Republic of Zambia

Ministry of Education

“Learning at Taonga Market” in Government Schools

An Evaluation of the 2005 Pilot of Interactive Radio Instruction in Grade One

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TED in collaboration with QUESTT

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Abbreviations and acronyms

DODE.....Directorate of Open and Distance Education
DRCC.....District Resource Centre Coordinator
EBS.....Education Broadcasting Services
EDC..... Educational Development Center
EFA ..... Education for All
EMIS .....Education Management Information System
GRZ.....Government of the Republic of Zambia
IRI .....Interactive Radio Instruction
LTM .....Learning at Taonga Market
M&E..... Monitoring and Evaluation
MOE..... Ministry of Education
ODL.....Open and Distance Learning
OVC ..... Orphans and Vulnerable Children
PCV .....Peace Corps Volunteer
PDP ..... Programme Production and Development
POC..... Provincial Outreach Coordinator
QAA ..... Quality Assurance and Accreditation
QUESTT.....Quality Education Services Through Technology
SEO ..... Senior Education Officer
SESO…….Senior Education Standards Officer
TA .....Technical Advisor
TED .....Teacher Education Department
ZIP..... Zonal In-service Provider

Executive Summary

Background

The Learning at Taonga Market radio programmes are part of the Interactive Radio Instruction programme developed by the Directorate of Open and Distance Education in collaboration with Education Development Centre. These interactive radio programmes helps teaching subjects effectively by broadcasting radio programmes where a radio teacher provides instructions and guidance to the classroom teacher and the pupils. The interaction between the radio teacher, the classroom teacher and the pupils is guided and determined during the radio broadcast by the radio teachers.

The radio instructions for each grade are carefully planned to cover all aspects in the Zambian national curriculum. The radio programmes comes together with a teacher's guide for a particular grade. With these two tools, a teacher has a comprehensive and carefully planned lesson plan for the whole year.

Zambian National Broadcast Corporation broadcast the first Learning at Taonga Market radio programmes in 2000 for grade One. Since 2000 additional Learning at Taonga Market radio programme have been developed so that there are in 2006 interactive radio programmes broadcast for all grades from one to six.

The Learning at Taonga Market radio programmes have since the first broadcast in 2000 been utilized by an increasing number of schools, learners and teachers. In 2005 DODE registered 857 community schools and IRI centres to be using the radio programmes to teach more than 55,000 children in all 9 provinces in Zambia.

In March 2005 MOE decided to field test how the Learning at Taonga Market radio programmes would assist teachers to teach grade one learners effectively in Basic school that were relatively understaffed, under resourced and where many teachers had to do multigrade teaching.

Study Goals

The overall goal of the pilot study was to determine if educational broadcasting of Learning at Taonga Market radio programmes is an effective tool for teaching Zambian language literacy, English language, numeracy and life skills to first grade pupils in Zambian government schools.

QUESTT project staff and MOE staff from Teacher Education Department developed an implementation plan and an evaluation plan for how to evaluate if using the Learning at Taonga Market radio programmes in GRZ schools would make a measurable difference. The overall research questions were:

1. Do the pilot schools receive the radio broadcasts?
2. Do teachers effectively conduct lessons using the broadcasts?
3. Do teachers integrate the educational broadcasts into their daily schedules and do the programmes help them teach efficiently?
4. Do pupils who use the broadcasts make learning gains that are greater than pupils who are not using the broadcasts?

The first three research questions are about the practicality of using the radio broadcasts in GRZ schools. Answers to these questions were sought by conducting field monitoring visits to each pilot IRI GRZ school. Monitoring questionnaires were use to collect information during classroom observations and discussions with the teachers. The fourth research question about learning gains was answered by conducting baseline pretests and learning achievement post-tests on learners in grade one in both IRI GRZ schools and Control GRZ schools.

By addressing the four research questions, this report will answer the overall question as to whether the Learning at Taonga Market programme is an effective tool for teaching first grade pupils in Zambian government schools.

Summary of the Experience of Using IRI in GRZ Schools

Radio reception

During the field monitoring it was found that almost 90 percent of the selected schools had radio reception that was either very clear or acceptable, but only 65 percent reported that the radio reception was either very clear or acceptable during all 5 days during the week. The districts with problems with radio reception seem to be Luangwa and Solwezi districts. It was also found that some teachers did not make use of extension cables and other means to enhance reception and that improvement on the radio reception in this way could be made.

Conduct the lessons effectively

Field monitors found that the teachers are able to teach the Taonga Market radio programmes effectively. The teachers followed the instructions of the radio teacher while the educational broadcasts were playing. The teachers used all the listed materials for the observed lessons. They were also able to engage the learners during the lesson and most classes had teaching aids on the walls such as words and drawings.

Field monitors found that learners were very motivated and engaged in the classroom. The learners l ked the songs and games used in Learning at Taonga Market and enjoyed being taught with the radio broadcasts. Their enjoyment is reflected in the overall attendance of learners, as most learners who were in class in April continued to attend classes. Field monitors observed that the radio broadcasts promoted good class and time management and that learners were very focused on their lessons.

Integration of the radio broadcasts into daily schedule

On the question on how easy it has been to integrate the radio broadcasts into the daily teaching schedule, it was found during monitoring that a little more than half of the teachers found that it has been either very easy or easy to integrate Taonga Market radio programmes into their daily schedule. Seventy percent of the teachers using the radio broadcasts found that they now spend less time preparing for the lessons than before because activities and needed materials are described in the lesson plans in the mentor's guides. This freed up time for the teachers to prepare lessons plans for the other grades they had responsibility for.

All but two of the 36 schools have a complete set of NBTL materials and more than 75 percent of the teachers have been trained in NBTL. Seventy percent of all the teachers use NBTL materials to teach literacy in addition to the Taonga Market radio programme. Twenty two of those teachers continued to conduct lessons with four ability-level groups, indicating that they had been able to integrate the two teaching resources.

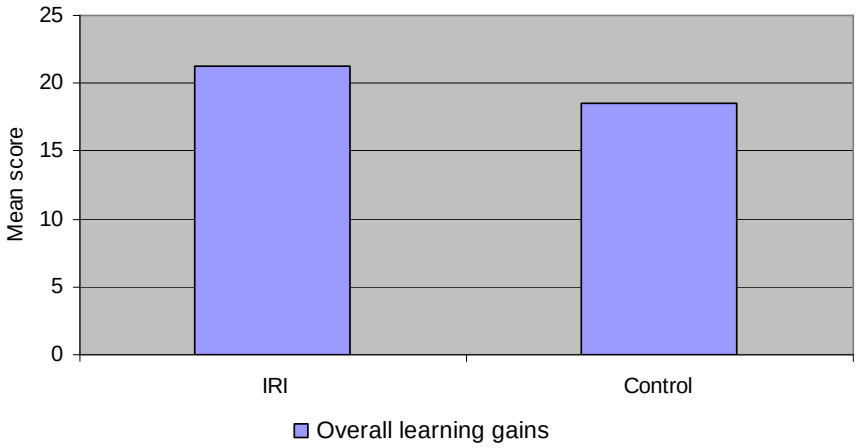
Some teachers mentioned that they were not clear about the purpose of introducing Taonga Market into their class and that more information on that at the beginning of the pilot study would have helped. Some teachers also mentioned that they were confused about whether Taonga Market programmes should replace or supplement NBTL lessons.

During the monitoring visits where this feedback was collected, these teachers were told that the purpose of introducing the radio programmes was to supplement already existing and available teaching resources like NBTL materials and that Learning at Taonga Market and standard NBTL are very complementary as both teach phonics and a substantial sight vocabulary of useful words using the same methodologies.

Overall Learning Gains

The achievement test results shows that the amount of learning gains from pretest to posttest by learners in IRI GRZ schools was 21.3 percent, whereas learners in GRZ control schools achieved a 18.5 percent learning gain in the same period. So the overall learning gains by learners in IRI GRZ schools were higher than the learning gains achieved by learners in Control GRZ schools.

Graph 1: Pretest to Posttest Percentage Gains for Overall Test Score for IRI GRZ Schools and Control GRZ Schools

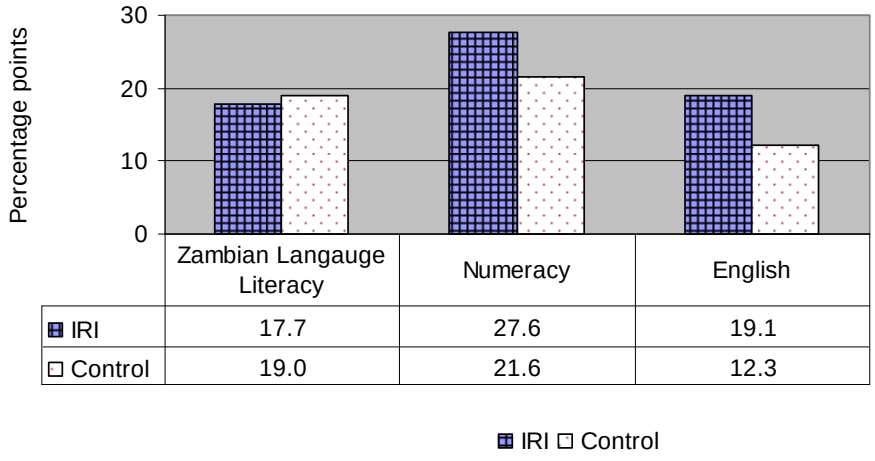


A statistical test of significance on the overall scores reveals that the IRI learners obtained significantly better post achievement score than pupils in the control schools.

Learning Gains by Subjects

The next graph depicts the gains from pretest to posttest for learners in IRI GRZ schools and Control GRZ schools for the three different subjects in the Zambian national curriculum at grade one. As can be seen the biggest learning gain by learners was registered in numeracy by learners in IRI GRZ schools with 27.6 percentage points. This should be compared to the 21.6 percentage points learning gains by learners in Control GRZ schools.

Graph 2: Pretest to Posttest Percentage Gains for Zambian Language Literacy, Numeracy and English Score for IRI GRZ Schools and Control GRZ Schools



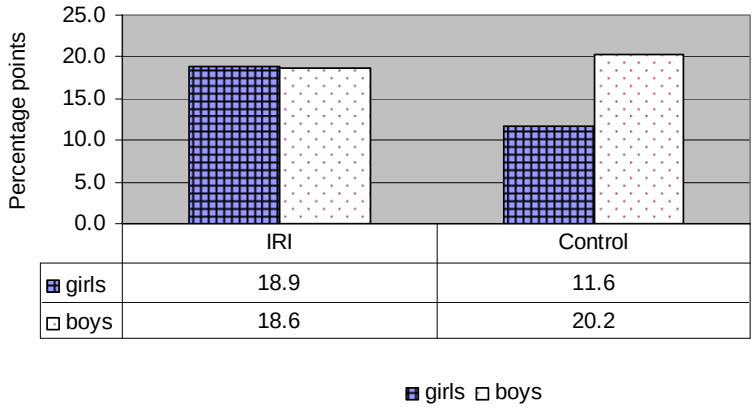
Analyses of statistical significance show that IRI learners obtained statistically significantly greater gains than the learners in the control group in numeracy and English language. The difference in

gains in the subject of Zambian language literacy is not statistically significant. In other words, the learners in both groups achieved similar gains in Zambian language literacy; however, the pupils who used Learning at Taonga Market achieved significantly better command of English language and numeracy skills.

Learning Gains by Gender

In addition to analysing overall learning gains, the study also determined whether learning gains achieved were equally attributed to boys and girls. The next graph depicts the percentage point gain from pretest to posttest for boys and girls in the two treatment conditions. The graph shows that the difference in learning gains between girls and boys in the IRI schools is 0.3 with girls achieving slightly higher gains than boys. On the other hand, in the control schools the boys obtained score gains that were 8.6 percentage points higher than the girls. The boys increased their overall mean score by 20.2 points whereas girls only increased their scores by 11.6 points.

Graph 3: Pretest to Posttest Gains for Boys and Girls in IRI GRZ Schools and Control GRZ Schools



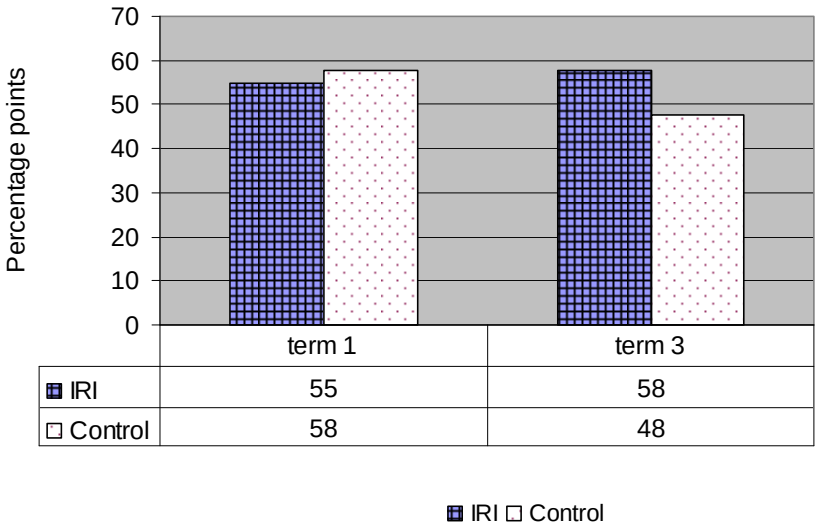
A statistical analysis of this data indicates that the difference in learning gains between girls and boys in Control GRZ schools was statistically significant whereas there was no statistical difference between the learning gains achieved between boys and girls in IRI GRZ schools. This indicates that a gender gap developed in the control schools with boys' performance outpacing that of the girls. In contrast, the boys and girls in the IRI GRZ schools had equal levels of skill development.

Enrolment Gains

Enrolment data was collected twice during the year: once during the beginning of the pilot in April and May and once during the end of the term in November. The graph below shows the average class size in the 36 pilot IRI GRZ schools and the 14 control GRZ schools.

While the enrolment in the IRI schools increased from an average of 55 to 58 pupils, the average size of the classes in the control schools decreased from 58 to 48. That is, while the control GRZ schools tended to experience attrition in their grade one enrolment, the IRI GRZ schools tended to attract more grade one pupils during the school year.

Graph 4: Enrolment Statistics for IRI GRZ Schools and Control GRZ Schools



Evaluation of Piloting of IRI into GRZ schools

The overall goal of this evaluation was to determine if educational broadcasting of the Learning at Taonga Market radio programmes is an effective tool for teaching Zambian language literacy, English language, numeracy and life skills to first grade pupils in Zambian government schools. This was determined by comparing academic gains by learners enrolled in GRZ schools that used the Learning at Taonga Market radio programmes with learners enrolled in GRZ schools not using the radio broadcasts. The evaluation efforts involved an examination of academic performance on two tests. A pretest administered late April and a posttest administered in November. In between these two academic performance tests, a monitoring field visit was conducted to both assess implementation and assist teachers with any problems in using the IRI methodology.

This report descr bes the activities associated with the development and administering of the tests and it descr bes the learning outcomes on the tests with emphasis on answering the question of whether there are learning differences between learners who are taught using the IRI methodology and learners who are taught without the use of the IRI methodology.

1.0 Introducing IRI into GRZ schools

1.1 IRI is a teaching methodology

In March 2005 the Ministry of Education decided to embark on a pilot study of the use of IRI in a restricted number of GRZ schools. In Zambia the IRI methodology has been used since 2000 under the name Learning at Taonga Market. “Learning at Taonga Market” is the name of a radio programme but it is also the name of a complete learning system which consists of radio programs based on the national curriculum, printed materials and mentor training developed by MOE’s Directorate of Open and Distance Education (DODE). The program in 2005 covered Zambia’s basic school curriculum for Grades One to Five in:

- Literacy and English language
- Mathematics
- Science and Social Studies
- Life Skills and HIV/AIDS

IRI follows the national curriculum and the MOE’s school calendar of three terms. It has incorporated all the changes outlined in recently adjusted new basic education curriculum framework, most notably the inclusion of overt literacy instruction. The IRI programmes adapted the content and procedures of the literacy courses, New Breakthrough to Literacy (NBTL) for Grade One, the Step into English (SITE) for Grade Two and the Read On Course (ROC) for Grades Three to Seven. This meant that children learning by radio in Grade One would now be learning to read and write in the familiar local language according to the MOE policy.

The radio programmes are broadcast on Zambia National Broadcasting Corporation’s (ZNBC) Radio Two. There are 150 radio programs for each subject for each grade. These are broadcast on a daily basis on weekdays. Each term consists of 10 weeks of 50 half hour lessons for the learners and one week (5 lessons) of mentor/teacher training.

For each grade there is a mentor’s guide to support the radio lessons. The guide is the teacher’s daily link to the radio broadcasts and assists the teachers in three ways: first, it reminds them of what they learn during the IRI training, second, it tells them what is going to happen in every lesson and what they will need to prepare and how to prepare it and third, it is a resource that provides them with the words of all the songs, descriptions of some songs, instructions for making simple teaching tools such as puppets, explanations to difficult concepts especially in Mathematics and most importantly, it clearly lays out after broadcast activities. Since air time is limited, it is essential that teachers follow up with post broadcast activities that are outlined in the guides for each daily lesson. Likewise, the guides contain a pre-broadcast activity outline that will help the teacher to recap previous lessons and connect them to the content of the lesson for the day.

The Learning at Taonga Market for Grade One follows the national curriculum and is designed to improve academic skills for the three main subjects Zambian Language Literacy, Numeracy and English. [More on specific things to improve within each subject]

The success of the Learning at Taonga Market in achieving these goals for each subject is determined by comparing the performance of learners who listened to the radio programmes with the performance of comparable learners who did not listen to the programmes.

1.2 Expansion of Learning at Taonga Market

The first radio broadcasts of Learning at Taonga Market programmes began in 2000 with a limited number of IRI centres started by communities themselves in collaboration with PDP[1] and QUESTT[2]. In the pilot year in 2000, there were 22 IRI centres in Lusaka and Southern Provinces that utilised the radio broadcasts of the Learning at Taonga Market programmes for Grade One to teach less than 1,300 learners.

After a pilot evaluation where successful learning gains were demonstrated, the Learning at Taonga Market programme was expanded in scope and outreach with new radio programmes for more grades and more IRI centres established. In 2001 more than 250 IRI centres were registered by DODE in all 9 provinces. In 2003, DODE registered the first community schools using the IRI methodology with 88 community schools out of a total of 516 schools. In 2005, there were 893 schools that reported to DODE that they used the IRI methodology, including 36 GRZ Schools that are part of this pilot study and 338 community schools.

1.3 Introducing Taonga Market into selected GRZ schools

The decision to pilot the use of Learning at Taonga Market radio programmes in a limited number of GRZ schools for grade one learners was made in late March by MOE. Immediately afterwards letters to the 7 selected districts[3] were dispatched to respective DEBS informing them about the possibility of having GRZ schools involved in the pilot study. Each DEBS was asked to select 5 GRZ schools, where the use of the IRI methodology could be piloted in 2005. They were asked to select schools using 3 criteria; 1) schools that were understaffed, 2) schools with untrained teachers and 3) schools where teachers taught several grades.

After selecting the 5 schools[4], the DEBS was also asked to send the grade one teachers in the selected 5 schools to a combined orientation of the pilot study and IRI training session that took place from 13th to 15th April 2005[5]. Here 39 teachers from the selected GRZ schools observed and practiced the methods used to conduct lessons with Taonga Market educational broadcasts. They were given all the required teaching materials to teach the Taonga Market radio programme for Grade One, namely a teacher's guide and a conversation poster.

At the training session it was also agreed that the teachers would be administering the achievement testing for the pre-test. It was also agreed that there would be monitoring teams consisting of staff from MOE and QUESTT that would visit each district and most schools during the time period allocated to conduct the testing that would be supervising and monitoring the testing. During the training session, all the teachers were trained in how to conduct the achievement testing, and were provided with the test materials.

However, as the training workshop took place middle of April, the fifty programmes for the first term of Grade One had already been transmitted. The content of the lessons is carefully planned and scripted, so understanding the content of the Term 2 lessons is heavily dependent upon understanding the content of the Term 1 lessons. Since pupils were more likely to benefit from the Term 2 lessons if they had completed the Term 1 lessons, they were given the opportunity to catch up during the holiday between Terms 1 and 2

For the learners to catch-up with the missed lessons for term 1, the teachers were instructed to teach two lessons per day using a distributed cassette tape-player and tapes containing pre-recorded Taonga Market lessons for term 1 lessons, so that the pupils could cover all 50 lessons in term 1 by the time the broadcasts for Term 2 began on 23 May 2005. The teachers were paid a lunch allowance for each of the 16 days of work done during the school holidays. The catching-up programme means that the learners in the GRZ schools using IRI have been taught more days during the school year than learners in normal GRZ schools.

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[1] At the time called Education Broadcasting Services (EBS)
[2] At the time EDC staff was working on the USAID funded IRI project
[3] Lusaka, Chongwe, Serenje, Mkushi, Masaiti, Lufwanyama and Solwezi districts
[4] See appendix G for the list of GRZ schools selected by DEBS to pilot IRI use in 2005
[5] A comprehensive report on the training is available from MOE Teacher Education Department or QUESTT on request

After the training session, all piloting GRZ schools were visited according to the agreed plan by either MOE or QUESTT staff within a span of 3-4 weeks after the training. The purpose of the visits was partly to answer any questions, the teachers would have in relation to teaching using the IRI methodology, partly to distribute a wind-up radio to be used in terms 2 and 3 to receive the radio broadcasts from ZNBC and to pay the teacher's lunch allowances for their work during the school break between terms 1 and 2 and lastly to supervise and monitor, where possible, the achievement test administration by the teachers.

After the training of teachers, each DEBS was asked to select 2 GRZ schools that would be comparable to the 5 GRZ schools selected to use the IRI methodology in 2005. It was the responsibility of each DEBS to determine which schools would be the most comparable schools. After the selection of 2 additional GRZ schools as comparable Control schools, testing plans were made and a team of external testing staff did the achievement testing in the 14 Control GRZ schools during the same periods as the testing in the IRI GRZ schools were done[6].

1.4 Contact and Monitoring during 2005

The contact for 36 IRI GRZ schools participating in the pilot study if the teachers had questions or problems in using the IRI methodology was primarily the local DEBS office. However, three visits to all piloting GRZ schools by MOE and QUESTT staff were planned and implemented during the term 2 and term 3.

April - Initial visit: The purpose of the first visit was as mentioned above to ensure that each teacher had started to use the IRI methodology and to supervise and monitor the pretest achievement test administration.

September - Monitoring visit: The purpose of the second round of visits was to monitor progress and implementation status of the use of Taonga Market radio broadcasts into the teaching of Grade One learners. The main goals of the visits was to find out 1) how the ZNBC broadcast reception was, 2) if teachers could effectively teach using the IRI methodology and 3) if the radio broadcast could be easily integrated into the daily teaching schedule of the teacher and the school as a whole.

November – Testing visit: The purpose of this third round of visits was to conduct achievement testing to measure the learning outcome at the end of the school year.

The 14 Control GRZ schools were visited twice during the year. Both times the purpose was to conduct achievement testing. The pretesting was conducted in the same period in late April that the pretesting in the IRI GRZ schools was conducted. The second round of visits was in November to conduct a similar round of achievement testing as in IRI GRZ schools.

The monitoring visits conducted in the first weeks of term 3 were conducted by MOE and QUESTT staff. During the visits interviews with teachers, classroom observation, question sessions with the learners and a pre-determined questionnaire were used to collected information about the current implementation status, implementation problems encountered and achievements in the 36 IRI GRZ schools.

After the visits the collected information and submitted field reports were analysed and a monitoring report was written including recommendations on how to ensure the most effective use of IRI in GRZ schools[7]. The formation collected during the monitoring visit to all IRI GRZ schools in September is used further to help analyse the achievement test data.

[6] See appendix G for the list of the 14 Control GRZ schools.
[7] The monitoring report is available from TED or QUESTT upon request.

1.5 2006 Plans for IRI use by GRZ schools

With the information from field observations and the monitoring report and its recommendations, the Teacher Education Department decided in October 2005 to extend the pilot into 2006 and expand its scope. It was decided that the 36 pilot schools would continue using the IRI methodology for their Grade One classes and expand to Grade Two as well.

In addition, the Teacher Education Department asked QUESTT to give support to government schools that are using Learning at Taonga Market out of their own initiative. During the 2005 annual school census, 108 government schools reported using IRI. QUESTT is assessing the needs of the schools in terms of materials and training in order to develop a support plan.

Participants at the training of trainers workshop for expansion of pilot project into grade two, Capital Hotel, December 4-6, 2005

2. Learning Gains Analysis

This section describes the process used to develop the Grade One test. The test development process included test planning, item writing, pilot testing and a review by a panel of experts. The test administration procedure is described, followed by a presentation and discussion of test results.

2.1 Test Development

2.1.1 Test Planning

A Grade 1 test of mathematics and English language skills was used to evaluate Grade One IRI learners in IRI centres and community schools in 2001 and 2003. This Grade One test was based on the old Zambia Basic Education Curriculum. In 2004, the new Basic Education Curriculum was implemented in Grade One. The new curriculum places emphasis on Zambian language literacy as taught through the New Breakthrough To Literacy (NBTL) methodology. The "Learning at Taonga Market" educational broadcasts were revised, using many of the NBTL techniques to teach literacy in a Zambian language. The Grade One test was also revised with reference to the new curriculum. The most significant change was that a section on Zambian language literacy was added, giving the Grade One test three sections:

1. Zambian language literacy
2. Mathematics
3. English language

The new test was developed over a period of time starting in March, 2004. EDC consultants Kathleen Letshabo of the University of Botswana and David Anderson of the Molepolole College of Education in Botswana worked with the EBS Grade One team, the EDC Literacy Advisor and the EDC Research Advisor in developing the test. The test development team first reviewed the contents of the new curriculum to make revisions to the mathematics and English language sections. The team then created a Zambian language literacy section. The first task was to select terminal objectives that should be mastered by learners during grade one, as well as important developmental objectives that are emphasised during the first year. Once the team had selected objectives to be assessed, a test plan was developed to determine which skills were to be assessed. The table below shows the skills covered in each subject area, along with the point values that were assigned to each skill area.

Figure 1: Skills Areas within the Achievement Test

Zambian Language Literacy	Numeracy	English Language
• Write from dictation • Write one's own sentences • Identify words and sentences • Read sentences aloud • Read comprehension	• Count aloud • Write numbers • Add • Subtract • Shapes	• Name common items • Talk about time of day • Talk about actions • Count objects in picture • Use plural forms • State days of the week • Follow commands

As in the government curriculum for grade one, the Zambian language literacy section of the test focuses on reading and writing skills, while the English language assessment focuses on speaking skills. The numeracy assessment covers major math skills covered in grade one: counting, addition, subtraction and the ability to identify and draw shapes.

2.1.2 Task Selection and Item Writing

The Interactive Radio Instruction methodologies used in the "Learning at Taonga Market" radio lessons emphasise a participatory learning approach, where learners acquire knowledge and skills through activities. When selecting tasks for the test, the goal was to use the types of activities practised during lessons to assess the learning objectives. The Grade One Mentor's Guide was useful in selecting specific tasks used during the radio lessons.

The participatory approach of the lessons, combined with the young age of the learners, lent itself to a test that consists mainly of oral questions answered orally by learners during individual

interviews. Only four of the 33 questions in the test require written answers. The English and Zambian language vocabulary that the children need to answer the test questions is selected from the vocabulary covered during radio lessons.

The same teams that selected the tasks wrote the items for the tests. Descriptions of the tasks in the final version of the test are given in Appendix A.

2.1.3 Pilot Testing

On 4th June 2004, test administrators piloted the test at five IRI centres/community schools in Lusaka District. The test administrators included the testing consultants, Senior Education Officers for Open and Distance Learning, Provincial Outreach Coordinators from EDC, members of EBS and the EDC Research Advisor.

The pilot testing was preceded by one day of training in which the test administrators read and practised administering the tests. After the pilot testing, the test administrators revised the test items and discussed three general concerns. One concern was that the Zambian language section was too difficult, as many of the grade one learners could not complete the reading or the writing tasks. In response, the test consultants added two easier tasks: one in which the learner listens to a word and then selects it from a group of written works and another in which the learner listens to a sentence and then picks the sentence from a group of written sentences.

Another concern was that some learners who were unable to read the story aloud were nevertheless able to answer the reading comprehension correctly because of what they remembered from lessons. Thus, the original reading comprehension items were inadvertently testing the ability to recall answers from prior lessons instead of reading comprehension. To resolve this problem, the test consultants wrote a new story made up from vocabulary covered during grade one. The last concern was that the administrators sometimes had trouble remembering certain testing procedures. To make it easier for administrators to follow uniform procedures, instructions were added at the beginning of each section letting the administrators know whether to administer the test section to individuals or groups and reminding the administrators whether the questions should be given in the Zambian language or in English.

2.1.4 Review by a Panel of Experts

The last step in the test development process was to have the grade one test reviewed by a panel of testing experts. Copies of the test were sent to members of the Examinations Council of Zambia, the Directorate of Standards, the Directorate of Open and Distance Education and the University of Zambia. On 14th January 2005, members from all of the institutions attended a meeting where the test was presented and discussed.

The panel made a number of observations that led to test revisions. The panel members thought that the test seemed complicated to administer. They recommended administering the group tasks before administering items to individuals. There was consensus that this would make the test easier to administer and cut down on the time that it takes to administer the test. In response to this recommendation, the sentence writing tasks were moved to the beginning of the test. In the mathematics section, it was suggested that some easier items be added to the beginning of the test to help learners feel confident and to capture information about easier skills. Two questions were added to the test: the first one asking learners to count from one to ten aloud and the second one asking them to write the numbers from one to ten. When reviewing the English section, the panel observed that the question about colours would disadvantage children who are colour blind. The item was replaced with an item asking learners to name two common objects in the classroom. In the Zambian language section, revisions were made to one of the rubrics used to rate sentences as a result of the comments made by the panel.

The members of the panel agreed that the test was a satisfactory tool for measuring the achievement of learners who had completed grade one. Appendix A gives an outline of the tasks, questions, point values and scoring rubrics of the final version of the Grade One test.

2.2 Test Scoring

The three sections of the test have different total point values. The Zambian language literacy section is worth 43 points, while Mathematics is worth 28 points and English language is worth 16 points. All of the items allowed for partial credit. For the first four items, the test administrators

collected the learners' written sentences, scored them according to a rubric and then entered the scores on a scoring grid. For the remainder of the items, the test administrators scored the items according to the rubrics and entered the scores directly on the scoring grid as they administered the questions to each individual learner. The scoring rubrics are provided in Appendix A. The pupils' scores were entered in SPSS for analysis.

2.3 Test Administration and Training

2.3.1 Test Administration Guidelines

All test administrators were given written guidelines that described procedures to follow before, during and after the test administration. The purpose of the guidelines was to help the administrators deliver the tests uniformly while giving the grade one learners the opportunity to perform to their capability.

Test administrators were given a list of materials to have ready for testing. They were given step-by-step procedures to follow when performing the sampling and they were directed to remove any instructional materials from the walls so that children would not copy any words or numbers. Standard instructions were printed for delivering test questions, along with the scoring rubrics for each item. The test administration team leaders were trained at workshops in Lusaka to deliver the tests. Team leaders trained other team members to administer the tests in the provinces before the test administration.

The test administrators followed several procedures to help the grade one pupils feel comfortable and perform to the best of their ability. The administrators were instructed to always greet the learners and introduce themselves before beginning testing. They were directed to use the first language instead of English to administer the numeracy section, if the first language was easier for the pupil to understand. (The Zambian language and English sections were always administered in the language being tested.) Guidelines were given on how to deliver test questions, including the amount of guidance that could be given to the learners in how to respond. For instance, when asking children to count from one to 100 by tens, the administrators are instructed as follows:

> You can ask [the learner] to count in tens, or ask [the learner] to count "10 by 10". Present the first 3 numbers of the sequence, and let them give the last seven.

In this instance, the administrator can help the learner understand the task by counting "ten, twenty, thirty" and asking the learner to continue up to 100. For every item, learners are given two chances to respond to a question. If the learner were to make a mistake in counting from ten to 100, then the test administrator would ask the learner to try again.

Administrators were responsible for buying bread and drinks at the beginning of the day. These refreshments were served to the children during a break in the testing to keep the children from becoming too tired.

These test administration procedures were followed at both the control schools and the schools using IRI.

2.3.2 Baseline Testing

When decision to pilot "Learning at Taonga Market" radio lessons came in late March 2005, the researchers had to determine a way of collecting baseline data from the experimental and control schools efficiently. The decision was made to have the grade one class teachers collect the data from eight of their own pupils and have SEO-ODLs and POCs perform the testing at the control schools.

The grade one teachers were trained to use "Learning at Taonga Market" during a three-day workshop from 13 to 15 April 2005. The first two days dealt with how to use the radio lessons. The last day of the workshop focussed on training the teachers how to select a sample of eight pupils and test them before beginning instruction with "Learning at Taonga Market". The workshop was facilitated by the Teacher Education Advisor, who was also responsible for test development and administration, and a Senior Curriculum Development Specialist who had coordinated the test development work until the end of the first phase of the IRI project in September 2004.

During the training, the teachers read the tests, viewed examples of how the test should be administered, translated the Zambian language section into the local language and had time to practise testing each other. The three languages to be used in the Zambian language section were Cinyanja, Icibemba and Kikaonde. The Senior Curriculum Development Specialist informed the teachers of the importance of using the local language of play in the translations and reviewed translations before they were transferred to manila paper for testing purposes. In an evaluation questionnaire completed by 38 of the 39 teachers trained, 36 of the teachers reported that they felt prepared to conduct the grade one tests at their school. Two of the teachers indicated that they did not feel prepared because they had not received their allowance money, which is not a reflection on the quality of the training.

Baseline results were received from 35 of the 36 pilot schools. The baseline testing was conducted by the teachers as soon as possible after returning to the school after the training workshop. Some schools were able to test as early as Monday, 18th April—the first business day after training. Other teachers needed time to return to their schools or to inform the parents of grade one pupils that their children should come to school during the school break for radio lessons.

Results from 33 of the 36 pilot schools were collected during the first round field visits from 18th April to 6th May. Three schools from Masaiti had not conducted the testing by the time of the field visit during the week of 18th April because they had not collected their students yet. Results from two of these schools were received in the mail, while the results from one school were lost in the mail.

To promote uniform, quality testing standards among the teachers, the researchers implemented three measures:

1. The teachers completed a Test Quality Assurance form (See Appendix B)
2. Testing was observed at a number of schools
3. The Monitoring and Evaluation department filtered the data for inconsistencies

The Test Quality Assurance form was introduced to the teachers during the training. It was designed as a checklist to help the teachers remember to follow proper sampling and test administration procedures, such as using English only during the English language section and making sure that all scores are entered in the scoring grids. All of the 35 teachers who returned results completed the forms and their responses indicated that they had conducted the testing properly.

The teachers were informed that members of the QUESTT Project would observe testing at schools. One member of the QUESTT Project visited two schools in Chongwe District. The only testing irregularity that was observed was that after asking the children the names of the shapes (circle, square, triangle, and rectangle), the teacher would leave the picture of the shapes in view when asking a child to draw them. This irregularity was identified early, so it did not have an impact on the scores.

The members of QUESTT who collected the data and the Monitoring and Evaluation department were asked to survey the data for surprising results that might indicate irregularities in administration. For instance, it would be surprising to find consistently high scores for the sentence writing task because the pupils had completed only one term of grade one. One instance of high grades for the sentence writing task was discovered when the data was collected. The teacher stated that the students were told to copy the sentences from the board. The data from this task was excluded from the set of pretest data, but all other scores from the school were entered as there was no evidence of irregularities elsewhere on the test.

The SEO-ODLs and POCs who conducted the baseline testing at the pilot schools had been trained to perform testing at IRI centres/community schools in January 2004. Before testing at the control schools, they were trained in the sampling procedures. The testing was done during the week of 16th May 2005, which was the second week of term two. The data from the 14 control schools was reviewed for surprising results and none were found.

2.3.3 Achievement Testing

The achievement testing took place from 14th to 25th November 2005. Four testing teams of four members each conducted the testing in Lusaka, Central, Copperbelt and Northwest Provinces. The team leaders were the SEO-ODLs from the four provinces. The team members from Lusaka, Central and Copperbelt Provinces were well-practised at administering the grade one test, having just completed achievement testing at IRI centres/community schools. The researchers provided the test administrators with a list of similarities and differences between the IRI centre/community school administration and the government school administration to avoid test irregularities. The same test was used in both administrations, but different sampling methods were used and different information was collected from schools and teachers.

One critical error was made during the administration of the test: the test materials were not collected from the teachers after pretesting even though the same test was to be used for achievement testing at the end of the year. This made it possible for the grade one teachers to use the grade one tests with pupils during the year, potentially giving the pupils in the pilot schools an advantage over the pupils in the control schools. In response to this error, the researchers included a question on the end-of-year questionnaire asking the teachers how many times they used the test during the year. The test was given in the middle of a series of other questions about instruction during the year and the test administrators were informed that they should pose the question in a natural manner without an accusing tone. This was done to avoid giving the teacher a cue that a response of "No" was desirable. A summary of responses for those schools that did use the test during instruction is given in the following table.

Table 1: Number of Times Test Used During Instruction

Number of Times Test Used	1	2	3	4	8	9
Number of Schools	5	6	3	1	1	2

In all, 18 teachers responded that they had used the test for instructional purposes. The researchers did an analysis of the data, comparing the average achievement scores at schools where the tests were used with the average achievement scores of the schools that did not use the test. The achievement scores of schools that used the test one or two times did not differ significantly from the achievement scores of schools where the test was not used, so the data from the eleven schools where the test was used once or twice was retained in the final analysis of learning gains. The data from the seven schools where the test was used three or more times was removed from the data set for learning gains analysis.

2.4 Sampling Plans

The sampling process was carried out with the goal in mind to balance out demographic and treatment factors in the evaluation design to the extent it was possible to balance them. In particular, the sampling plan was determined by taking into consideration that the primary goal of the evaluation of determining if educational broadcasting of the Learning at Taonga Market radio programmes is an effective tool for teaching Zambian language literacy, English language, numeracy and life skills to first grade pupils in Zambian government schools.

The budget allocated to the evaluation of the pilot study also set an upper limit on the number of learners sampled for testing. For the pretest it was determined that 8 learners from each class using IRI should be tested, so that 14 learners could be tested in posttest. Using the current number of enrolled learners collected during the monitoring visits of 2,107 learners being taught by teachers using the IRI methodology, it can be deducted that there was on average 57 learners per class[8] and that the number of learners sampled for the pretest was about 14 per cent of the total number of learners and that it was about 25 per cent for the posttest.

The sampling procedures were designed to select pupils in a random manner and to select a ratio of girls and boys that is similar to the ratio of girls and boys in the schools. For sampling during the baseline testing, the test administrators were instructed to select eight students in each school by taking every fifth boy and every fifth girl. This allowed for selection of learners at all ability levels. The administrators were also requested to ensure that the gender of the study participants was proportionate to the gender of students in the whole class. For example, if 75% of the class was girls, then six of the eight participants would be girls and two would be boys.

[8] Chilese school in Masaiti district had two classes using IRI, one for only boys and one for only girls.

At the time of achievement testing, the test administrators were directed to avoid testing pupils with low attendance, as it was anticipated that the radio lessons would have little impact if a learner had low attendance. Administrators rated the attendance of pupils as High (attended 120-150 radio lessons), Medium (90-119 lessons) or Low (less than 90 lessons). Only those pupils from the baseline who had High or Medium attendance were to be selected for achievement testing. Once members of the baseline group had been chosen, an administrator selected the remaining 14 pupils from among those who had High or Medium attendance. The administrators were cautioned not to let the teachers select the pupils, as the goal was to randomly select pupils with High or Medium attendance. In situations when it was not possible to select 14 pupils who had attended 90 or more radio lessons, administrators were instructed to randomly select pupils with Low attendance to complete the sample of 14 pupils at the school.

Once sampling was complete, the administrators collected information about characteristics of the sample that were thought to be related to learner performance, such as the quality of radio reception at the school and teacher attendance. Analyses were performed to determine whether or not such factors had an effect on learner achievement.

2.5 Descriptive statistics

The pretest sampling distribution for each of the four provinces can be found in the table 2. A total of 424 learners from the 36 IRI GRZ Schools and 14 Control GRZ schools were pretested and the breakdown of the province, type of school and gender is presented in table 1. It can be seen that gender distribution is very even overall as well as within all the provinces.

Table 2: Number of learners and schools pretested by province

School type	Number	Provinces				Total
		Central	Copperbelt	Lusaka	North-Western	
IRI GRZ schools	boys	36	49	46	23	154
	girls	36	47	50	17	150
	total	72	96	96	40	304
	schools	10	10	11	5	36
Control GRZ schools	boys	20	14	18	8	60
	girls	18	18	14	8	58
	total	38	32	32	16	118
	schools	4	4	4	2	14
Total	boys	56	63	64	31	214
	girls	54	65	64	25	208
	total	110	128	128	56	422
	schools	14	14	15	7	50

In table 3 the age distribution of the learners that were pretested is presented. It can be seen that the average age for all learners was close to 8 years, and that the learners tested in the IRI GRZ schools were a little younger than the learners tested in the Control GRZ schools.

Table 3: Age distribution of learners pretested by IRI GRZ school and Control GRZ school

	IRI GRZ schools	Control GRZ schools	Overall
Mean Age	7.94	8.17	8.00
Modal Age	7	8	8
Minimum Age	6	6	6
Maximum Age	12	13	13

A similar sampling distr bution with respect to the province, type of school and gender as was presented for the pretest is presented for the posttest in table 4. The total number of learners tested was 655. The gender distribution overall as well as within each province was very even. The lowest age recorded for a learner tested was 6 years and the highest was 13 years.

Table 4: Number of learners and schools posttested by province

School type	Number	Provinces				Total
		Central	Copperbelt	Lusaka	North-Western	
IRI GRZ schools	boys	65	69	83	23	240
	girls	76	69	71	17	233
	total	141	138	154	40	473
	schools	10	10	11	5	36
Control GRZ schools	boys	33	29	28	7	97
	girls	23	26	27	9	85
	total	56	55	55	16	182
	schools	4	4	4	2	14
Total	boys	98	98	111	30	337
	girls	99	95	98	26	318
	total	197	193	209	56	655
	schools	14	14	15	7	50

In table 5 the age distribution of the learners that were posttested is presented. It can be seen that the average age for all learners again was close to 8 years. The discrepancy between the average age of learners in IRI GRZ schools and Control GRZ schools here was even smaller than for the pretested learners. The lowest age recorded for a learner tested was 5 years and the highest was 12 years.

Table 5: Age distribution of learners posttested by IRI GRZ school and Control GRZ school

	IRI GRZ schools	Control GRZ schools	Overall
Mean Age	8.07	8.08	8.07
Modal Age	7	8	8
Minimum Age	5	6	5
Maximum Age	12	12	12

As can be seen in table 5, for the posttested learners the average age of the learners in the IRI GRZ schools and the Control GRZ schools is very even. So for the post test achievement test scores, the influence of age as a contributing factor to learning achievement will not have an influence on the differences in achieved learning achievement between the IRI GRZ schools and Control GRZ schools.

2.6 Test Reliability

The reliability of the pretests and posttests used was examined by using the Chronbach alpha procedure. This measure of reliability is used to evaluate the extent to which content sampling affects observed scores. The Chronbach alpha procedure gives an estimate of the internal consistency of a test; it is not a measure of test-retest reliability. It yields the average of all poss ble split-half reliability coefficients that could be computed for a single form of a test. The reliabilities of the tests are reported in table 6.

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Table 6: Reliability (coefficient alpha) for Pretest and Posttest

Test	Number of items	# of learners	Test reliability based on total sample
Pretest	33	422	0.9237
Posttest	33	655	0.9239

The reliability levels of the tests are satisfactory with both having an alpha value of slightly more than 92 percent. This means that on average the relative standing of the pupils is 92 percent consistent when comparing scores derived from two halves of the test.

2.7 Observations on Pretest Scores

The overall pretests mean score for learners in IRI GRZ schools was 21.18 points or 24 per cent whereas for learners in Control GRZ schools it was 18.75 points or 22 per cent. A statistical analysis shows that the difference between the IRI GRZ schools and Control GRZ schools was not

statistically significant. The observed t-value is 1.483 at 400 degrees of freedom and 95% confidence interval ($p > 0.05$) whereas the critical t-value is 1.960 (See Appendix C for more details). This provides a situation where the effect of using the IRI methodology in some schools compared to schools where it was not used can be shown, if they are present.

Before presenting the results on learning achievement gains it is worth considering a number of aspects on interpretation of the data.

As the pretest assesses what learners know of the curriculum that they are about to be taught during the upcoming school year, it was expected that most learners' performance on the pretest would be low. The average per cent correct performance on the pretest for all learners tested in IRI GRZ schools and Control GRZ schools was 24 per cent and 22 per cent respectively. However, working with low scores involves another testing and interpretation aspect. Is there a risk that the results are due to chance alone? In other words, could the learners have randomly guessed an answer to each question, and have obtained an inaccurate performance score?

The answer to this question is that it is unlikely that the scores are due to chance alone. Most of the test items are questions that involve learners to actively construct an answer. Of the 87 possible points on the test, only eight points involve a multiple choice format. For that reason the risk of having learners guessing the right answers is limited and unlikely to occur across the tested population. Given the nature of the tasks, it was more likely that children would not give a response instead of guessing at an answer.

It is also worth mentioning that learners on some item questions in fact never gambled and or just guessed. In fact, on some item questions a significant proportion of the tested learners never managed to respond to a question at all and this is recorded as an incorrect score. These non-response answers are added to the score already recorded as incorrect where a response, but an incorrect one, was given. The pattern of no response scores to some of item questions occurred on the posttest as well.

It should be mentioned that there could be several reasons why learners might not respond to an item question. First, and most straightforward, they might have not responded if they had no idea what the correct answer is, making the scoring as wrong the correct scoring option. However, the learners might not have been able to answer because they did not understand the directions for responding to the items or they might not have understood the wording or situation on a poster. Thirdly, some learners might have felt intimidated by the whole testing situation that involves unfamiliar people coming and asking them questions in a situation they are not used to being in. If any learners were in the last two situations, the scoring of an incorrect score could actually be a wrong scoring option that has been recorded.

To give every learner the best and equal opportunity in the achievement test, the testing administration was done as uniformly as possible and with guidelines for making the testing situation for the learners relaxed and comfortable. There were also guidelines for how to introduce the item questions to the learners so that they understand the questions. In addition, test administrators were directed to repeat a question twice if a learner did not understand or respond the first time.

Test anxiety was kept to a minimum by not calling the testing a test or an exam but a game. The day when testing took place was a play-day. It is possible that some learners might have felt uneasy with the testing situation, and indeed it was mentioned by test administrators in some cases. However, the administration of the pretest in IRI GRZ schools was done by their familiar classroom teachers, only supervised and monitored by external school staff in some cases, and the average score for the learners in IRI GRZ schools is only marginally higher than for the learners in Control GRZ schools, where MOE and QUESTT staff that did the testing.

Another way to look at the overall score levels is to look at the frequency with which the scores occurred. The maximum number of points possible to obtain in the test is 87 points and none of the learners in the pretest and the posttest got a score of 87 points. For the pretest 50 per cent of the learners got less than 16 points which is 18 per cent of the possible score. For the pretest there were 2 learners who attained a score of zero, meaning that they either did not answer any of the questions or that they answered so few that they could not get one correct score by chance.

Another interesting comparison is to look at the score at which 90 per cent of the learners taking the tests fell below that score. The score point that separated the lower 90 per cent of the learners

in the pretest and the top 10 per cent was 40 points or 46 per cent. Finally, 31 learners out of the 422 learners pretested scored 50 per cent or better, with the top score on the test being 87 per cent correct.

In conclusion, the pretest scores were sufficiently low, so that there was ample room to improve the scores by the posttest at the end of the school year.

2.8 Where should IRI work?

Having now established that the pretest data provides a good background for documenting an effect of using IRI in GRZ schools, if present, it is necessary to further discuss under which conditions the IRI methodology can be expected to produce measurable change.

As the IRI methodology is largely communicated through radio broadcasts, the first condition needed to be satisfied is that the ZNBC radio broadcast should be of sufficiently good quality so that both the teachers and the learners can hear the content of the radio lesson in the classroom. The DEO office in each of the 7 districts selected the pilot schools based upon the criteria mentioned in section 1.3 and that they believe that the schools had good radio reception. However, radio reception is not a static condition as it depends upon the daily atmospheric and local weather conditions as well as broadcasting and transmitting equipment.

The teachers in the IRI GRZ schools were asked, as part of the questions about the school and learning environment, how many days a week they on average had had a good radio reception during the school year. The data collected revealed that teachers in three pilot GRZ schools (Kakushi, Kapako and Luamfula) reported to only have had good radio reception four days during a week on average, and that Kangili and Kavalamanja basic schools reported only to have had 3 days a week when they had had good radio reception during the school year.

Secondly, it is not enough just to have good radio reception for IRI to produce measurable change. It is also a prerequisite that the pilot schools had a working radio during the whole school year. That was ensured during the pilot study by providing each school with a portable and robust wind-up radio. This radio type ensures that teachers did not miss a radio broadcast because of for example expired or missing batteries as they just had to wind-up to charge the special inbuilt batteries (or place a solar panel in the sun). The pilot school teachers were also instructed to get in contact with the local DEO office if they had any problems with the radio during the year, and only one problem [which school was it in Copperbelt? Make a footnote on it] were recorded during the year and that was quickly rectified.

Thirdly, any teacher using IRI will be most effective if they have the teacher's guide that accompanies and supplements the content of the radio broadcast. This teacher's guide contains information about the daily lesson, what will be taught during the lesson, what and how to prepare themselves (the teachers) for the lesson and exercises to practise with the learners before and after the daily broadcast. At the initial training each teacher was provided with a guide and at every visit to the schools during the year, it was ensured that each teacher had a guide.

Fourthly, the IRI methodology cannot be expected to produce measurable change if learners being taught the Grade One curriculum did not have an acceptable attendance during the school year. If a learner never attended many of the lessons, it can not be expected that the same lessons would produce a measurable academic gain by the same learner. Along the same lines, it is also important that there were a teacher teaching the lessons during the school year. The IRI methodology is an interaction between the radio teacher, the classroom teacher and the learners. If one of the players is missing, the interaction misses a link and the methodology will not produce the expected results.

Fifthly, the IRI methodology is a teaching methodology that can be used effectively by certified teachers as well as uncertified teachers and without prior intensive face-to-face training if the teacher has some experience using it. Without a face-to-face training, some learning-by-doing will help the teacher using the broadcast lesson as he/she with time gets used to working with songs and games as well as time management during the broadcast where activities and timing is predetermined.

The teachers in the pilot were selected quickly in April and had no prior experience using the IRI methodology (most of them did not know much about it before the first training). Therefore, it can not be expected that the IRI methodology would produce measurable change unless the initial

trained teacher (or a trained replacement) taught learners during the whole school year. The fact that the learners in the pilot school could be said to have got more teaching during the term than the learners in the control schools should be taking this fact into account; the teachers most likely used the teaching of the Grade One lessons during the school break using tapes to get used to the IRI methodology with its emphasis on songs and games and its strict time management demands during broadcasts.

During the monitoring visits and the post testing both learner and teacher attendance was monitored and data was collected.

In summary the preconditions that need to be satisfied to expect IRI to produce measurable change are:

- Good radio reception and a working radio
- A teacher's guide
- Good attendance by learners as well as the teacher

Applying these preconditions to analyse which learners in the posttest should be used to document any measurable change, if present at all, results in the achievement test data as presented in table 6. Here only test scores from learners in IRI GRZ schools that had 1) good radio reception 5 days a week, learners that had an attendance of 80 per cent of the lessons or more, 3) the teaching was done by a trained teacher (or a sufficiently able replacement) and 4) teacher absence was not high.

Having established the criteria to analyse learning performance by learners in IRI GRZ schools, it is necessary to apply the criteria of good attendance by learners in order to have comparable performance test scores by learners in the Control GRZ schools.

3. IRI Learning Gains

The analysis in the following sections will focus on comparisons between learners pretest and posttest performance. First, statistics on the performance for learners in IRI GRZ schools and Control GRZ schools will be presented to show how learners in the different treatment groups perform on the pretests and the posttests. Secondly, analyses will also be presented that show how male and female learners performed on the tests, and how students from different geographical regions on the tests, and how students with varying demographic characteristics performed. Additional analyses will also be performed to indicate whether there are statistically significant differences between treatment groups.

3.1 Overall Test Score Comparison between Treatment Groups

Having established in section 2.5 that treatment groups does not differ significantly from each other except from the treatment, i.e. use of Learning at Taonga Market teaching materials, the learning gains can now be analysed. For the IRI GRZ schools only learners for which the IRI precondition criteria (i.e adequate radio reception, adequate learner attendance and adequate teacher attendance) apply have been included in the analysis. For comparison only learners who had a good attendance in Control GRZ school classes have been included.

The results presented in table 7 addresses the first question of whether the treatment groups differ in the amount of learning gains made from pretest to posttest.

The data in these tables was collected from learners who took both the pretest and posttest as well as for learners who only took the pretest or the posttest. The reason for this is that the selected learners by being sampled among their classmates randomly represent the performance of all the learners in the class[9].

Table 7: Mean per cent Correct Performance on Pretest and Posttest, and Pretest to Posttest Gain by Treatment Group

Sch ool	Subj ect	N	Mini mu	Maxi mu	Mea n	Std. Dev.	Pos sible	Mea n

[9] For the posttest it was asked to test all pretested learners if possible, but it turned out that only 224 out of the 422 (53%) pretested learners were also posttested

type		m Score	m Score	Score	Score	as %
IRI pretest	Overall	296	0	76	21.18	14.86	87	24%
IRI posttest	Overall	104	11	83	39.67	17.74	87	46%
Gain	*Overall*				*18.49*			*22%*
Control pretest	Overall	106	0	59	18.75	13.52	87	22%
Control posttest	Overall	85	8	75	34.93	16.01	87	40%
Gain	*Overall*				*16.18*			*18%*

Table 7 shows the mean per cent correct performance on the pretest and the posttest, and it shows the average amount of gain from pretest to posttest for learners in IRI GRZ schools and learners in Control GRZ schools. The data presented in the table shows;

1. On average the learners in both IRI GRZ schools and Control GRZ school experienced a learning gain between the pretest and posttest, and
2. On average the learners in IRI GRZ schools experienced a bigger learning gain than the learners in Control GRZ schools with learning gain of 22 per cent and 18 per cent respectively.

These results were subjected to an independent groups T-test to investigate if there was significance in the differences in gains obtained by the learners in the IRI GRZ schools and the learners in the Control GRZ schools.

At 90% confidence interval and 189 degrees of freedom the observed t-statistic is 1.912 ($p < 0.10$) while the critical t-value is 1.645. The conclusion is that there is a significant difference in the mean scores. The T-test analysis indicates that the learners in IRI GRZ schools scored significantly higher on the posttest than did the learners in the Control GRZ schools.

Conducting a similar analysis for the three different subjects for Grade One curriculum results in the data in table 7, where the overall test score is broken down by subject matter.

3.2 Test Score Analysis for Numeracy for learners in IRI GRZ Schools

The numeracy section of the test has a total possible score of 28 points. Learners in both the IRI group and the control group had learning gains in the area of numeracy as indicated in the following table.

Table 8: Learning Gains for Numeracy

Type of School	Possible Score	Baseline Mean	Achievement Mean	Gain	Percentage Gain

IRI	28	10.83	18.55	7.72	27.6 %
Control		10.21	16.25	6.04	21.6 %
Difference in Gains				1.68	6.0%

The IRI learners had an average gain of 7.72 points (27.6%) in the numeracy section, while the learners in the control group had an average gain of 6.04 points (21.6%). On average, the IRI learners gained 1.68 points or 6.0% more than learners in the control group. These results were subjected to an independent-groups T-test to determine whether the difference in the gains is statistically significant. In numeracy the observed $t = 2.817$ at 192 degrees of freedom and $p < 0.05$. The critical t-value is 1.960. This indicates that there is a statistically significant difference between the gain scores. That is, the IRI learners obtained significantly greater gains in numeracy than the learners in the control schools.

The numeracy section of the test has questions that assess learners' achievement in the areas of counting aloud, writing numbers, adding and subtracting, as well as identifying and drawing shapes. A further analysis of the learning gains for each skill area is given below.

Table 9: Learning Gains for Curriculum Items within Numeracy

Numeracy Skill	Possible Points	IRI Gain	Control Gain	Difference In Gains
Counting aloud	8	2.87	-0.17	3.04
Writing numbers	4	1.52	0	1.52
Addition	4	1.18	0.05	1.13
Subtraction	4	1.13	0.10	1.03
Shapes	8	1.66	0.01	1.65

** The learning gain analysis for individual skills item is done with learners where the testing materials were used in order to get more learners into the analysis. The results can therefore not be directly compared to overall score level.*

The second and third columns show the average score gains for the IRI learners and the learners in the control schools. The IRI learners had greater gains for each of the numeracy skill areas. The right column shows how many points higher the IRI gains were than the gains of the control group. The greatest gains occurred in the areas of counting aloud and writing numbers. In the skill of counting aloud, IRI learners scored an average of three points better than learners in the control group on a set of questions that was worth eight points. In the skill of writing numbers, the IRI learners scored an average of one and a half points better on a set of questions that was worth four points. On average, IRI learners scored more than one point better than learners in the control group in each skill of addition, subtraction and shapes.

The overall learning gains in numeracy are distributed across all five tested numeracy skill areas. The five skills of counting numbers, writing numbers, addition, subtraction and shapes are major areas of focus during grade one. During the months of April to November, the IRI learners obtained a better command of these five critical numeracy skills than their counterparts who did not receive IRI instruction.

3.3 Test Score Analysis for English for learners in IRI GRZ Schools

The English language section of the test has a total possible score of 16 points. Learners in both the IRI group and the control group had learning gains in this area.

Table 10: Learning Gains for English

Type of School	Possible Score	Baseline Mean	Achievement Mean	Gain	Percentage Gain
IRI	16	4.82	7.87	3.05	19.1 %
Control		4.10	6.06	1.96	12.3 %
Difference in Gains				1.09	6.8 %

On average, the IRI learners gained 3.05 points (19.1%), while the learners in the control group gained 1.96 points (12.3%). For the English language section, the observed $t = 4.652$ with 193 degrees of freedom and $p < 0.05$. The critical t-value is 1.960. The conclusion is therefore that there is a statistically significant difference in the score gains. That is, the IRI learners achieved

significantly greater gains in English language than the learners in the control schools. The IRI learners gained an average of 1.09 points (6.8%) more than learners in the control group.

All of the English language test questions assessed the learner's ability understand and answer questions in English. The questions covered the skills of naming common items, ta king about the time of day, ta king about common actions, counting, using plural forms of words, talking about the days of the week, and following simple commands. The IRI learners had greater gains in all of the skill areas with the greatest gains in the areas of naming common items and using the plural forms of words.

Table 11: Learning Gains for Curriculum Items within English

Subject Skill	Possible Score	IRI Schools Gain	Control Schools Gain	Difference in Gains
Naming Items	4	1.17	0.57	0.60
Time	2	0	0.12	0.12
Picture	2	0.16	0	0.16
Count	2	0.16	0.23	0.07
Plural	2	0.90	0.15	0.75
Days	2	0.23	0.03	0.20
Command	2	0.56	0.51	0.05

** The learning gain analysis for individual skills item is done with learners where the testing materials were used in order to get more learners into the analysis. The results can therefore not be directly compared to overall score level.*

The IRI learners showed greater improvement than their counterparts in the areas assessed by the test, which are also key areas of the grade one curriculum. The IRI learners were better able to understand question in English and speak English than their counterparts who did not receive IRI instruction.

3.4 Test Score Analysis for Zambian Language for learners in IRI GRZ Schools

The Zambian language literacy section of the test focussed on reading and writing skills in the learners' first languages. It has a total possible score of 43 points. Both IRI learners and learners in the control group showed gains in this area.

Table 12: Learning Gains for Zambian Language Literacy

Type of School	Possible Score	Baseline Mean	Achievement Mean	Gain	Percentage Gain
IRI	43	5.51	13.12	7.61	17.7 %
Control		4.31	12.47	8.15	19.0 %
Difference in Gains				0.54	1.3 %

On average the IRI learners showed a gain of 7.61 points (17.7%), while the learners in the control group showed a gain of 8.15 points (19.0%). The 0.54 point (1.3%) difference in gains was subjected to statistical analysis using the independent samples t-test to determine significance. The analysis showed that for Zambian language literacy, the observed $t = 0.265$ at 192 degrees of freedom and $p < 0.05$. The critical t-value is 1.960 implying there was no significant statistical difference in pretest to post-test learning gains between the IRI learners and the learners in control schools. Although the learners in the government schools showed slightly better gains in the area of Zambian language literacy, this difference in the gains is not statistically significant. The IRI learners and the learners in the control schools had similar gains in Zambian language literacy.

Table 13: Learning Gains for Curriculum Items within Zambian Language Literacy

Subject Skill	Possible Score	IRI Schools Gain	Control Schools Gain	Difference in Gains
Dictation	6	1.32	1.12	0.20
Writing sentences	6	1.32	1.22	0.09
Identifying words and sentences	8	2.34	2.40	0.06
Reading aloud	16	3.25	3.10	0.15
Reading comprehension	7	0.75	0.49	0.26

** The learning gain analysis for individual skills item is done with learners where the testing materials were used in order to get more learners into the analysis. The results can therefore not be directly compared to overall score level.*

The Zambian language literacy section assessed the learners' ability to write sentences from dictation, write their own sentences, identify words and sentences, read sentences aloud and answer reading comprehension questions. The learners in both groups had similar learning gains in all skill areas.

3.5 Overall Test Score Comparison between Girls and Boys

The next section will address the question of whether boys and girls differ in achieving learning gains. Table 14 below shows the average performance of boys and girls on the pretest and posttest for both IRI GRZ schools and Control GRZ schools and it shows the average pretest to posttest learning gains for boys and girls.

The results in the table show that there was a 1.77 learning gain difference between boys and girls in IRI GRZ schools in the favour of the boys, whereas the learning gain difference between boys and girls in Control GRZ schools was 6.89, again in favour for the former.

Table 14: Mean per cent Performance on Pretest and Posttest, and Pretest to Posttest Gain by Gender and School type

School type	Sex of learner	N	Pretest TOTAL	N	Posttest TOTAL	*Gain*
IRI GRZ schools	female	21	26.43	59	38.20	11.77
	male	18	27.89	47	41.43	13.54
Difference			*1.46*		*3.23*	*1.77*
Control GRZ schools	female	11	17.27	40	30.03	12.76
	male	14	19.64	45	39.29	19.65
Difference			*2.37*		*9.26*	*6.89*

The findings in table 14 above were subjected to a two-way between group analysis of variance to determine if the differences observed between the male and female learners and also between the different school types were significant. The analysis shows that both the type of school and the gender of learners had a significant interaction effect on the performance of the learners ($p < 0.05$). This suggest that the introduction of the use of the IRI methodology in GRZ school classes have assisted the teacher to ensure that the learning gains have been achieved by a better and wider distribution of all learners, including between girls and boys.

This distribution effect of learning gains by the IRI methodology is not unexpected because the IRI methodology is structured to ensure that every learner in the classroom gets proper and equal attention and opportunity to express themselves and to raise questions. The three-way interaction between the radio teacher, the classroom teacher and the pupils together with emphasis on exercises, songs, games and the guidance by the radio teacher ensures that an equal representation of boys and girls and learners in the front of the classroom and in the back of the classroom in general get the same opportunities and are being called to the board should lead to an generally well distributed learning gains.

3.6 Enrolment Gains

The Learning at Taonga Market radio programmes is made with the intent to have pupils and teachers to enjoy being in the classroom. The tools of learning involve songs, structured games and plays that aside from being enjoyable for the pupils reinforces the concepts and facts of the learning objective of a given lesson or segment of lesson.

Table 15: Increase in Mean Class Size between Term 1 and Term 3

School type	Class size in term 1	Class size term 3*	*Change in mean class size*
IRI GRZ schools	54.70	57.66	*2.96*
Control GRZ schools	57.63	47.50	*-10.13*

** the data collected for term 3 was collected during monitoring in the month of term 3 for IRI GRZ schools and during testing activities in the last month of term 3 for Control GRZ schools.*

During the school year enrolment data was collect twice from schools. Enrolment is depending on many factors aside from what takes place in the classroom however it is interesting to note that the collected enrolment indicate that the enrolment in IRI GRZ schools increased between term 1 and 3 whereas it deceased for Control GRZ schools in the same period.

The decrease in the enrolment in the Control GRZ schools is rather dramatic as it fell with not less than 18 per cent between term 1 and term 3, which means that on average more than 10 learners had dropped out of the class. That IRI GRZ schools experienced a slight increase in the enrolment into grade 1 might be linked the fact that these grade 1 classes received some special attention during the year by being part of the pilot study.

The relative big difference in enrolment between IRI GRZ schools and Control GRZ schools and the fact that the enrolment has moved in opposite directions indicate that the learners enjoy being taught by teachers using the Learning at Taonga Market radio programmes and will make efforts to come to school. Unfortunately, the research setup did not include any explanatory factors for enrolment changes, so this aspect can not be documented with other materials than the statements from teachers and learners as observed during the field monitoring.

3.7 Discussion of Assessment Results

IRI learners achieved significantly higher gains than learners in the control group in the areas of numeracy and English language, while both groups obtained similar results in the area of Zambian language literacy.

There are probably a number of reasons why the “Learning at Taonga Market” programme helped learners make greater improvements in numeracy and English language than learners in the control group. The mentor’s guide provides pre- and post-broadcast activities in numeracy that reinforces the skills that are practised during the radio lessons. In addition, the mentor’s guide provides a list of the materials that the teacher and pupils need to prepare for each lesson. Real objects are used during lessons to ensure that children develop firm initial concepts of numbers that form the foundation of all later learning. For example, they use bundles of sticks when learning to count by tens. When learning English, the radio teacher provides an excellent model of English language on the radio. Many of the grade one English objectives are taught through songs that help children expand their vocabulary and improve their confidence in speaking English.

It is not clear why “Learning at Taonga Market” lessons promoted stronger numeracy and English language skills, while gains in Zambian language literacy remained the same. One reason may be that while the radio lessons provided an equal focus on the three subject areas, teachers in the control schools may have put a greater emphasis on Zambian language literacy than on numeracy and English. All of the government school teachers have had training in Primary Reading Programme methodologies, including New Breakthrough To Literacy, within the last two years. The emphasis on Zambian language literacy during in-service training may have improved the quality of instruction in that area and encouraged teachers to place greater emphasis on the subject.

Another reason may be that the radio lessons and accompanying pre- and post-lesson activities might not provide an added advantage for improving writing and reading skills when class sizes

are large. The average size of the 36 classes using IRI was 58 by the end of the year and two classes had more than one hundred pupils. While the pupils were able to work in large groups to improve their numeracy and English language skills, they may have had trouble getting any added individual attention to improve their Zambian language reading and writing skills further than the pupils in the control schools. It is worthwhile mentioning that the IRI classes were an average of 10 pupils larger than the control classes by the end of the year, so it somewhat surprising that the IRI learners were able to achieve the same levels of learning gains as the pupils in the control schools.

The test results did not reveal any measurable effects of the Learning at Taonga Market programme at the end of grade one; however, it may be that it would take more than two terms of study with Learning at Taonga Market for learners to display accelerated learning gains in the tested skills. Many of the Zambian language literacy skills were higher order skills than those tested in English or Numeracy. For example, students were asked to write two of their own sentences about a story and they were asked comprehension questions about a story. Further research will explore whether IRI learners display accelerated gains in these skills at the end of grade 2.

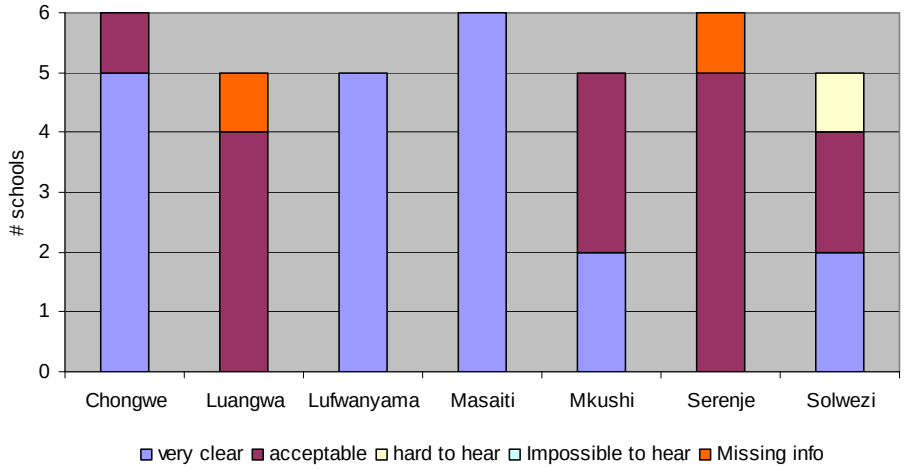
4. IRI Introduction into GRZ schools

The analysis in the following sections focused on learning gains by learners. This chapter will concentrate on the key factors that are essential to have in place for the IRI methodology to be most effective. The pilot study looked at 3 key implementation factors to have in place; good radio reception, ability to conduct the Learning at Taonga Market lesson effectively and how the radio lessons can be integrated into the daily teaching schedule for GRZ school teachers. In the following sections results and observations on each of these 3 key factors arising from field monitoring visits during the school year will be outlined.

4.1 Radio Reception

All 36 experimental schools had a radio that was working at the time of the monitoring visit and it was found that almost 90 percent had either very clear or acceptable radio reception. Only 4 schools, in 4 different districts, reported to have radio reception that was hard to hear[10]. No school had radio reception that made it impossible to hear Taonga Market radio programmes.

Figure 2: Radio Reception at the 36 IRI GRZ Schools



As can be seen in the Figure 1, the radio reception was particularly good in the schools in Copperbelt (Lufwanyama and Masaiti districts) where all schools reports “very clear” radio reception. In Lusaka province there is some difference between the radio reception quality between Chongwe district and Luangwa district with the former having 5 out of 6 schools reporting very clear radio reception and no school in Luangwa having a “very clear” radio reception. In Central Province, it seems that the radio reception for the pilot schools in Mkushi was a little better than for the schools in Serenje.

Nineteen of the schools (or 53 per cent) used the FM band to receive the Taonga Market programmes and 15 schools (or 43 per percent) used the SW band (15). There is some correlation between the quality of the radio reception and the band used to receive the broadcast as 15 schools out of 17 schools that used the FM band[11] also reported very good radio reception. It can also been seen from the fact that all 10 schools in Copperbelt used the FM band and all schools reported a “very clear” radio reception. Only Kamalamba School in Solwezi district reported to be using the FM band and a reception quality where it could be “hard to hear”.

[10] The scale of reception was: 1. very clear, 2. acceptable, 3. hard to hear and 4. Impossible to hear. For more details on all details on questions asked during field monitoring, see appendix XX for the questionnaire used.
[11] Two schools using the FM band are excluded here as information for radio reception is missing.

Table 16: Radio band used

Province	Lusaka	Copperbelt	Central	North-western	Average
District	Chongwe (6)	Luangwa (4)	Lufwanyama (5)	Masaiti (5)	Mkushi (5)	Serenje (5)	Solwezi (5)	
FM	5	0	5	5	2	0	2	19 (53 %)
SW1	1	4	0	0	3	5	2	15 (42 %)
Other	0	0	0	0	0	0	1	1 (3%)
Missing info	0	1	0	0	0	0	0	1 (3%)

The strength of the radio reception can change during the week, so the schools were asked about the number of days with either very clear or acceptable radio reception. On average, twenty-two of the schools (or 64 per cent) reported a very clear or acceptable radio reception for all 5 week days. It was also reported that the radio reception can change with the weather; with cold weather making it harder to receive the radio broadcast than when the weather is warmer.

Table 17: Radio Reception during the week

Province	Lusaka	Copperbelt	Central	North-western	Average
District	Chongwe (6)	Luangwa (4)	Lufwanyama (5)	Masaiti (5)	Mkushi (5)	Serenje (5)	Solwezi (5)	
All 5 days	5	0	5	4	4	2	3	22 (64 %)
4 days	1	0	0	0	0	1	0	2 (6%)
3 days	0	3	0	0	1	2	2	8 (22 %)
2 days	0	1	0	0	0	0	0	1 (3%)
1 day	0	0	0	0	0	0	0	0 (0%)
0 days	0	0	0	0	0	0	0	0 (0%)

Missing info	0	0	0	1	0	0	0	2 (6%)

Copperbelt Province again reported very good radio reception, as 9 out of 10 schools reported either a very clear or acceptable radio reception all 5 days of the week[12]. In Lusaka province there was again a difference between Luangwa and Chongwe districts with the latter having much better radio reception on average during a week than the former. In Central Province, the schools in Mkushi district report more days on average per week with very clear or acceptable radio reception than the schools in Serenje.

Table 18: Enough Learning Materials for the next 3 months

Province		Lusaka	Copperbelt	Central	North-western	Average			
District		Chongwe (6)	Luangwa (4)	Lufwanyama (5)	Masaiti (5)	Mkushi (5)	Serenje (5)	Solwezi (5)	
Chalk	Yes	6	3	5	5	4	4	5	32 (91 %)
	No	0	1	0	0	1	1	0	3 (9%)
Pencils	Yes	3	1	3	5	1	3	3	19 (54 %)
	No	3	3	2	0	4	2	2	16 (46 %)
Exerc. books	Yes	2	1	1	3	3	1	1	12 (34 %)
	No	4	3	4	2	2	4	4	23 (66 %)
TM guide[13]	Yes	6	4	5	5	5	4	5	33 (94 %)
	No	0	0	0	0	0	1	0	2 (6%)

During the field monitoring visits it was also reported that classes with a high number of learners might need an extra radio to enable all learners in the classroom to hear the radio well. In classrooms with many learners, some learners are forced to sit too far away from the radio[14]. In

[12] And for the last school Chilese in Masaiti the information is missing.
[13] Mulembo School reports a missing teacher's guide.
[14] Classrooms where learners are divided into 4 groups according to abilities will even increase the distance some learners might sit from the radio and 22 classrooms out of 37 had learners sitting in ability groups as reported in more details in section 3.

the case study, 18 out of the 37 classes have more than 50 learners in the classroom and 30 classes have more than 40 learners in the classroom[15]. Field monitors reported that some schools make use of two radios in classes with many learners and that it improves the ability of all learners to listen to the radio. This is consistent the recommendation from the producers of the used radio Freeplay Foundation who recommends the radio is most effective in groups of maximum 40 persons.

From the field monitoring visits it was also found that not all grade classes would have enough learning materials for the next 3 months. Some of the teachers expected shortages of exercise books and pencils for the learners, 66 percent and 46 percent respectively, that could affect the learning achievement by learners in these schools. There was a general trend in the districts in terms of learning and teaching materials available for the grade 1 classes. Thirty-three schools (or 91 per cent) had enough chalk, but 34 per cent and 46 per cent of the schools reported a shortage of exercise books and pens.

4.2 Conduct the Lessons Effectively

Evaluating the ability of the teachers also done during field monitoring, and overall it was found that the teachers were able to teach the Taonga Market radio programmes effectively and that children generally enjoyed the radio broadcast lessons.

In 34 out of 36 observed lessons (or 94 per cent) the teacher made use of the materials listed in the Taonga Market teacher's guide for that lesson. In 29 lessons (or 81 per cent) the teachers were reported to have been able to engage learners effectively and according to the lesson plan for the lesson on the radio.

Table 19: Observations from lessons observed

Province	Lusaka	Copperbelt	Central	North-western	Average
District	Chongwe (6)	Luangwa (4)	Lufwanyama (5)	Masaiti (7)	Mkushi (4)	Serenje (5)	Solwezi (5)	
Teacher ready for lesson	5	3	5	7	4	5	5	34 (94 %)
Pre-broadcast activity done	5	2	5	7	4	4	4	31 (86 %)
Engaged learners	5	3	5	4	4	4	4	29 (81 %)
Made use	6	4	5	7	3	5	4	34 (94 %)

[15] DODE recommends that a suitable class size in a community school or IRI centre should not be higher than 30-35 learners.

of listed materials								
Post-broadcast activity done	6	3	5	6	4	5	3	32 (89 %)
Words and drawings on wall	6	4	4	7	5	2	3	31 (86 %)

Pre- and post broadcast activities were reported to have been done for the majority of the classes, or 86 percent and 89 percent respectively. At the five schools where pre-broadcast activities were not done, three of the teachers were late on the day of the monitoring visit and two teachers led other pre-broadcasting activities related to the day's lesson. There were a variety of reasons why four of the teachers did not perform post-broadcast activities. One teacher was reported to have done other post-broadcast activities related to the lesson of the day. A second teacher reported not knowing what to do and a third teacher reported that the relevant lesson was missing in the teacher's guide (probably due to loose pages). The information for one teacher was not reported. Teaching aids of posters with words and drawings were observed in 31 of the classrooms visited.

Singing was a challenging aspect of the lesson for teachers in Luangwa district. Only two of the four lessons observed had a teacher that sang the Taonga Market songs for the class. However, in general the field monitors found that most teachers are using the singing part effectively and all learners were able to sing the essential songs and clearly enjoyed the singing part of the lessons.

Field monitors also observed that classroom movement could be difficult in classes with a high number of learners as furniture made it difficult for some children to get to the board quickly or participate in games and exercise in front of the class. One recommendation from the field monitors was for teachers to make use of a "free space" (the so-called NBTL teaching corner) as much as possible as children here can sit as a group and in a space where movement is easier[16].

During the field monitoring the involved teachers in the pilot also had the opportunity to self-evaluate how easy or difficult it was for them to teach using the Taonga Market broadcasts. The majority of teachers found Taonga Market lessons easy to teach. Only two teachers self-reported that they found it difficult to teach using the radio programme. One of those 2 teachers had not been trained to use Taonga Market: he was standing-in for the regular grade 1 teacher who had been trained.

Table 20: Teacher's ability to teach Taonga Market

Province	Lusaka	Copperbelt	Central	North-western	Average
District	Chongwe (6)	Luangwa (4)	Lufwanyama	Masaiti (7)	Mkushi (4)	Serenje (5)	Solwezi (5)

[16] Each NBTL class is recommended by the NBTL teaching plan to have a "teaching corner" in the classroom.

			(5)					
Very easy	4	0	2	0	2	0	0	8 (22 %)
Easy	1	1	0	2	1	4	2	11 (30 %)
Normal	0	3	2	5	2	1	2	15 (41 %)
Difficult	1	0	1	0	0	0	0	2 (5%)
Missing data	0	0	0	0	0	0	1	1 (3%)

4.3 Integration of the Radio Lessons into Daily Schedule

More than half of the teachers found that it has been easy to integrate Taonga Market radio programmes into their daily schedule and 70 percent find that they now spend less time preparing for lessons because the lesson plan for Taonga Market is already drawn up. Only 5 teachers (or 14%) reported that it has been difficult to integrate Taonga Market into their daily programme.

It was also found that teachers who have been trained in NBTL found it easier to teach and use the Taonga Market programme than teachers who had not been trained in NBTL. This is might be due to the similarities between the two teaching methodologies. On the other hand, field monitors found that some teachers were not able to see the link between the Taonga Market programme and NBTL in the sense that they did not know whether Taonga Market should replace the NBTL lessons or supplement them. Lastly, the integration of Taonga Market into the daily programme might have been difficult for some teachers because they (and the head-teachers) were not clear about the purpose of introducing the Taonga Market programme into their class.

Table 21: Ability to work Taonga Market into daily program

Province	Lusaka	Copperbelt	Central	North-western	Average
District	Chongwe (6)	Luangwa (4)	Lufwanyama (5)	Masaiti (7)	Mkushi (4)	Serenje (5)	Solwezi (5)	
Very easy	4	0	1	0	1	0	0	6 (16 %)
Easy	0	2	1	3	2	1	4	13 (35 %)
Normal	1	0	2	2	2	3	1	11 (30 %)
Difficult	0	2	0	2	0	1	0	5 (14

								%)
Missing data	1	0	1	0	0	0	0	2 (5%)

The field monitors recommend that the next training session for teachers should clarify the purpose and the link between the two teaching programmes[17]. A second recommendation was to include head-teachers in the next training programme in order to inform them of the purpose and benefits of Taonga Market. It was felt that the support from the head-teachers to the teachers teaching Taonga Market was insufficient because of head-teachers' lack of knowledge and involvement in the programme.

The Taonga Market programme was introduced to under-staffed schools to help them overcome some of the challenges they face because of teacher shortages. Enrolment data from the monitoring exercise shows that there were 2,303 learners in the classes using Taonga Market in the first weeks of term 3 with 1,167 girls and 1,136 boys. The 2,303 learners give an average of 54 learners per class. The highest number of learners in a class was registered in Kashitu Basic in Masaiti district and in Kapako Basic in Solwezi district, where both reported 102 learners in the class. The lowest number of learners in a class was reported in Sh kabeta Basic in Chongwe with only 17 learners. In addition, 27 out of the 39 teachers responded that they were teaching more than one grade.

One expectation with introducing Learning at Taonga Market into these schools was it would ease these teachers' work-load. Field monitoring found that 26 teachers (or 70 per cent) felted that they now spend less time on lesson preparation for their grade 1 class than compared to before they started using the Taonga Market materials. The pre-pared lesson plan for the every broadcast lesson during the year seems to ease the work-load for teachers. This is especially useful for teachers that are responsible for more than one grade.

Self-reporting on how well Taonga Market and NBTL support each other shows that 76 per cent of the teachers found that the two programmes support each other very well. None of the teachers reported that Taonga Market and NBTL do not support each other at all. The main explanations given by teachers for why they believe that the two programmes support each other very well were that pupils are taught phonics, they learn the same vocabulary and they are taught to read and write their own sentences taken from conversations.

One indication of the government school teachers' ability to integrate the NBTL and Taonga Market programmes is their ability to use Taonga Market while continuing to perform activities with four ability-level groups[18]. Here it was found that out of the 25 teachers who used NBTL to teach literacy, 22 organised the classroom with learners in four groups according to abilities. Only one teacher reported having the learners in one single group in the classroom, while the data for two of the teachers was missing.

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[17] Guidelines that where given to teachers in Serenje district during the pilot but generally to the all school in the initial training in April through the DEBS office were:

1. If you have the full NBTL kit, have been trained to use it and are confident to use it, then go ahead and use NBTL the way it is intended. Listen to the radio lessons and follow the literacy content on air, but do not do the literacy after broadcast activities and do not do the LTM assessment for literacy, as you will be doing this in your regular hour-long NBTL lesson. Five minutes on radio is NO substitute for one hour of good literacy teaching with good materials.

2. If you have the NBTL kit but are not trained and not confident to use the kit properly to teach literacy, then do the LTM literacy on the radio and do the after broadcast activities and the LTM literacy assessment, but in addition find ways to use the kit - make the sentences with the sentence maker, let kids identify words in the sentence maker and let them make the sentences, let kids read the readers, read the readers to the learners and do an extended version of the LTM after broadcast activities using the excellent NBTL kit you have.

3. If you don't have the NBTL kit then just follow the LTM version of NBTL and make sure you do the full after broadcast activities and assessment as stated in the TLM Mentor's Guide.

[18] One major difference in the way that Taonga Market and NBTL are currently implemented is in the way that the classroom is organised. In community schools where Taonga Market is used without NBTL, teachers generally instruct the whole class each day as a single group during pre-broadcast, broadcast and post-broadcast activities. The NBTL methodology, on the other hand, requires teachers to divide their classes into four groups according to ability levels. Each day in NBTL, the teacher sets independent learning activities for two of the groups and meets the two other groups in the teaching corner.

A majority of the teachers who used NBTL with Taonga Market continued to conduct lessons with four ability-level groups, indicating that they had managed to integrate the two programmes. When teachers are trained to use Taonga Market, it is recommended that teachers be given guidance on how to organise their classes during different activities. The teachers should understand when to conduct whole-class activities and when to conduct activities with four ability-level groups.

5. Conclusion

The purpose of the research was to answer four questions. A brief overview of the findings for each research question follows.

Do the pilot schools receive the radio broadcasts?

A majority of the pilot schools do receive the radio broadcasts. Almost 90 percent of the pilot schools had radio reception that was either very clear or acceptable, but only 65 percent reported that the radio reception was either very clear or acceptable during all 5 days during the week. Reception could be improved through the use of extension cables attached to the antennae.

Do teachers effectively conduct lessons using the broadcasts?

Overall it was found that the teachers were able to teach the Taonga Market radio programmes effectively.

In 34 out of 36 observed lessons (or 94 percent) the teacher made use of the materials listed in the Taonga Market teacher's guide for that lesson. In 29 lessons (or 81 per cent) the teachers were reported to have been able to engage learners effectively and according to the lesson plan for the broadcast portion of the lesson.

Do teachers integrate the educational broadcasts into their daily schedules and do the programmes help them teach efficiently?

More than half of the teachers reported that it has been easy to integrate Taonga Market radio programmes into their daily schedule and 70 percent find that they now spend less time preparing for lessons because the lesson plan for Taonga Market is already drawn up. Only 5 teachers (or 14%) reported that it has been difficult to integrate Taonga Market into their daily programme.

It was also found that teachers who have been trained in NBTL found it easier to teach and use the Taonga Market programme than teachers who had not been trained in NBTL. On the other hand, field monitors found that some teachers were not able to see the link between the Taonga Market programme and NBTL in the sense that they did not know whether Taonga Market should replace the NBTL lessons or supplement them. Lastly, the integration of Taonga Market into the daily programme might have been difficult for some teachers because they (and the head-teachers) were not clear about the purpose of introducing the Taonga Market programme into their class.

Do pupils who use Learning at Taonga Market make learning gains that are greater than pupils who are not using the radio lessons?

The learners who used Learning at Taonga Market performed in Numeracy and English language skills better than learners in the control GRZ schools. After two terms of instruction, pupils using Learning at Taonga Market scored an average of 6.8% more in English and 6.0% in numeracy than their peers in the control schools. The tests used to assess the learning gains cover a variety of skills that form the focus of the grade 1 curriculum.

While the programme led to greater gains in the areas of numeracy and English language, the learners in both IRI GRZ schools and Control GRZ schools performed similarly in Zambian language literacy. The test results indicate that Learning at Taonga Market did not have an impact on learning gains in the area of Zambian language literacy that could be measured at the end of grade one. This could be because the teachers in the control schools might have put greater emphasis on Zambian language literacy activities due to recent training in NBTL teaching methods. Another reason may be that the radio lessons and accompanying pre- and post-broadcast activities might not have provided an added advantage for improving writing and reading skills in the large classes in the pilot schools.

The Learning at Taonga Market programme had an impact on enrolment and retention. Whereas IRI classes gained an average of three learners during the seven months of research, the control classes lost an average of ten learners. The satisfaction of following the Learning at Taonga Market programme seems to make education appealing to a greater number of pupils.

In addition, the programme makes learning more access ble to girls. A gender gap had begun to develop in the control schools, where the boys made significantly greater learning gains than the girls. However, in the IRI schools, the girls and boys made similar learning gains.

To conclude the Learning at Taonga Market programme led to greater learning gains in the areas of numeracy and English language, gave girls equal access to learning gains and boosted enrolment and retention in the grade one pilot schools. With proper training, teachers are able to conduct lessons effectively and integrate the programme with other elements of the curriculum. The overall conclusion of this report is that the Learning at Taonga Market programme is an effective tool for teaching first grade pupils in Zambian government schools.

6. Recommendations

The first 19 recommendations come from the education officers and QUESTT staff who monitored the use of "Learning at Taonga Market" in the government schools in October 2005. The remaining recommendations come from the researchers who wrote this report.

Learning Materials

1. Teachers should be trained to use antennae extensions to improve reception where needed.
2. Classes with more than 40-50 learners should be divided into two classes where there are enough teachers. Where there are not enough teachers, two radios should be used to enable all learners to have good radio sound quality.
3. Teachers should colour in the black-and-white posters so that they are easier for children to read.
4. Ring-bound guides for grade 1 should be distributed to the GRZ schools using Taonga Market educational broadcasts in January 2006, as the guides with glued bindings are falling apart.
5. Teachers should keep all posters available for each lesson, as the radio teacher sometimes calls for use of a poster that is not listed in the mentor's guide.
6. All teachers who have Primary Reading Programme readers should use them to teach reading skills. Any school without readers should obtain them from the District Resource Centre.

Teaching Techniques

7. During training, teachers should practise teaching some of the songs, as singing is an important learning technique in the Interactive Radio Instruction methodology.
8. Teachers should be advised to have children sitting in an open space during the radio broadcasts so that they can move to the board or do other activities quickly.
9. Teachers should be shown how to sit during finger-counting activities so that they reinforce counting from left to right.
10. All teachers should create "talking walls" by displaying target vocabulary and sentences along with pictures.

Integration of NBTL and Taonga Market

11. The Taonga Market teacher training programme should emphasize the ways that NBTL and Taonga Market complement each other. The training programme should demonstrate that Taonga Market is a tool that helps teachers use their time efficiently, which is especially helpful to teachers at understaffed schools.
12. All teachers should use NBTL assessment procedures to put children into pace groups for literacy lessons.
13. Teachers should conduct whole-class activities during the radio broadcasts. During literacy lessons without the radio, teachers should conduct activities with four ability-level groups. The pre-broadcast and post-broadcast activities can be used with one or more of the ability-level groups. L kewise, teachers who have different groups for mathematics lessons (as promoted by the MARK programme) can use the pre-broadcast and post-broadcast activities for one or more of the groups.

Supporting Learners with Special Needs

14. Teachers should be encouraged to use day 5 for remedial work with learners who need individual attention. Remedial work should be done as a post-broadcast activity after the regular pre-broadcast and broadcast activities.
15. A pilot in schools for the disabled should be carried out, as Taonga Market could be beneficial to students with impaired sight and impaired hearing. The students with impaired hearing would need to have teachers who are skilled in using sign language.

Teacher Support

16. Teachers should use GRACE meetings to share their experiences using Learning at Taonga Market.
17. Head-teachers should be trained in Learning at Taonga Market so that they can act as mentors to the teachers who are using it.
18. Back-up teachers should be trained so that the pupils will still have proper Taonga Market instruction when their teacher is absent.

19. Provincial and district Ministry of Education officers should monitor the use of Taonga Market in GRZ schools.

Teaching Zambian Language Literacy

20. A timetable that is approved by the Curriculum Development Centre should be distributed to teachers during training. This will give teachers a clear understanding of how to integrate “Learning at Taonga Market” with other elements of the curriculum.
21. Teachers should be given the full set of core vocabulary to be focussed on during continuous assessment. Currently, the teachers are expected to identify the core vocabulary from within the target sentences.
22. Teachers should be trained to have children who can read and write well help other children who are not skilled at reading and writing. This technique is especially helpful with larger classes where the teacher finds it difficult to provide individual attention.
23. Pupils should have reading cards to practise reading words with classmates, guardians or other members of the community for homework. The word cards can be made by children who write well.

Appendix A: Test Tasks, Questions, Point Values and Scoring Rubrics

Subject	Item No.	Task	Test Question	Point Value	Scoring Rubrics
Zambian Language Literacy (43 points)	1	Write a sentence from dictation based on a picture from story. In the first picture, mother is carrying a bucket.	[In the Zambian language] Write this sentence on your paper: Mother is carrying a bucket.	3	0 points: Writes nothing at all, or writing not legible/readable, or the sentence is not related to the dictation. 1 point: Writes one or two words of the dictated sentence legibly, but not the full sentence. 2 points: Writes the dictated sentence fully, correctly and leg bly, but with one or more spelling errors. 3 points: Writes the dictated sentence fully, correctly and legibly, with no spelling errors.
	2	Write a sentence from dictation based on a picture from story. In the second picture, mother is drawing water into a bucket.	[In the Zambian language] Write this sentence on your paper: Mother is drawing water.	3	
	3	Write a sentence of your own based on a picture from story. In the third picture, mother is washing clothes.	[In the Zambian language] Write your own sentence about picture 3.	3	0 points: Writes nothing at all, or writing not legible/readable, or the sentence is not related to the picture. 1 point: Writes one or two words that are related to the picture, but not a full sentence. 2 points: Writes a legible sentence about the picture, but with fewer than three words spelled correctly. 3 points: Writes a legible sentence about the picture, with three or more words spelled correctly.
	4	Write a sentence of your own based on a picture from story. In the fourth picture, mother is hanging clothes to dry.	[In the Zambian language] Write your own sentence about picture 4.	3	
	5	After hearing a word, select it from a group of written words	[In the Zambian language] Point to the word “baby”. Point to the word “maize”. Point to the word “chickens”. Point to the word “bananas”.	4	One point for every word identified correctly.
	6	After hearing a sentence, select it from a group of written sentences	[In the Zambian language] Point to the words “Uncle is drinking tea”. Point to the words “The boy is cooking”. Point to the words “The girl is writing”.	4	One point for every sentence identified correctly.

			Point to “The cow is eating grass”.		
	7 to 10	Read the sentences of a story aloud	[In the Zambian language] Please read the story aloud: 7. A boy is selling maize at the market. 8. The boy is playing with a ball. 9. Goats are eating the maize. 10. The boy chases the goats. [The story is presented with one sentence per line without the question numbers.]	16	0 points: Not able to read any words at all, or mumbling incomprehensibly. 1 point: Reads sounds or syllables, but cannot read a complete word. 2 points: Reads one or more complete words, but cannot read the complete sentence. 3 points: Reads all of the words of the sentence, but with hesitancy or has to repeat certain words. 4 points: Reads all words of the sentence fluently.
	11	Answer a question about a story	What is the boy selling?	1	0 points: Incoherent or mumbling response, or wrong answer 1 point: Correct answer: maize
	12	Answer a question about a story	Why did the boy chase the goats?	3	0 points: Incoherent or mumbling response, or wrong answer 1 point: Correct answer using only one word (for example, eating/maize) 2 points: Correct answer using only a phrase (for example: goats eating/eating maize) 3 points: Correct answer using a clause or a full sentence, with an explanation (For example: Because they are eating maize. /He chased them because they are eating maize.)
	13	Answer a question about a story	Why do you think the boy was playing with the ball?	3	0 points: Incoherent or mumbling response, or wrong answer 1 point: Correct answer using only one word (for example, training/practicing/fun) 2 points: Correct answer using only a phrase (for example: to train/to practice/for fun) 3 points: Correct answer using a clause or a full sentence, with an explanation (For example: He is training. /He wants to have fun. /He is playing for

					_____ team.)
Maths (28 points)	14	Say the numbers from 1 to 10 aloud	Count from 1 to 10	2	NR = No Response: The learner has not tried to give an answer. 0 points = Non-mastery: The learner has given an answer that is completely incorrect. 1 point = Partial Mastery: The learner has given an answer that is partially correct. 2 points = Full Mastery: The learner has given an answer that is completely correct.
	15	Write the numbers from 1 to 10	Write the numbers from 1 to 10.	2	
	16	Count by ones	Count from 48 to 68. [The test administrator can select from a variety of number ranges: 21–41; 37–57; 41–51; 73–93; 35-55; 70-90;29-49; 48-68; 25-55; 79-99; 62-82]	2	
	17	Write a 2-digit numeral	Now write 79. [The test administrator asks the child to write a specific number between 12 and 98 that has two different digits. That is, not 11, 22, 33, etc.]	2	
	18	Count by twos	Count in twos from 2 to 10.	2	
	19	Count by tens	Count in tens from 10 to 100.	2	
	20	Complete a number sentence	[Present on a flashcard: 6 + 7 = 13 ____ + ____ = 13 ____ + ____ = 13] 6 + 7 add up to 13. What are two other numbers that add up to 13? Again, what are two different numbers that add up to 13?	2	NR = No Response: The learner has not tried to give an answer. 0 points = Non-mastery: The learner has given answers that are incorrect. 1 point = Partial Mastery: The learner has given one correct answer. 2 points = Full Mastery: The learner has given two correct answers.
	21	Add two numbers	Add these numbers: 4 + 7 [Two of the following addition problems are presented on flash cards: 4+7; 9+8; 7+8; 5+9; 7+5; 7+9]	2	

	22	Subtract two numbers	Subtract these numbers: 9 – 4 [Two of the following subtraction problems are presented on flash cards: 9-4; 7-5; 8-3; 6-1; 9-2; 8-7; 7-3]	2	
	23	Subtract money to calculate change	A man has K___ and buys tomatoes for K___. How much will you give back? [Two situations are presented using two of the following pairs of numbers: K500-K200; K700-K300; K900-K600; K400-K200; K600-K100; K200-K100]	2	
	24	Name shapes	What is the name of this shape? / What shape is this? [The test administrator presents a circle, a square, a triangle and a rectangle in any order.]	4	One point for each correct response.
	25	Draw shapes	Now, draw a circle; a square; a triangle; a rectangle [The test administrator conceals the shapes used in the previous question.]	4	One point for each correct response.
English Language (16 points)	26	Name objects in the school	[The test administrator asks about two objects from the following: chair, door, window, floor, roof, chalk, pen, ruler, cup spoon.] What is this/that?	2	NR = No Response: The learner has not tried to give an answer. 0 points = Non-mastery: The learner has given answers that are incorrect. 1 point = Partial Mastery: The learner has given one correct answer. 2 points = Full Mastery: The learner has given two correct answers.
	27	Name items of clothing	[The test administrator asks about two pieces of clothing from the following set: dress, hat, shoes, socks, shirt.] What is this? /What am I wearing?	2	

			/What are you wearing?		
	28	Give the time of day when you go to sleep and wake up	[The test administrator asks two questions.] a. What time of the day do you wake up? b. What time of the day do you go to sleep?	2	
	29	Talk about common actions (e.g., The teacher is pointing.)	[The test administrator presents the grade 1 literacy poster called “At the Centre” and asks two questions.] a. What is the boy doing? b. What is the teacher doing?	2	
	30	Count the number of children and the number of boys in a picture	[The test administrator presents the picture on the cover of the Grade 1 Mentor’s Guide and asks two questions.] a. How many children can you see? b. How many boys can you see?	2	
	31	Give the plural of common words	[The test administrator presents two sets of objects (books, hands, pencils or legs), gives the singular form and has the learner give the plural form.] Here is one _book_, and here are two . . .	2	
	32	State what day was yesterday and what day is tomorrow	[The test administrator states what today is and asks two questions.] Today is _____. a. What day is tomorrow? b. What day was yesterday?	2	

	33	Follow a command	The test administrator tells the learner to do two of the following things: Open the book. Give me the pencil. Touch your nose. Point to the cha kboard.	2	

Appendix B: Test Quality Assurance: Teacher's Form

After testing 8 students at your school, please complete this form and follow the mailing instructions at the end.

Please answer all of the questions honestly. The purpose of the form is to check the quality of the test administration.

1. Your Name: _____

2. School: _____

3. District: _____

4. Province: _____

5. How many girls and how many boys did you test?
   Number of girls tested: _____
   Number of boys tested: _____

6. How did you choose the girls and boys who were tested? Circle one answer:
   a. I chose the most intelligent students.
   b. I made a list of the students present and chose them randomly.
   c. I chose the first 8 students who came to school.
   d. I used another method: (please describe) _____
      _____

7. Is your name, the name of the school, the name of the district, and the name of the province filled in at the top of the three scoring sheets? Circle one answer: Yes No

8. Is the student's name, the name of the school, the name of the district, and the name of the province filled in at the top of each Answer Sheet for Literacy Tasks 1 and 2?
   Circle one answer: Yes No

9. Did you administer the test in the following order: 1) Zambian Language Literacy, 2) Numeracy, 3) English Language? Circle one answer: Yes No

10. When testing Zambian Language Literacy, did you use the local Zambian language of play? Circle one answer: Yes No

11. What is the local Zambian language of play at your school? _____

12. When asking Numeracy questions 14 to 23, did you use the local Zambian language when a student had trouble understanding English? Circle one answer: Yes No

13. When asking Numeracy questions 24 and 25, did you use the local Zambian language when a student had trouble understanding English? Circle one answer: Yes No

14. When asking the English Language questions, did you use the local Zambian language when a student had trouble understanding English? Circle one answer: Yes No

15. What was the greatest number of times that you asked a student the same question? Circle one answer:
    a. I asked each question one time only.
    b. I asked each question two times if necessary.

c. I asked each question three times if necessary.

16. Look at the scoring grids for the Zambian Language Literacy, Numeracy and English Language tests. Are all of the scores filled in? Circle one answer: Yes No

    If some of the scores are not filled in, why are the spaces blank? Circle one answer:
    a. I forgot to fill in the score.
    b. The learner did not give an answer. (Note: If a learner did not give an answer, you should write NR in the space.)
    c. The student did not finish the test.
    d. Other reasons: _____

Thank you for filling in this questionnaire. Please make sure that all of the following papers are in an envelope:

___ Grade 1 Literacy (Zambian Language) score sheet
___ Grade 1 Numeracy score sheet
___ Grade 1 English Language score sheet
___ 8 copies of the Answer Sheet for Literacy Tasks 1 and 2 (one from each student)
___ Test Quality Assurance: Teacher's Form
___ Test Quality Assurance: Observer's Form (only if you were observed)

Please send all of the papers in one envelope to:

Education Development Centre
Attn: G1 Baseline Test for Government Schools
Private Bag 542x
Ridgeway
Lusaka

Thank your for your help!

Appendix C: T-test score

Independent Samples T-test Overall Learning Gains by School Type*

Equal variances assumed

	Levene's Test for Equality of Variances		t-test for Equality of Means					
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
								Lower / Upper
B_TOTAL	.028	.868	1.483	400	.139	2.443	1.643	-.7945.668

Independent Samples T-test Learning Gains by School Type and Subject

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
									Lower / Upper
A_ZAMTOT	Equal variances assumed	.043	.835	.265	192	.791	.484	1.824	-3.114 / 4.081
	Equal variances not assumed			.265	179.982	.791	.486	1.826	-3.119 / 4.086
A_NUMTOT	Equal variances assumed	1.916	.168	2.817	192	.005	2.375	.842	.712 / 4.035
	Equal variances			2.859	191.154	.005	2.375	.830	.736 / 4.011

	not assumed									
A_ENGTOT	Equal variances assumed	.127	.722	4.652	193	.000	1.876	.402	1.076	2.661
	Equal variances not assumed			4.655	184.640	.000	1.876	.401	1.077	2.660

Independent Samples T-test, Overall Pretest and Posttest Learning Gains by School Type

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval	
								Lower	Upper
A_TOTAL	Equal variances assumed	.727	.395	1.912	189	.057	4.700	2.460	-.149	9.555
	Equal variances not assumed			1.932	185.888	.055	4.700	2.435	-.100	9.506

Appendix D: Test of between subjects effects by Gender

Dependent Variable: Posttest TOTAL

\	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Non cent. Parameter	Observed Power(a)

Corrected Model	31323.187(b)	3	10443.762	.012	.057	11.296	.806
Intercept	25961 19.517	1	2596936.517	.000	.834	936.274	1.000
TYPESCHO	12451.201	1	12454.201	.035	.023	4.491	.559
SEX	18241.513	1	18246.513	.011	.034	6.580	.723
TYPESCHO * SEX	427.192	1	427.192	1.541	.216	.008	1.541	.235
Error	5185187.326	187	277.290				
Total	3241191 42.000	191					
Corrected Total	5498190 5.45	190					

a Computed using alpha = .05
b R Squared = .057 (Adjusted R Squared = .042)

Appendix E: Test scores Zambian Language for Individual Tasks

Dictation No.1 Task 1

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.32	0.94	0.62
N	301	130	
Std. Deviation	0.81	0.99	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.15	0.64	0.49
N	118	87	
Std. Deviation	0.38	0.88	

Dictation No.2 Task 1

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.30	1.02	0.72
N	302	130	
Std. Deviation	0.80	1.17	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.11	0.74	0.63
N	118	87	
Std. Deviation	0.39	1.03	

Writing sentence No.1 Task 2

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.23	0.90	0.67
N	302	130	
Std. Deviation	0.68	1.15	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.12	0.76	0.64
N	118	87	
Std. Deviation	0.37	1.10	

Writing sentence No. 2 Task 2

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.19	0.82	0.63
N	302	130	
Std. Deviation	0.58	1.11	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.10	0.68	0.58
N	118	87	
Std. Deviation	0.33	1.01	

Identify words No.1 Task 3

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.24	2.53	1.29
N	302	130	
Std. Deviation	1.25	1.51	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.07	1.95	0.88
N	118	87	
Std. Deviation	1.20	1.50	

Identify sentences No.2 Task 3

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.17	2.22	1.05
N	302	130	
Std. Deviation	1.28	1.62	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.70	2.21	1.51
N	118	85	
Std. Deviation	1.05	1.49	

No.1 Task 4 Reading

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.42	1.29	0.87
N	302	130	
Std. Deviation	0.99	1.43	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.33	1.40	1.07
N	118	87	
Std. Deviation	0.81	1.43	

No.2 Task 4 Reading

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain

Mean	0.27	1.22	0.95
N	302	130	
Std. Deviation	0.69	1.51	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.22	1.14	0.92
N	118	87	
Std. Deviation	0.72	1.53	

No.3 Task 4 Reading

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.27	1.09	0.82
N	302	130	
Std. Deviation	0.81	1.64	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.22	0.78	0.56
N	118	87	
Std. Deviation	0.72	1.40	

No.4 Task 4 Reading

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.26	0.86	0.60
N	301	130	
Std. Deviation	0.71	1.41	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.22	0.77	0.55
N	118	87	
Std. Deviation	0.66	1.38	

No.1 Task 5 Reading comprehension

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.20	0.27	0.07
N	302	130	
Std. Deviation	0.40	0.45	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.19	0.20	0.01
N	118	87	
Std. Deviation	0.40	0.40	

No.2 Task 5 Reading comprehension

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.36	0.66	0.30
N	302	130	
Std. Deviation	0.85	1.11	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.37	0.63	0.26
N	118	87	
Std. Deviation	0.90	1.11	

No.3 Task 5 Reading comprehension

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.32	0.70	0.38
N	302	130	

Std. Deviation	0.74	1.20	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.29	0.52	0.23
N	108	87	
Std. Deviation	0.71	1.06	

Appendix F: Test scores Numeracy for individual tasks

Numeracy: Counting 1 to 10

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.92	2.00	0.08
N	302	130	
Std. Deviation	0.32	0	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	2.00	2.00	0
N	61	182	
Std. Deviation	0	0	

Numeracy: Count in 1s

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.99	1.72	0.73
N	301	130	
Std. Deviation	0.80	0.54	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.43	1.37	-0.06
N	61	182	
Std. Deviation	0.81	0.85	

Numeracy: Count in 2s

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.67	1.59	0.92
N	302	130	
Std. Deviation	0.81	0.76	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.07	1.01	-0.06
N	61	182	
Std. Deviation	0.96	0.93	

Numeracy: Count in 10s

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.63	1.77	1.14
N	301	129	
Std. Deviation	0.82	0.58	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.28	1.23	-0.05
N	61	182	
Std. Deviation	0.88	0.92	

Numeracy: Writing 1 to 10

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.20	1.88	0.68
N	301	130	

Std. Deviation	0.78	0.42	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.62	1.59	-0.03
N	61	182	
Std. Deviation	0.69	0.73	

Numeracy: Writing 2-digit numerals

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.81	1.65	0.84
N	300	130	
Std. Deviation	0.90	0.71	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.30	1.32	0.02
N	61	182	
Std. Deviation	0.92	0.90	

Numeracy: Number facts

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.23	0.6	0.37
N	302	130	
Std. Deviation	0.56	0.92	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.20	0.23	0.03
N	61	182	
Std. Deviation	0.60	0.63	

Numeracy: Add

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.66	1.47	0.81
N	302	130	
Std. Deviation	0.86	0.86	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.08	1.10	0.02
N	61	182	
Std. Deviation	1.00	0.98	

Numeracy: Subtract

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.74	1.42	0.68
N	302	130	
Std. Deviation	0.87	0.90	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.05	1.09	0.04
N	61	182	
Std. Deviation	0.99	0.98	

Numeracy: Money

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.46	0.91	0.45
N	302	129	
Std. Deviation	0.75	0.97	
Control GRZ School	Baseline Mean	Achievement Mean	Gain

Mean	0.52	0.58	0.06
N	61	182	
Std. Deviation	0.87	0.87	

Numeracy: Naming shapes

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.81	1.99	1.18
N	301	130	
Std. Deviation	1.06	1.25	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.95	0.97	0.02
N	61	182	
Std. Deviation	1.13	1.17	

Numeracy: Drawing shapes

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.69	2.17	0.48
N	302	130	
Std. Deviation	1.44	1.31	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.00	0.99	-0.01
N	61	182	
Std. Deviation	1.20	1.19	

Appendix H: Test scores English for individual tasks

English language: Centre

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.28	1.81	0.53
N	304	130	
Std. Deviation	0.85	0.48	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.30	1.64	0.34
N	117	182	
Std. Deviation	0.79	0.68	

English language: Clothing

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.87	1.51	0.64
N	304	130	
Std. Deviation	0.76	0.77	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	1.08	1.31	0.23
N	118	182	
Std. Deviation	0.87	0.81	

English language: Time

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.22	0.22	0
N	304	130	
Std. Deviation	0.50	0.56	

Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.33	0.49	0.16
N	118	130	
Std. Deviation	0.62	0.80	

English language: Count

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.68	1.08	0.40
N	304	130	
Std. Deviation	0.87	0.94	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.37	0.60	0.23
N	118	130	
Std. Deviation	0.73	0.84	

English language: Plural

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.42	1.32	0.90
N	304	130	
Std. Deviation	0.67	0.87	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.47	0.62	0.15
N	118	182	
Std. Deviation	0.81	0.85	

English language: Days

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.25	0.48	0.23
N	304	130	
Std. Deviation	0.56	0.68	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.25	0.14	-0.11
N	304	118	
Std. Deviation	0.56	0.41	

English language: Command

Experimental GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.77	1.33	0.56
N	304	129	
Std. Deviation	0.86	0.82	
Control GRZ School	Baseline Mean	Achievement Mean	Gain
Mean	0.25	0.14	-0.11
N	0.53	1.04	0.51
Std. Deviation	118	182	

Appendix G: List of GRZ schools using IRI and Control schools by District

Name of district		Experimental GRZ schools	Control group GRZ schools	
Chongwe	Itope	17	0	17
	Mulalika	0	8	8
	Munyeta	16	0	16
	Namangongo	17	0	17
	Ndubulula	15	0	15
	Nkalamabwe	17	0	17
	Rufunsa	0	20	20
	Shikabeta	18	0	18
		100	28	128
Luangwa	Janeiro	14	0	14
	Kakaro	0	18	18
	Kaunga	0	18	18
	Kavalamanja	24	0	24
	Mankhokwe	22	0	22
	Mulalika	0	12	12
	Mwalilia	17	0	17
	Mwavi	19	0	19
		96	48	144
Lufwanyama	Chikabuke	16	0	16
	Chinemu	17	0	17
	Kashininkisha	0	16	16
	Lumwana	0	17	17
	Milulu	19	0	19
	Mukumbo	18	0	18
	Nchakwa	20	0	20
		90	33	123
Masaiti	Bangwe	20	0	20
	Chilese	19	0	19
	Fifungo	16	0	16
	Kashitu	18	0	18
	Matipa	0	20	20
	Munkulungwe	20	0	20
	Ntengwa	0	20	20
		93	40	133
Mkushi	Chikupili	20	0	20
	Kafwa	0	14	14
	Kakushi	18	0	18
	Kangili	19	0	19
	Kaundu	11	0	11
	Mankanda	18	0	18
	Miseshi	10	0	10
	Momboshi	0	15	15
	Sonkolo	14	0	14
		110	29	139

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Serenje	Fitebo	15	0	15
	Kaundu	8	0	8
	Miseshi	8	0	8
	Miswema	0	19	19
	Mulembo School	21	0	21
	Nakasala	0	17	17
	Poosa	17	0	17
		69	36	105
Solwezi	Kapako	10	0	10
	Kazhiba	13	0	13
	Kishela	0	16	16
	Kyangozhi	13	0	13
	Luamfula	14	0	14
	Mwafwe	12	0	12
	Sandan'gombe	0	11	11
		62	27	89