanced ICT. However, it does not presume that the ultimate goal is necessarily to integrate IWB

technology into a teacher's practice, but rather it aims to facilitate the integration of more general ICT use for the purpose of enhancing the teaching-learning process for both teachers and learners.

The strategy presented is thus intended to be complete in itself, in the sense that successful implementation of this strategy may improve ICT use and integration amongst teachers to such an extent that they are harnessing capabilities which enhance the teaching-learning process significantly. The strategy recognises the following as its principal aims.

- Minimise initial hardware costs
- Minimise ICT skills required *initially* by teachers
- Minimise potential technical difficulties
- Maximise deployment of ICT throughout the school
- Maximise recognition of the value of ICT amongst teachers
- Maximise growth in teachers' confidence in ICT and their personal abilities to use of ICT
- Maximise opportunities for ongoing, differentiated, subject-specific and skill-dependent training and professional development
- Maximise opportunities for exploration and experimentation amongst teachers
- Promote frequent use of the ICT features recognised as advantageous by teachers
- Focus on teachers' needs, provide needs-based training and allow for just-in-time learning
- Build on existing ICT skills and current practice
- Create resources that may also be used independently of ICT, when necessary
- Create a culture of ICT use, while preventing complete dependence on ICT
- Foster, amongst teachers and learners, the expectation that use of ICT should be employed in the teaching-learning process on a regular basis
- Encourage innovation, collaboration and sharing of resources
- Provide reliable technical support

An Internet connection in the classroom would be useful, but not essential. For communication purposes it would be important for the school to have access to the Internet. If the network infrastructure is limited, and Internet access restricted, then it would be important for a staff member to co-ordinate the sharing and distribution of resources amongst the teachers. Bearing in mind the need to minimise costs, a list of essential software that would be necessary to allow this strategy to be implemented is provided below.

- An operating system (e.g. MS Windows XP)
- A word processing programme (e.g. Open Office Writer or MS Word)
- A data (spreadsheet) management programme (e.g. Open Office Calc or MS Excel)
- Subject-specific resources (e.g. a bank of scanned diagrams and downloaded images)

- Subject-specific software (e.g. a free graphing package for use in Mathematics)
- A web browser (e.g. MS Windows Internet Explorer)

What follows is an analysis of the costs involved in implementing the proposed ICT integration strategy. It is suggested that any money saved initially, by adopting this ICT integration strategy, rather than installing IWBs immediately, needs to be invested in staff training and professional development. The chapter ends with an outline of the practical steps involved in the implementation of this strategy and the key features that should characterise ICT use by teachers, if they are successfully progressing to a level of more advanced ICT integration in their teaching.

9.7.2 Cost analysis

This integration strategy takes into consideration the expenses involved in setting up a functional IWB, which is installed for permanent use in one particular venue. The cost of investing in ICT and, more specifically IWB technology, is a critical issue for South African schools, especially in the current global economic climate. Depending on the choice of computer, data projector and interactive hardware, the total setup cost may be well in excess of R40 000. The minimum cost, including interactive hardware, a computer, a data projector, a projector bracket, cabling and the installation of the equipment would be approximately R30 000, based on approximations taken from recent quotes (August 2009). The calculation of approximate minimum and maximum costs for setting up an IWB with the necessary accessories are given in **Table 81**, which follows.

Table 81: Estimation of IWB installation costs

Item	Minimum cost	Maximum (likely) cost*
Interactive hardware (IWB interface between user and computer)	R10 000	R28 500
Transport and installation of IWB	R1 000	R1 000
Computer	R6 000	R8 000
Data projector	R10 000	R10 000
Installation of data projector and computer (including brackets, cables, powered VGA signal splitter / booster and labour)	R3 500	R3 500
Remote control (optional extra)	–	R1 000
Total cost	**R30 500**	**R50 000***

*These costs are based on the best prices for particular models, taken from official quotes provided in 2009. Obviously costs may be higher if different suppliers are used or if the school wishes to purchase other models with different specifications.

Considering the approximate costs presented in **Table 81**, it is clear that, if a data projector is installed with a retractable white screen (costing R1500), instead of interactive hardware, then the total cost is likely to be as low as R22 000. The ICT integration strategy which this study proposes, involves the installation of a traditional whiteboard to serve as a writing and projection surface, with a view to replacing this with an IWB, ultimately, if the teacher embraces ICT more generally in stage one. This cost of such a whiteboard could range from approximately R1 000 to R2 000 and thus this first phase installation would allow a saving of between R10 000 and R28 000.

Obviously adopting this approach with a fixed budget would allow for the installation of a greater number of whiteboard-and-data projector setups. However, it is the recommendation of this study that the money saved initially should be invested in initial and ongoing training and technical support for the teaching staff. The financial saving on one IWB alone could provide the opportunity for substantial training and professional development of staff during the early phases of the ICT integration strategy.

9.7.3 Practical implementation of the strategy

From the outset, it must be made clear to teachers who are considering embracing ICT, that the use of technology cannot serve as a substitute for good teaching, and an increase in the prevalence of ICT in lessons does not imply that the role of the teacher decreases in importance. In fact, the opposite may be true, with ICT providing teachers with the opportunity to play an even more influential role in the learning process than they have played in the past. Implementation of this strategy involves initially assisting teachers to become competent in the use of basic software and ICT skills, prioritised in the following order.

- Word processing
- Spreadsheet management
- Use of presentation software

Initially the focus would be on the creation of paper-based worksheets, using word processing software. (As a precursor to this, scanned documents may be used by the teacher.) The worksheets generated by the teacher should be printed and photocopied, for use as handouts. However, it would also be expected that the teacher should use the worksheet as a visual aid during the lesson. An electronic copy of the worksheet may be projected on to the whiteboard at appropriate times. The attention of the learners will be captured by the bright, large-screen display and it will be easy for the teacher to guide the learners through the worksheet, scrolling down where necessary, and annotating the image on the whiteboard, where appropriate.

Worksheets should thus be created in such a way that they may be used effectively as visual aids, as well as handouts. One method of achieving this would be through structuring the worksheets so that the learners write their answers in spaces provided on the worksheets themselves. Then, when an answer is being discussed, the teacher (or a learner) may write it in the space provided on the whiteboard, providing a focus for the class. As teachers acquire more knowledge and their skill levels increase, they should be encouraged to increase the number of relevant diagrams (imported and self-generated) included in the worksheets. These will serve as useful visual aids during class discussions.

Because the teacher will have photocopied the worksheet, it will be easy enough to continue the lesson without the aid of technology, should there be a technical fault or a power failure. In the author's experience, the teacher is likely to enjoy a positive reaction from the learners in response to the use of technology in this manner. Simple as this application of ICT may be, use of a well-designed paper-based worksheet as a visual aid has the potential to improve lesson flow and classroom management, partially as a result of the fact that it allows learners to follow the teacher's progression through the lesson plan more easily.

In order to avoid being trapped behind the computer, with the screen between him/her and the class, the teacher may control the computer and manipulate the projected image with a wireless keyboard and mouse. This would allow the teacher the freedom to remain in the front of the class, adjacent to the whiteboard. Mobility may be achieved through the use of a simple trolley. Other technological options such as tablets and slates may fulfil the same purpose.

If the technology and technical support is found to be reliable, hopefully the teachers will grow in confidence and become more adventurous. If the visual enhancements are found to have a positive impact on the learners, this should also motivate teachers to continue their exploration of various options, including Internet-based resources. As far as ICT skill levels are concerned, implementation of this model would require only the basic use of a computer and data projector initially. If the teacher is able to incorporate this basic level of technology use into lessons seamlessly, and move comfortably between different media and various modes of thinking, then s/he should be able to incorporate IWB technology without much effort.

Table 82, which follows, presents an outline of the steps involved in the progression through this proposed model of integration. As indicated, initially teachers will employ very basic ICT skills. But even these very basic skills are sufficient to allow the teacher the opportunity to incorporate the use of ICT into their lessons in a meaningful way, which enhances the teaching-learning process for teachers and learners. Once the teachers become competent in their use of the basic word processor functions, they may progress to importing or creating illustrations. After acquiring the

essential word processor skills, this model suggests that teachers should progress to using spreadsheet management software, because it has the capacity to assist them with administration, as well as being useful for data capturing exercises during lessons.

Table 82: Outline of progression through the ICT integration model

Stage	Application of ICT skills by teachers during lesson preparation	Optional integration of ICT into lessons by teachers
1	Teachers create basic paper-based worksheets, using word processing software, and including spaces for learners to write their answers.	Worksheets may be projected on to a conventional whiteboard and annotated, serving as visual aids and providing a central focus for the lesson. During feedback/discussion sessions, learners write answers on their copies of the worksheets, guided by the teacher.
2	Teachers create more complex paper-based worksheets, including self-generated graphics, as well as imported images that have been scanned or downloaded off the Internet.	Worksheets may be projected on to a conventional whiteboard and annotated, serving as visual aids and providing a central focus for the lesson. Digital images are clearer and more visually appealing. Diagrams may require labelling. The teacher may begin to utilise the dynamic nature of electronic images, where appropriate. During feedback/discussion sessions, learners write answers on their copies of the worksheets, guided by the teacher.
3	Teachers make use of spreadsheet management software to keep a record of learners' results. Teachers create paper-based worksheets, which include graphs and tables generated using spreadsheet management software.	Worksheets may be projected on to a conventional whiteboard, serving as visual aids. Graphs are clearer and more visually appealing. The teacher may begin to capture data and create graphs during the lesson. During feedback/discussion sessions, learners write answers on their copies of the worksheets, guided by the teacher.
4	ICT skills acquired during the use of word processing software may be transferred to use in presentation software, e.g. MS PowerPoint.	The teacher may prepare presentations in dedicated presentation software for use in conjunction with paper-based worksheets. Teachers may plan to move between the image of a projected worksheet and the presentation during the course of the lesson.
5	Teachers create paper-based worksheets using dedicated graphics software and subject-specific software.	Teachers begin using a combination of paper-based worksheets (projected on to a conventional whiteboard), spreadsheet management software, dedicated presentation software and subject-specific software. Teachers are able to move between different software packages spontaneously and with confidence during the course of a lesson.

As **Table 82** indicates, skills acquired in the use of word processing software should allow teachers to progress to using dedicated presentation software relatively easily. Throughout each of the stages of progression, teachers should be encouraged to try new ideas, without fear of failure. It is hoped that by encouraging teachers to support their use of ICT during lessons with traditional paper-based resources, this strategy with allow them to grow in confidence faster than they would if they were completely dependent on the technology and it occasionally failed them. As the teachers grow in confidence, hopefully they will be inspired to become more creative, and begin exploring new ideas more readily. Success achieved in the application of the basic features of ICT will hopefully spur the teachers on to discover the amazing potential ICT holds for enhancing the teaching-learning experience for both teachers and learners.

9.8 Chapter nine in summary

This chapter presents a discussion of the findings of this study, and an attempt is made to answer each of the research questions, based on the findings. The integration of IWBs into classrooms at the well-resourced South African high school, which was at the centre of this study, is analysed and discussed, with a view to determining what lessons can be learnt from this case study. The analysis of the findings is followed by a discussion of the conclusions and recommendations arising from the study. The lessons learnt in this context may prove useful for informing decision makers in other schools and, more broadly, policy makers working at provincial level throughout the country. The chapter concludes with a discussion of a proposed practical implementation strategy for the integration of ICT into classrooms in South African high schools, specifically with a view to making provision for the integration of IWBs in the longer term.

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Our deepest fear is not that we are inadequate,
But that we are powerful beyond measure.

It is our light, not our darkness which most frightens us.

We ask ourselves,
"Who am I to be brilliant, gorgeous, talented and fabulous?"

Who are we not to be?

Your playing small doesn't help the world.
There's nothing enlightening about shrinking,
so that other people won't feel insecure about you.

We were born to manifest the glory of God.
This is within us; it is in everyone.

And as we let our light shine,
we unconsciously give other people
permission to do the same.

As we are liberated from our fears,
our presence automatically liberates others.

A return to love
– Marianne Williamson