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Implementation of evidence-based teaching and psychological
evaluation of primary school children in a high HIV endemic setting:
the case of Botswana

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General introduction

HIV/AIDS is a major public health concern in Africa. However, Africa is leading the world in expanding access to antiretroviral therapy (ART), with 7.6 million people across the continent receiving ART (UNAIDS, 2015). HIV is transmitted horizontally, mostly through sexual intercourse, and vertically from the mother to the new-born. HIV prevention in woman during pregnancy is of paramount importance, since the virus is transmissible during labour and delivery. The risk of transmission in the absence of any intervention by an infected mother is estimated to be 15-25%, which increases significantly to 20-45% when infants are breastfed (Kolawole et al., 2018). Thanks to the adoption of Prevention of Mother-To-Child Transmission (PMTCT) policy, the number of children born HIV-positive in Africa is dramatically decreased (Kandawasvika et al., 2016). African HIV-exposed uninfected (HEU) children are growing in number and it has been shown that often they are functioning below than HIV-unexposed uninfected (HUU) children on several psychological, cognitive, behavioural, and developmental parameters (Sherr et al., 2014). Moreover, HEU children in Africa are at increased risk of mortality, morbidity, and slower early growth than their HUU counterparts (Filteau, 2009). The causal mechanisms are not fully established. It might be a direct result of HIV and/or exposure to Antiretroviral Therapy (ART) *in utero*, parental risk factors, parental health status, and environmental factors, or a combination of both.

Children born into HIV-affected families have reported numerous psychological and physical problems, including fear, isolation, depression, anxiety, grief, low self-esteem, and trauma (Betancourt et al., 2014). It is now recognized that children living in HIV-affected families also face multiple social adversities, including the disruption or loss of parental care and support, increased poverty, loss of income, malnutrition, withdrawal from school, decline in school enrolment and attendance, decreased access to health care, increased participation in household activities, as well as increased risks of abuse, exploitation, and HIV infection (Islam

et al., 2014). Moreover, resiliency, or the ability to overcome stressors in a psychologically healthy way, amongst HEU children is attributed to caregiver quality, contact with immediate and extended family, and school attendance and success (Sugandhi et al., 2013).

Since school is the primary place where children start their community life, evaluation and intervention at a school level have proven to be the key to improve resilience in HIV-affected children in countries such as South Africa, Zambia, and Zimbabwe (Ebersöhn et al. 2011; Campbell et al., 2016). This could also be true in countries such as Botswana, which shares a similar school system, cultural background, and very high HIV with the other three Southern African countries.

Infants, adolescents, children with infected or ill mothers, and children living with severely ill adults are particularly vulnerable. There is a critical need for more attention to causal inference and further characterization of processes and circumstances related to vulnerability and resilience. However, research shows that children who perform better at school have higher self-esteem and that better academic skills lead to a lower level of psychological problems than their counterparts who perform lower (Goldberg et al., 2016; Lin et al., 2010).

School interventions addressing reading skills could be of paramount importance as future academic success is dependent on students' ability to read effectively. Students who struggle to read are at a greater disadvantage than their peers (Carnine, 2004). With the lack of reading skills comes the inability to access information from the text that may result in students' frustration and performance lower in other subject areas (Slavin et al., 2011; Rasinski et al., 2004).

This thesis results from my work experience in Botswana, where I had the opportunity to meet faculties and researchers of Botswana-University of Pennsylvania Partnership, Botswana-Harvard AIDS Partnership, and the University of Botswana. Besides, I was assisted

and advised by Prof. R. M. Kubina from The Pennsylvania State University in the implementation of Precision Teaching in the context of Botswana.

Botswana is a landlocked country located in southern Africa. It is topographically flat, with up to 70 percent of its territory being the Kalahari desert. The country surface is similar to France but it is lower in population and, with only 2.3 million people, it is one of the most sparsely populated countries in the world. The official language of Botswana is English but the national language and culture of most citizens are Setswana. Citizens refer to themselves as Batswana and to one citizen as Motswana. With the discovery of diamonds and the increase in government revenue that this brought, there was a huge increase in educational provision in the country. All students were guaranteed ten years of basic education, leading to a Junior Certificate qualification.

Access to healthcare is free to all Batswana but the country is still battling high rates of HIV/AIDS and other infectious diseases such as tuberculosis and malaria. Botswana is also grappling with high rates of malnutrition among children under the age of 5 which has led to other health concerns such as diarrhoea and stunted growth.

The purpose of my work was to experiment evidence-based teaching to improve the school abilities of children with developmental disabilities and vulnerable/underprivileged children coming from HIV-affected families.

Evidence-based teaching relies on all of the approaches that have been scientifically proved, where goals are clear and results can be graphically displayed.

In this work, I employed the Applied Behavioural Analysis, which I was able to deeply understand during my Summer School study at the Morningside Academy (Seattle, WA, USA) in July 2018. The Morningside Academy is also innovative for its Morningside Model of Generative Instruction (MMGI), a research-based approach and an empirically validated model

extremely effective in developing competent learners, with or without developmental disabilities.

The three chapters in the present PhD thesis are based on 1 manuscript *under review*; 1 *published* paper; and another manuscript *in preparation*. The first is an overview of the existing literature on HEU and HIV-affected children (children living in an HIV-positive environment) and their psychological well-being in association with school performance. The second paper is a pilot case study exploring the use of Frequency Building, Precision Teaching, and positive reinforcement in a special school in Gaborone, Botswana, with children with neurodevelopmental disabilities. The last study is a case-control study on HEU and HUU children. The aim was to investigate if improving the reading performance (applying Frequency Building and Precision Teaching) of HEU and HUU students increased their self-esteem, happiness, and hope. Ethical approval was obtained from the Ethics Commission of the Department of Developmental and Social Psychology of the Sapienza University of Rome, from the Botswana Ministry of Education, and the Botswana Ministry of Health and Wellness.

The first chapter is a systematic examination/review of 50 papers with studies conducted in Africa, especially in the Sub-Saharan region. The objective was to determine what type of psychological and cognitive problems are shown by HEU and HIV-affected children and identify how and if these problems are connected with school achievement, enrolment, and behaviour. This manuscript is *under review* since the 20th October 2020 on the *African Journal of AIDS Research* (Mensi, Ahishakiye, Journeay, Baiocco, Betancourt & Paganotti: HIV-exposed uninfected children: a systematic review on psychological well-being and association with school performances in Africa).

The second chapter presents a pilot case study. Four children with neurodevelopmental disabilities underwent an intervention made by Frequency Building and Precision Teaching combined with positive reinforcement. The study aimed to explore the feasibility of those

techniques in a low-middle income country to enhance the early reading skills of children from a special school in Gaborone, Botswana. Results were remarkable and in line with previous studies from other Western countries. The study was published in November 2020 in the *Journal of Intellectual Disabilities* (Mensi, Baiocco, Otukile-Mongwaketse, Paganotti & Kubina: Improving the reading skills of children with neurodevelopmental disabilities: Preliminary study from Botswana).

The third chapter contains a case-control study with a sample of 49 students (32 HEU and 17 HUU children) from three government primary schools located in three different areas of Gaborone, the capital of Botswana. All the students received a psychological pre-test assessment to evaluate self-esteem, happiness, hope, and a reading pre-test assessment. Students were randomly subdivided, and 25 underwent the reading intervention while 24 continued school as usual. The intervention lasted approximately 3 months, and it was conducted using Direct Instruction, Frequency Building, and Precision Teaching. Post-test results showed a significant improvement in reading skills and happiness. The longitudinal study was measured using the Standard Celeration Chart, a special ratio chart that exhibits quantitative developments over time. The chart's visual display showed significant children's improvement and was subsequently confirmed by statistical analysis. (Mensi, Baiocco, Otukile-Mongwaketse, Solimini, Kubina & Paganotti: Enhancing self-esteem and wellbeing of HIV-exposed uninfected children (HEU) and HIV-unexposed uninfected children (HUU) by improving their reading performances: the case of Botswana).

Chapter 1. HIV-exposed uninfected children: a systematic review on psychological well-being and associated school performances in Africa

This research essay, under the form of a scientific manuscript, is under review for publication at the *African Journal of AIDS Research*, and has been electronically submitted to the journal on the 22nd of October 2020.

Mensi, M., Ahishakiye, A., Journeay, K., Baiocco, R., Betancourt, T., S., Paganotti, G. M. (*under review*). HIV-exposed uninfected children: a systematic review on psychological well-being and association with school performances in Africa. *African Journal of AIDS research*.

Introduction

With increasing access to Antiretroviral Therapy (ART) globally, HIV has become a chronic illness. One of the consequences is a large growing number of HIV-exposed uninfected children (HEU) worldwide. Moreover, as infected parents live longer, the main health and social outcomes of HIV have an even broader impact on families and communities. Young people may live with sick parents, face the death of one or both parents, experience adversities such as the increased risk of school dropout or taking on other additional responsibilities at home. These challenges may also cause psychological problems. The present review aims to highlight HEU children and their families' psychosocial health and focus attention on psychological interventions conducted for HEU children in school and other settings where children spend their time.

The vast majority of people living with HIV reside in low and middle-income countries (LMIC), and approximately 68% of them live in sub-Saharan Africa (UNAIDS, 2020). In

Africa, the most affected countries are: Eswatini, with 27.0% prevalence among adults, Lesotho, with 22.8%, South Africa, with 19.0%, and Botswana, with 20.7% (UNAIDS, 2020). West and Central Africa have a much lower rate of people living with HIV (UNAIDS, 2020). However, Nigeria has over 3 million people infected with HIV because of its exceptionally large population (UNAIDS, 2020).

In 2019, there were 1.3 million HIV-positive pregnant women globally. (Slogrove et al., 2019). For many of them, pregnancy was the gateway for HIV diagnosis (Slogrove et al., 2019). The risk of vertical transmission in the absence of any infected mother intervention is estimated to be 15-25%, which increases significantly to 20-45% when infants are breastfed (Kolawole et al., 2018).

Prevention of Mother-To-Child Transmission (PMTCT) interventions reduce the risk of transmission to less than 5% if strategies are adhered to during pregnancy, labor, delivery, and breastfeeding (Kolawole et al., 2018). Infants born from HIV-infected mothers who underwent PMTCT intervention and are virus-free are defined as HEU. In 2018, there were an estimated 14.8 million HEU children globally, 13.2 million of whom resided in sub-Saharan Africa (Slogrove et al., 2019).

In Africa, PMTCT interventions for HIV were first applied in South Africa in 1998-1999 in two midwife obstetrics units, even though PMTCT was not yet officially implemented as a national policy (Barron, 2012). Nowadays, PMTCT policies have been implemented in all African countries, with different success and impact. Therefore, a large, growing population of HIV-negative newborns, exposed *in utero* to the virus and to the antiretroviral drugs used for the prevention in the affected populations (Filteau et al., 2009). In general, their prevalence is highest in Southern Africa, where there is also the highest prevalence of maternal HIV.

Despite being virus-free, there is some evidence that HEU children are at increased risk of mortality and morbidity for common infectious diseases, slower early growth,

developmental delays, and mental health problems than their HIV-unexposed counterparts (Slogrove et al., 2019). For example, a study from the Democratic Republic of Congo showed that HEU children (at preschool age) demonstrated moderate to severe delay in mental, motor, and language development compared to HUU children (Van Rie et al., 2008). There have been several studies in various African countries that evaluated neurodevelopmental outcomes of very young HEU children (aged between 11 and 24 months) (Boivin et al., 2013; Bass et al., 2016; Boivin, 2017; Le Roux et al., 2017; Chaudry et al., 2018; Springer et al., 2018). Furthermore, a recent study from South Africa (Wedderburn et al., 2019) showed that HEU children are at high risk of receptive and expressive language delay at the age of 2 years. This study also highlighted the importance of long-term follow-up to study the developmental outcomes of HEU children in Sub-Saharan countries. ART exposure *in utero* has also been associated with growth faltering among HEU infants in a study from Botswana (Powis et al., 2016) and with neurological impairment in a study from South Africa (Coelho et al., 2017).

Moreover, it is important to point out that studies on childhood developmental status demonstrated that several factors may contribute to putting children at risk of poor development. These include low maternal schooling, violence against children, and exposure to poor adult health and well-being (McCoy et al., 2016; Lu et al., 2016).

It should also be highlighted that other contributing factors that undermine the mental health of HEU children are caused by parental illness or death, which often results in reduced care of children. Many children under the age of 18 have lost one or both parents, leading to results such as older children taking care of the youngest, homes being headed by children, and children dropping out of school (Nordtveit, 2010). Importantly, poverty and HIV seem to be correlated with child labor and children leaving school. The need for money to take care of their families' impoverished situation, can lead to children becoming involved in commercial activities with many negative consequences, such as child abuse and sex work (Nordtveit,

2010). Over and above, children with ill parents tend to become overprotective of them, with a shift of responsibility from caregiver to child. The range of consequences is wide. Several studies indicate that HEU children are at risk of mental health problems, including depression, anxiety, social problem, low self-esteem, and stigma (Cluver et al., 2009). In addition, HEU children face many consequences, as economic insecurity, caregiver depression, and physical impairment (Han et al., 2013, Betancourt et al. 2014, Govender et al., 2014, Skovdal, 2016). Often HEU children experience poor educational outcomes, with little chance to attend school. Alternatively, if enrolled they may not attend regularly, due to their home duties. Most of them are constantly worried for their sick parents at home; this manifests as concentration problems in the classroom, which undermine the student's success in school (Skovdal, 2016).

The sole systematic review to date on school outcomes of HEU children at a global scale describes how the affected children drop out of school when a family member is ill, or dead (Guo et al., 2012). There are also occurrences of children not being enrolled in school at all, as caregivers give preference to only one child, deemed the smartest in the family, to attend school. In the same review, school outcomes are considered using different variables: school enrolment and attendance, appropriate grade by age, school performance (only for one study in China), school behaviour, and school attainment (Guo et al., 2012). The growing number of HEU children in Africa, besides an important impact on HIV epidemiology, also affects education. School is a place for socialization, where children learn by observation, identification, obtain social-emotional skills, social norms, and behaviour codes (Adler, 2016). Furthermore, teachers may be necessary for vulnerable children to provide relief and discuss their burdens and worries. Effective schools have been commonly identified as being protective for high-risk children (Nordveit, 2010), and because schools are charged with educational goals, if children perform well in school, they may hope for a better future and job, and decrease the possible chance to engage in risk behaviour (Betancourt et al. 2014).

The present review aims to organize papers on existing research related to HEU children and their families' psychosocial health and the corresponding connection to how school and intervention systems respond. Research questions of interest are: *a)* what are the most common psychological problems identified among HEU children?; *b)* how, if at all, have psychological problems among HEU children been linked to school functioning and other elements of well-being?; and *c)* what, if any, psychological interventions have been conducted for HEU children? What if any, interventions have been delivered in school and other settings where children spend time?

Methods

Literature research

This systematic review follows the guidelines outlined by PRISMA 2009 checklist (Moher et al., 2009). To identify papers on HEU children in Africa and related mental health and or psychological problems in the school context, several databases were consulted: PubMed, PsycInfo, and Google Scholar. The search comprised: *1)* a complete search of PubMed, Psycinfo, and Google Scholar database; *2)* an examination of the references from relevant papers; *3)* a search of the articles of the authors in this field of research, and *4)* efforts to contact authors working in the fields regarding published and unpublished studies (choices were based on the relevance and number of published studies and authorship in highly relevant journals).

Inclusion criteria were: *a)* HIV-exposed uninfected children; *b)* HIV-exposed uninfected children AND Africa; *c)* HIV-exposed uninfected children AND Africa AND well-being; *d)* HIV-exposed uninfected children AND Africa AND mental health AND resilience; *e)* HIV-exposed uninfected children AND Africa AND risk and protective factors; *f)* HIV-exposed uninfected children AND Africa AND developmental disabilities; *g)* HIV-exposed uninfected children AND Africa AND developmental disabilities AND school outcomes OR

performances; *h*) HIV-exposed uninfected children AND Africa AND developmental disabilities AND school outcomes OR performances AND neuropsychology; *i*) HIV-exposed uninfected children AND Africa AND developmental disabilities AND school outcomes OR performances AND language delay.

Studies were excluded if they were located outside Africa and if they did not mention school performances or any kind of connection with the criteria mentioned above. All studies had to be published in peer-review journals, English language, from 2000 to 2020 (few years after introducing the PMTCT), and include children from 6 to 18 years of age.

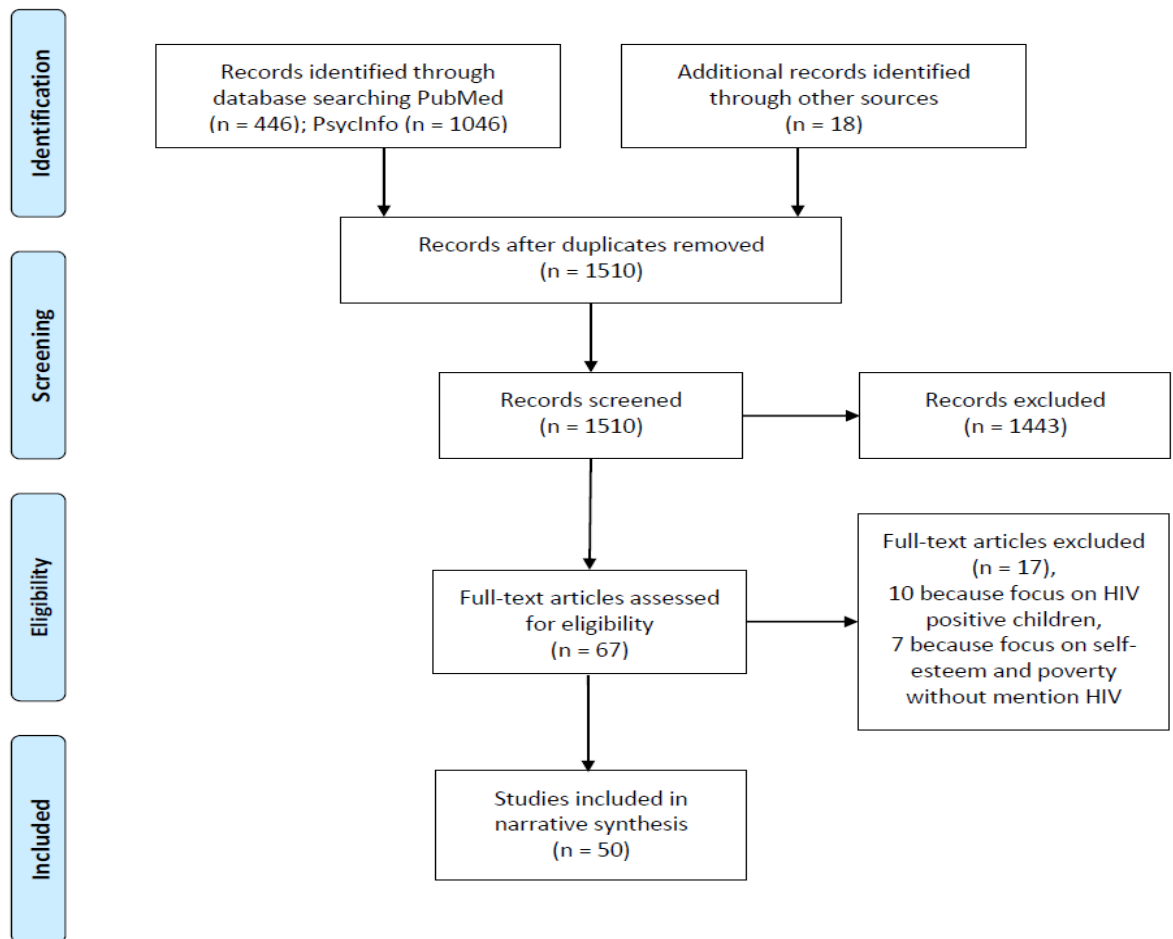
Besides, the NIH RePORTER database has been consulted for ongoing research projects. The keywords were: HIV-exposed uninfected children AND cognition AND neurocognition AND mental health. Restrictions were: age between 6 and 18 years, and be based on African countries.

Figure 1 shows the systematic review process following the PRISMA flow diagram. In total we found on PubMed 446 papers about HEU children, 412 studies have been excluded because refer to medical research, 34 titles were eligible and fully read, of which 10 did not satisfy the inclusion criteria, while 24 studies were included. A total of 1,046 studies were found through PscycInfo, 1,031 were excluded reducing by argument, 15 studies were assessed for eligibility, and 9 were included. Two papers were eliminated because duplicated. An extra 17 studies were added after bibliography mining and checking by authors expert in the field. The final number of 50 studies were used for the purpose of this review, both qualitative and quantitative studies were included.

It is important to clarify that in this review HIV-negative children born from an HIV-positive mother, are defined HEU, while children living in an HIV environment, without specifying if born from an HIV-positive mother, have been named HIV-affected children and, in this review, they are not HIV-infected by definition. AIDS orphans are also considered part

of the HIV-affected group, even if papers do not specify if they are HEU or HIV-infected. Lastly, the category of HIV-unexposed uninfected children (HUU) corresponds to a group of HIV-negative children born from HIV-negative mothers, and they were never exposed to HIV. The HEU and sometimes HUU children may fall under the category of HIV-affected children.

Figure 1. Systematic review following PRISMA standards.



Results

A summary of all the studies is presented in Table 1. Fifty (50) papers have been retrieved for the purpose of this review: 8 qualitative and 43 quantitative studies, of which 2 being both qualitative and quantitative. All studies were conducted in sub-Saharan African countries and include Botswana, Eswatini (ex-Swaziland), Kenya, Malawi, Namibia, Rwanda,

South Africa, Uganda, Zambia, Zimbabwe. Only 1 study is from North Africa, namely in Egypt.

This review focuses on the psychological health and well-being of school-aged children related to school outcomes and teachers' support. Nevertheless, to achieve a comprehensive picture, we also address psychological health and well-being itself.

Results are organized into the 3 main factors 1) individual factors; 2) family factors, and 3) social factors and school environment. In the last section are described interventions aiming to improve the psychological well-being of HEU children and affected families.

Individual factors

The psychological health of HIV-affected children is a topic that is frequently addressed by researchers, and many studies suggest that the affected children are at a high risk of psychological distress and behavioural problems.

Self-esteem and resilience

Self-esteem is considered a part of resilience (Mueller et al., 2011). Children with high self-esteem can better cope in stressful environments, while children with low self-esteem are at a greater risk of depression and anxiety (Mueller et al., 2011). Furthermore, community violence and trauma are associated with lower self-esteem (Skeen et al., 2016). A high score of self-esteem corresponds to a high level of Perceived Social Support (PSS). Regular school attendance and educational opportunities are predictors of a high score of PSS, which refers to schools as an effective setting to generate a support network (Okawa et al., 2011).

Mental health resilience may be associated with multiple factors across children, family, and community. Child physical health, caregiving support, food security, peer relationship quality, and lower exposure to community violence and bullying or stigma, seem to be strong predictors of resilience (Collishaw et al., 2016; Small et al., 2019). Moreover, a study from Egypt suggests that children and adolescents of HIV-positive parents had a

significantly lower health-related quality of life than children of healthy parents. This may be attributed to the effect of parental HIV on the family with the connected economic and social problems. (Ashry et al., 2018).

Table 1. Summary of the 50 studies analysed in the present systematic review.

N	Author(s)	Country	Sample (N)	Age (years)	Domain assessed	Measurements	Type of study
1	Cluver et al., 2007	South Africa	1025 children (425 orphans by HIV/AIDS, 241 orphans by non-HIV/AIDS causes, 81 orphans by unknown causes, 278 not orphans)	10 – 19	Individual	CDI; R-CMAS; SDQ using the 5-items peer problems subscale; Amaya-Jackson's Child PTSD Checklist; SDQ using the 5-items conduct problems subscale; CBCL YSR using the 11-items delinquent subscale	Quantitative study, interviews
2	Betancourt et al., 2011	Rwanda	43 children (HIV/AIDS-affected) and 31 adults	10 – 17	Individual	Free-Listing interview: "What are the problems of HIV/AIDS-affected children in this community?" Key Informant Interviews: "Tell me more about the problem of <i>agahinda kenshi</i> (persistent sorrow) among HIV/AIDS-affected children in this community"; "How does a child with <i>agahinda kenshi</i> feel?"; "How does a child with <i>agahinda kenshi</i> behave?"; "How does a child with <i>agahinda kenshi</i> think about themselves or others?"	Qualitative study
3	Han et al., 2013	Uganda	297 children (orphans by HIV/AIDS)	12 – 14	Individual	BHS; CDI	Two-arm cluster randomized controlled trial
4	Sipsma et al., 2013	South Africa	Children (HEU) and 509 mothers (395 HIV-positive, 114 HIV-negative)	6 – 10	Individual	VABS; CBCL; CDI; RCMAS; BOEQI YV	
5	Betancourt et al., 2014b	Rwanda	683 children (218 HIV-positive, 228 HIV-affected, 237 HIV-unaffected)	10 – 17	Individual	WHODAS-Child; CESDC; YSR; anxiety/internalizing scale; Parental Acceptance and Rejection Questionnaire using 16-items; United Nations Children's Fund's Multiple Indicator Cluster Survey using 12-items; Post-War Adversities Index; SAFE child protection checklist using 17-items; HIV-related stigma reported on a 4-point Likert scale of <i>never, sometimes, or often/a lot</i> ; HSCL	Case-control study

6	Govender et al., 2014	South Africa	623 children (226 orphans by HIV/AIDS, 397 not orphans)	9 – 15	Individual	YSR; SACAS	Cross-sectional study
7	Barenbaum & Smith, 2016	South Africa	100 children (vulnerable or orphaned by HIV/AIDS)	12 – 22	Individual	PAS-A; RADS-2; R-CMAS	The study investigated the role of social support and attachment on positive well-being among orphans and vulnerable children due to HIV/AIDS
8	Ezeamama et al., 2016	Uganda	166 children (58 HIV-positive, 55 HEU, 53 HUU)	6 – 18	Individual	BRIEF questionnaire	Comparative study
9	Milligan, & Cockcroft, 2017	South Africa	273 children (95 HIV-positive, 86 HEU, 92 HUU)	Mean age: 7.42, 7.36, 7.05, respectively	Individual	AWMA; ELP	Case-control study
10	Nkwata et al., 2017	Uganda	168 children (58 HIV-positive, 54 HEU, 56 HUU)	3 – 18*	Individual	PedsQL; medical history; physical examination, and laboratory evaluations	Retrospective cohort study
11	Lowenthal, et al., 2018	Botswana	650 children (200 HIV-positive, 200 HEU, 250 HUU)	7 – 18	Individual	PennCNB; PSC	Case-control study
12	Robb et al., 2018	South Africa and United States of America	Three cohorts: HIV-positive, HEU, HUU	Adolescents	Individual	Higher cognition; executive, emotional and behavioural functioning; identify the determinants of resilience	Case-control study
13	Boivin, et al., 2019	Malawi and Uganda	Three cohorts: HIV-positive, HUU, HEU	12	Individual	BPG; CCRT	Case-control study
14	Cluver et al., 2012	South Africa	599 children	10 – 20	Social	Questionnaire: educational outcomes when controlling for sociodemographics	Mix qualitative and quantitative study

			(212 with HIV/AIDS sickness at home, 140 with other- sickness at home, 247 in healthy homes)				
15	Campbell et al., 2014	Zimbabwe	128 children	10 – 14	Social	Children story about HIV in the school context	Qualitative study draws and write story about HIV
16	Nabunya, & Ssewamala, 2014	Uganda	1410 children (orphans by HIV/AIDS)	Mean age: 12.7	Social	Questions on the effects of parental loss on children's feelings: 1) How has the loss of your father affected the way you feel about life? and 2) How has the loss of your mother affected the way you feel about life?	Quantitative study; survey
17	Watkins et al., 2014	South Africa	243 children (orphans by HIV/AIDS)	13 – 22	Social	Open-ended questions to elicit individual perspective on education; risk and protective factors	Qualitative study
18	Collishaw et al., 2015	South Africa	944 children (425 orphans by HIV/AIDS, 241 orphans by non-HIV/AIDS causes, 278 not orphans)	10 – 19	Social	CDI; RCMAS; CPTSDC; SDQ; CBCL	Longitudinal study
19	Skovdal, 2016	Kenya	47 children (orphans and vulnerable children by HIV/AIDS) and 18 teachers	10 – 20	Social	Interview: school experiences of HIV affected children	Qualitative study
20	Visser et al., 2012	South Africa	45 children/ HIV-positive mothers dyads	6 – 10 and 25 – 42	Individual, and family	N/A	Qualitative study
21	Orkin et al., 2013	South Africa	723 children (269 orphans by HIV/AIDS, 103 with HIV/AIDS sickness at home, 351 not orphans)	11 – 25	Individual, and family	Educational outcome; poverty; CDI; RCMA; CPTSD	Quantitative study

22	Betancourt et al., 2014a	Rwanda	39 children and 28 caregivers	7 – 17 and 30 – 70	Individual and family	Family connectedness; good parenting; CD-RIS; pro-social behaviour; MICS; CESDC; ISSB; YSR; IRQ; YCPS-RS; WHODAS-Child	Pre-post design, including 6-month follow-up; qualitative and quantitative study; Intervention
23	Sherr et al., 2014	South Africa	381 children (24 double orphans by HIV/AIDS, 70 single orphans by HIV/AIDS, 287 not orphans)	8 – 19	Individual and family	RSE; SEQ-C; CDI; SDQ; Adapted Community Maltreatment, Exploitation, Stigma & Discrimination Scale; P-C CTS; Externalizing and Risk Behaviour Scale	Interview; quantitative study
24	Casale et al., 2015	South Africa	2477 children/caregivers dyads	10 – 17 and >18	Individual and family	MOS-SSS; APQ – short form; SF-12; SDQ	Cross-sectional household survey
25	Skeen et al., 2016	Malawi and South Africa	588 children (HIV-affected)	4 – 13*	Individual and family	CDI; TSCC; RSE; SDQ; SAHA P-C CTS; Child Abuse and Neglected screening tools	Cross-sectional study
26	Nalugya et al., 2018	Uganda	38 HIV-positive parents	18 – 61	Individual and family	First interview (unstructured): life and illness history; second interview (semi-structured): life history and HIV self-management. role of children with their parents	Qualitative study
27	Cluver et al., 2008	South Africa	944 children (425 orphans by HIV/AIDS, 241 by non-HIV/AIDS causes, and 278 not orphans)	10 – 19	Individual and social	CDI; CMAS-R; SDQ; PTSD; CBC; Social and Health Assessment Peer Victimization Scale; self-report of the past-year experience of witnessing or having been a victim of the study area's four most common community crimes; Berger Stigma Scale for HIV-positive youth– Revised	Quantitative study; interview
28	Cluver et al., 2009a	South Africa	944 children (425 orphans by HIV/AIDS, 241 orphans by non-HIV/AIDS causes, 278 not orphans)	10 – 19	Individual and social	CDI; CMAS; SDQ; PTSD -C	Quantitative study; interview
29	Cluver et al., 2009b	South Africa	1050 children (HIV-affected)	10 – 19	Individual and social	CDI; CMAS; SDQ; PTSD-C; Social and Health Assessment Peer	Quantitative study; interview

						Victimization Scale; Berger Stigma Scale for HIV-positive youth–Revised	
30	Nordtveit, 2010	Namibia and eSwatini (Swaziland)	70 children 40 adults	8 – 17	Individual and social	School as a protective factor and HIV context. Unstructured, semi structured, and open-ended questions	Qualitative studies: 2 cases studies in Namibia and Swaziland (eSwatini)
31	Mueller et al., 2011	South Africa	297 children (HIV-affected)	8 – 18	Individual and social	RSES; SEQ; CDI; SDQ; Snider scale for Stigma, social connection and experiencing violence; Social and Health Assessment Scale, psychosociodemographic characteristics	Quasi-experimental project: art to increase self-esteem and self-efficacy
32	Okawa, 2011	Kenya	398 children (orphans by HIV/AIDS) pairs with caregivers	10 – 18	Individual and social	MSPSS; CES-DC; RSES	Cross-sectional study
33	Kagotho et al., 2012	Uganda	297 caregivers	18 – 87	Individual, and social	Depression	Longitudinal study
34	Pufall et al., 2014	Zimbabwe	4577 children (HIV-affected, HIV-positive)	6 – 17	Individual and social	CWI; monitoring and evaluation facility survey	Data from a cross-sectional household survey were linked to data on schools from a parallel monitoring and evaluation facility survey
35	Thurman et al., 2014	South Africa	1487 children (HIV/AIDS-affected) 918 caregivers	10 – 17	Individual and social	CESDC; World Health Organization Quality of Life subscale	Longitudinal quasi-experimental design
36	Nicholson et al., 2015	Zambia	390 children (111 HEU, 279 HUU)	6 – 12	Individual and social	General health, school report	Cross-sectional study
37	Sseswamala et al., 2016	Uganda	346 children (orphans by HIV/AIDS)	12 – 16	Individual and social	School primary leaving examination; child confidence in achieving educational plans; Beck hopelessness scale; Tennessee self-concept scale	Randomized experiment case-control study
38	Scorza et al., 2017	Rwanda	367 children (HIV-affected)	10 – 17	Individual and social	CD-RISC; protective and risk factors	Qualitative study
39	Sherr et al., 2017a	Malawi and South Africa	588 children (HIV-positive, HIV-affected, HUU)	4 – 12*	Individual and social	Draw-a-person Test; Digit Span Test	Quantitative study

40	Sherr et al., 2017b	Malawi and South Africa	854 children (HIV-affected)	5 – 15 *	Individual and social	CSI; Educational risk; grant receipt; number of grants; good parenting; Draw a Person test	Cash grant intervention
41	Phaladze et al., 2018	Botswana	732 children (orphans by HIV/AIDS)	10 – 18	Individual and social	School grade, loss and grief, living arrangement	Qualitative study; interview
42	Sharp et al., 2018	South Africa	750 children (224 orphans by HIV/AIDS, 276 orphans by non-HIV/AIDS causes, 250 not orphans)	7 – 11	Individual and social	SDQ; School Connectedness Scale	Cross-sectional study
43	Webster et al., 2018	Uganda	168 children (HEU, HUU) 106 caregivers (HIV-positive, HIV-negative)	6 – 18	Individual and social	Distress Weinberger Adjustment Inventory; Children's Hopelessness Scale; Positive Outlook-Individual Protective Factors Index; Hare Area-specific self-esteem scale; PedsQLTM	Cross-sectional study
44	Katsi et al., 2019	Botswana	650 children (orphans by HIV/AIDS)	11 – 17	Individual and social	Child and Youth Resilience Measure-28; 5-point Inventory of Complicated Grief; 3-point Future Aspirations/Peer Leader Survey	Quasi-experimental; pre-test and post-test
45	Small et al., 2019	South Africa	475 children (HIV-affected)	9 – 13	Individual and social	General health questionnaire; global indicator of well-being; CBCL; Neighborhood Social Control Scale; Neighborhood Social Cohesion Scale; Neighbourhood Disorganization Scale	Longitudinal study
46	Lachman et al., 2014	South Africa	2477 children-caregivers' dyads (HEU, HUU)	10 – 17 >18	Individual, family, and social	APQ; BNS 8-items about poverty; CESD, MOS-SSS; SDQ	Cross-sectional survey
47	Anabwani et al., 2016	Botswana	1238 children (984 children HIV-positive, 254 HIV-affected)	6 – 18	Individual, family, and social	Question about school, activities, care, and stigma	Survey interview
48	Hensels et al., 2016	Malawi and South Africa	979 children (HIV-affected)	4 – 13*	Individual, family, and social	CSI; P-C CTS; SDQ; ISPCAN; CDI; RSES; TSCC; Experience of Stigma, Discrimination and Social Exclusion Domain; PedsQL Draw-a-person Test; Digit Span Test; Ten Questions disability questionnaire	Longitudinal study

49	Ashry et al., 2018	Egypt	65 children (33 HEU, 32 HUU)	3 – 17*	Individual, family, and social	HRQOL; KINDL	Cross-sectional comparative study
50	Slogrove et al., 2019	Global	HEU children	N/A	Individual, family, and social	N/A	Report

Acronyms used: Child Depression Inventory (CDI); Revised Children’s Manifest Anxiety Scale (R-CMAS); Strengths and Difficulties Questionnaire (SDQ); Post-Traumatic Stress Disorder (PTSD); Child Behaviour Checklist Youth Self-Report (CBCL YSR); Beck Hopeless Scale (BHS); Vineland Adaptive Behaviour Scales (VABS); Child Behaviour Checklist (CBCL); Revised-Children’s Manifest Anxiety Scale (RCMAS); Bar-On Emotional Quotient Inventory: Youth Version (BOEQI YV); World Health Organization Disability Assessment Schedule for Children (WHODAS-Child); Centre for Epidemiologic Studies Depression Scale for Children (CESDC); Achenbach Youth Self Report (YSR); subscales of South African Child Assessment Schedule (SACAS); Psycho-Social Adjustment Scale-Adolescents (PAS-A); Reynolds Adolescent Depression Scale 2 (RADS-2); Behaviour Rating Inventory of Executive Function (BRIEF); Automatic Working Memory Assessment (AWMA); English Language Proficiency (ELP); Pediatric Quality of Life inventory (PedsQL); Penn Computerized Neurocognitive Battery (PennCNB); Paediatric Symptom Checklist, (PSC); Brain Powered Games (BPG); Computerized Cognitive Rehabilitation Therapy (CCRT); Connor-Davidson Resilience Scale (CD-RISC); Multiple Indicator Cluster Survey-Round 4 (MICS4); Inventory of Socially Supportive Behaviours (ISSB); Irritability Questionnaire (IRQ); Youth Conduct Problems Scale-Rwanda Short Form (YCPS-RS); Rosenberg Self-Esteem Scale (RSE); Self-Efficacy Questionnaire for Children (SEQ-C); adapted Strauss Conflict Tactics Scale, Parent-Child version (P-C CTS); Medical Outcomes Study Social Support Scale (MOS-SSS); Alabama Parenting Questionnaire (APQ); 12-item Short Form Survey (SF-12); Trauma Symptom Checklist for Children (TSCC); Social and Health Assessment (SAHA); Multidimensional Scale of Perceived Social Support (MSPSS); Center for Epidemiologic Studies Depression Scale for Children (CES-DC); Child Well-being Index (CWI); Connor Davidson Resilience Scale (CD-RISC); Mullen Scales of Early Learning (MSEL); Color Object Association Test (COAT); Early Childhood Vigilance Test (ECVT); Behaviour Rating Inventory of Executive Function–Preschool version (BRIEF-P); Home Observation for the Measurement of the Environment (HOME); Hopkins Symptoms Checklist-25 (HSCL); Quality of Life (QOL); Basic Necessities Scale (BNS); Child Status Index (CSI); International Society for the Prevention of Child Abuse and Neglect (ISPCAN); Health-Related Quality of Life (HRQOL); Kinder Lebensqualität Fragebogen (KINDL).

*Cohorts of children younger than 6 years but with a range age up to 18 are still part of the studied group

Depression

Several studies include depression scales in their research and they usually report depression correlated to different circumstances. Multiple factors may lead to high levels of depression in HIV-affected children. Studies report contributions of family behaviour, as violence in the home, physical abuse, and daily hardship punishment, being the main responsible factors of a high level of depression (Mueller et al., 2011; Betancourt et al., 2014a; Sherr et al., 2014). Violence in the home between adults seems to be a predictor of increased depressive symptoms (Skeen et al., 2016). Domestic violence seems to be present in HIV-affected families, due to the high level of stressors (Betancourt et al., 2014a). An example of family stressors may be the correlation between caregiver's physical health and their caregiving capacities: children with a high level of depression and anxiety are those whose caregivers reported mental and physical health impairment (Sipsma et al., 2013; Govender et al., 2014).

One of the first quantitative studies on psychological health in South Africa (Cluver et al., 2007) demonstrated that HIV orphans had a higher level of depression, post-traumatic stress, and suicidal intention when compared to orphans from other causes, and non-orphans. Meanwhile, there were no significant differences in anxiety levels among the three groups. Another study from South Africa (Cluver et al., 2008) about the effect of stigma on mental health, showed that AIDS-related stigma strongly mediated the association between AIDS orphanhood and depression. Poverty, measured through school access, food security, household employment, and household receipt of welfare grants, was another factor that mediated the association between AIDS orphanhood and depression (Cluver et al., 2009a). Besides, in a deprived, violent, urban South Africa setting, it has been demonstrated that the interaction among poverty, AIDS-related stigma, and bullying were predictors of depression and other psychological problems in HIV orphans (Cluver et al., 2009b). Data showed that

food insecurity and stigma increased the percentage of children with mental health disorders from 19% to 83% (Cluver et al., 2009b). A qualitative study (Betancourt et al., 2011) presented an analysis of mental health among HIV-affected children in Rwanda. The study employed open-ended interviews with adults (clinicians and social workers) and children. The 90% of the clinicians reported persistent irritability and anger in HIV-affected children and described children as always annoyed, grouchy, not appreciating anything, talking rudely, and quarreling. The study also showed that affected children often performed poorly at school and were isolated from other children (Betancourt et al., 2011).

A cluster randomized controlled trial study from Uganda with case and control groups showed a significant reduction of depression using an economic intervention (Han et al., 2013). Moreover, they found that depression symptoms were possibly related to different variables: old age of caregiver, the gender of caregiver (female), and poor physical health (Han et al., 2013). A study from South Africa tried to improve the level of depression using home visiting by specialized persons, but results did not show any change from baseline to the follow-up, and depression continuously persisted among HIV-affected households (Thurman et al., 2014). In a gender study based in South Africa and Malawi, depression scores and suicidal ideation did not show any differences between male and female children (Hensels et al., 2016). Another study from South Africa showed a high level of depression in HIV-affected children, especially boys between 11 and 25 years old, and a possible association with poor educational outcomes (Orkin et al., 2013).

Gender differences in school outcomes

A few studies described the outcomes between HIV-affected children, based on boys' and girls' differences. Some of them underlined boys as more at risk compared to girls. In the aforementioned study of Orkin et al. (2013), results directly associated boys with concentration problems and difficulties in grade progression, both in HIV-affected children and orphans from

HIV. HIV girl orphans showed significantly lower mental health problems than the boys (Sharp et al., 2018). The same differences in learning outcomes were also confirmed in the study from South Africa and Malawi (Hensels et al., 2016), where it appeared that boys struggled more in school and were slower learners than girls. The study also underlined the importance of addressing boys in education activities to reduce the possibility of engaging in risk behaviour (Hensels et al., 2016). Girls seemed to be more reactive when they meet some facilities, as appeared in a cash grant study (Sherr et al., 2017a). Receiving money and care was associated with lower educational risks. Alternatively, for boys, grants were associated with lower odds of being a quick learner and lower odds of doing better at school (Sherr et al., 2017a). In addition, a study from Uganda examined the differences in child gender on parental loss due to HIV/AIDS (Nabunya & Sseswamala, 2014). Findings showed that girls after the death of the mother were more likely to take care of younger children and the surviving parent in the house. They also reported having less food and money and being more scared than boys after the death of their fathers. Instead, boys after the death of the father were more determined to do well and despite that, they also received increase duties, they did not receive the same burden as girls did (Nabunya & Sseswamala, 2014).

Cognitive abilities

A study on working memory was conducted with 3 groups of children, HIV-infected, HEU, and HUU, in South Africa (Milligan & Cockcroft, 2017). It demonstrated that HIV-infected and HEU children manifested a similar low pattern on verbal storage and verbal processing tasks. While HIV-infected children had a more complex situation, HEU children's situation may lead to language difficulty. For visuospatial working memory, the score was the same as the HUU ones (Milligan & Cockcroft, 2017).

Cognitive abilities were measured with the draw-a-person tasks in a cash grant intervention study from South Africa (Sherr et al., 2017a). Results showed that cognitive

abilities were associated with being in the correct grade at school and attending school regularly. A study from Uganda determined how HIV infection predicts deficit in cognitive executive functions among school-aged children exposed or not to HIV (Ezeamama et al., 2016). Results showed that HEU children had significantly greater executive function deficits than HUU children, suggesting that perinatal exposure to HIV, even without infection, negatively affects executive functions (Ezeamama et al., 2016). On the other hand, a study from Uganda examined the quality of life of HIV-positive, HEU, and HUU children. Tests comprised the Cognitive Function Test, which results showed that only HIV-positive children had the lowest scores, while HEU and HUU children are on the same level on the entire Quality of Life subtest (Nkwata et al., 2017).

The NIH RePORT website describes three ongoing studies on the cognitive and behavioural function of primary school-aged HEU children, alone or compared with HIV-positive or HUU in Africa. Boivin JM (Michigan State University, US) explores whether Brain Powered Games cognitive assessment data, gathered as HIV-affected children (between 5 to 12 years old in Uganda and Malawi) play, can be analyzed to understand how HIV risk factors affect a child's developing brain (Boivin, 2020).

Another ongoing study in Botswana made by Lowenthal ED (Children Hospital of Philadelphia, US) explores whether HEU and HIV-infected children (primary school-aged) are more likely than their peers to have neurocognitive deficits. This will be determined through the implementation and validation of a computerized neurocognitive testing battery for the identification of neurocognitive problems (Lowenthal, 2020).

Finally, Robb ML (Henry M. Jackson Foundation, US) aims to explore determinants of resilience (defined as "competence during adolescence in cognitive, emotional and behavioural functioning in the face of adverse circumstances") in adolescents living with or affected by HIV in a comparative study also including a South Africa cohort (Robb, 2020).

Family factors

Family and parental support

It has been shown that HIV physical illness affects parents in many ways: decreasing interest in care, increasing parental absence, and neglecting their children. HIV-affected families are at elevated risk of adversities, thus resulting in increased child behavioural problems (Cluver et al., 2012; Sipsma et al., 2013). Depressed mothers of children affected by HIV/AIDS in Uganda were more likely to abuse and neglect their children, as underlined from Kaghoto et al. (2012) where it has been reported that women were more at risk to show higher depressive symptoms when compared to men. Thirty-five percent of the respondents had household savings and those without any savings reported depression symptoms (Kaghoto et al., 2012). A large survey on HIV/AIDS impact on parenting behaviour in South Africa confirmed the statement above and highlights that AIDS sickness was associated with less capacity to care (Lachman et al., 2013). The study reported that poverty is often present and relevant in HIV-affected families, in part due to the loss of work, and medical and funeral expenses. These factors contributed to increasing the caregiver's depression and limited their capacity to engage positively with their children (Lachman et al., 2013).

Another survey, conducted in Uganda on children orphaned by HIV/AIDS aged 10 to 16 years, explored the impact of parental loss on their well-being. Participants reported worsening in school grades and declining school attendance. After losing their mother, there was an impact on the basic needs of the family, while after the death of the father the majority of children reported feelings as being lonely, isolated, worried, angry, and scared. Nevertheless, participants reported feelings of comfort and relief following the parental loss, because they stop to care continuously for their HIV-sick parents, and determination to do well (Nabunya & Sseswamala, 2014).

In South Africa, a study by Sherr et al. (2014) examined differences in double or single parental death. Results showed that double orphans were significantly more likely to be kept out of school to help with family chores, while children with a single parental death and children with no death were kept in school.

Casale et al. (2015) and Ashry et al. (2018) described that caregiver's higher education was associated with lesser adolescent emotional and behavioural problems. Moreover, if caregivers received more support, adolescent's problems could be less. Findings in these studies reinforce the importance of promoting caregiver social support to improve parenting and reduce the risk of adolescent behavioural and emotional problems (Casale et al., 2015; Ashry et al., 2018).

Although the aforementioned studies concentrate mainly on psychological problems of children living in an HIV environment, a study from Uganda (Nalugya et al., 2018) underlined the role of children as important supportive figures for HIV-positive parents. Nalugya et al. (2018) showed that the role of children involved in the care of HIV/AIDS parents seemed to influence their sense of commitment, maturity, and self-esteem.

Another study from Uganda (Webster et al., 2019) examined caregiver's mental health, both on HIV-positive and negative caregivers, and their impact on child well-being. Results showed that there was no direct effect between HIV-positive caregivers and child well-being. Instead, data highlighted how depression and anxiety (with or without HIV) compromised caregiver quality and created problems on the five well-being indicators of children: distress, hopelessness, positive future orientation, self-esteem, and quality of life, in children between 6-18 years old.

Social factors and school environment

Risk and protective factors

A study from South Africa with 100 children aimed to explore possible differences in children's psychosocial well-being between two groups, one living in a homestead and one living in a shelter/hostel. Results showed that children who had trusted adults, and children who easily shared their feelings, had higher levels of positive well-being. Those without social support felt less safe, hungrier, and had more exposure to violence than those who receive social support (Barenbaum & Smith, 2016).

In 2004, UNICEF issued a document where the characteristics of protective schools were described as follows: quality learners which are healthy and well-nourished children, quality contents as curricula and materials, quality teaching-learning processes as technology child-centered and skill-based approach, quality learning environment as policies and practices, facilities and services, quality outcomes as knowledge, attitude and skills, suitable assessment at the classroom and national levels (UNICEF, 2004). In the HIV context, protective factors are associated with school enrolment and attendance, while risk factors are mostly related to poverty. Two papers considered the risk and protective factors in the school context (Watkins et al., 2014; Scorza et al., 2017). In Watkins et al. (2014) protective factors were mostly related to happiness at school, caregiving support, and community support. Scorza et al. (2017) considered resilience, patience and perseverance, self-esteem, tenacity, adaptation, and spirituality as important factors to accept adverse situations. Risk factors were commonly related to poverty, unhappiness at school, assisting sick caregivers, emotional distress/suicidal ideation, crime and substance abuse, adolescent's health, and multiple traumatic events (Scorza et al., 2017). Orphans by AIDS exhibited a higher level of delinquency and conduct problems when compared with non-AIDS orphans (Cluver et al., 2009b). Furthermore, AIDS orphans showed higher school dropout compared with their non-AIDS orphan counterparts.

Additionally, they were less likely to live in a household receiving any state grants and have less access to welfare support (Cluver et al., 2009a).

Despite the school seems to be the place where most of the children's needs should be addressed, it is also the place where children may experience troubles such as stigma, bullying, and poor interactions with peers. A study from Namibia and Swaziland (Nordtveit, 2010) reported how, in general, schools did not address HEU children's needs and most of them dropped out of school due to being beaten by teachers and the ostracism from their teachers and peers. In addition, social issues such as bullying, discrimination, and stigma for HIV families were very frequent, and teachers also confirmed that those were among the causes for dropping out of school (Nordtveit, 2010).

Studies from Zimbabwe and Kenya (Campbell et al., 2014; Skovdal, 2016) showed that in HIV-affected households the lack of supportive adults, household responsibilities, and children abuse and neglect, impacted school attendance. The qualitative study from Kenya (Skovdal, 2016) reported teachers' interviews. Most of them explained that pupils had to provide medicine and food for their HIV-sick parents every day. If the caregivers were bedridden, they may also have taken care of their basic needs, such as hygiene. Taking care of their sick parents left children exhausted, mentally, and physically. School concentration became a problem, and most of them did not receive enough food so they feel lethargic, tired, and anxious at school (Skovdal, 2016). Moreover, when children were at school, they continuously worried about their home situations and lived in fear of finding their parents dead (Campbell et al., 2014). A study from Botswana (Anabwani et al., 2016) showed that HIV-affected children were usually very happy, but those who were unhappy reported they did not like going to school because of bullying, stigma, teasing, and poor interaction with other children and teachers.

In a qualitative study (Campbell et al., 2014), students from a school district in Zimbabwe were asked to write a story about a child in their school affected by HIV and described challenges and difficulties in their everyday lives. Results showed how children conceived an HIV environment: for example, houses that were visibly poor, or having lack of food, etc. It also demonstrated how the child coped in the school context, as well as teacher support or negative responses, peers support, and social exclusion. Overall, the stories described the emotional impact of HIV on HEU children and the limited support provided by schools. Specifically, the difficulty to establish relationships and support networks and the fear of stigma from peers and teachers even if they recognize their suffering.

Most people affected by HIV are school-aged HEU children. The school has a pivotal role in their growth because often it is the unique place where they can address their needs (Anabwani et al., 2016). Many children use the school as a distraction from life tragedies. They associate their home with negative emotions and their school with positive emotions, where they can play freely without any family burden (Campbell et al., 2014). School is identified as the institutional setting that children engage with most regularly and teachers should be the principal support resource (Guo et al., 2012; Visser et al., 2012; Campbell et al., 2014; Anabwany et al., 2016). In an interview with HIV-affected students from Botswana, children expressed their desire to improve their school grade, receive better scholastic material, more teaching support, have better schools meals, eliminate bullying and teasing, receive more understanding/love by teachers and better teacher attendance and teaching approaches (Anabwani et al., 2016).

Educational outcomes

Research on educational outcomes considers a range of outcomes including school dropout, failure to enroll, lower grade for age, poor behaviour at school as well as school performance and grade attainment (Guo et al., 2012; Pufal et al., 2014).

In a study from Zambia with two cohorts of primary school-aged children (Nicholson et al., 2015), authors examined growth and health outcomes of 111 HEU and 279 HUU children together with school reports. Reports showed that there were no differences in English scores between HEU and HUU students, while HEU students showed a lower score level in Mathematics than HUU students.

A study from Botswana on orphans by HIV (it is not explicated if the children were HIV-positive or negative) showed that most children have access to school, and they liked it because of teachers and quality of education (Phaladze et al., 2017). In another context, Adler's study (2016), also showed the importance of having at least one best friend. This would protect children and adolescents from being bullied. However, some children did not like school because of corporal punishments and being bullied by other students (Phaladze et al., 2017). Results on school performance were quite low but still met the letter C criteria (from the scores criteria A B C D E, being A considered outstanding, D unsatisfactory, and E lack of effort/interest) (Phaladze et al., 2017).

A paper from South Africa examined adolescents' major difficulties (Cluver et al., 2012). Problems included: concentration at school, hunger at school, and missing and dropping out of school. Quantitative analysis showed evidence that adolescents living in a household with HIV/AIDS sick relatives or caregivers, were more likely to experience those problems than children in a healthy home and tended to be more vulnerable to educational challenges (Cluver et al., 2012).

In line with the aforementioned study, it seems that the main factor impairing HIV-affected school-age children in Zimbabwe was socioeconomic, and findings showed that most of the vulnerable children were linked to financial constraints. The authors suggested that investing in cash grants could be a good solution for HEU children to promote well-being and school progress (Pufall et al., 2014).

Interventions

A quasi-experimental, cross-sectional, post-intervention survey evaluated the use of an art program to increase the self-esteem and self-efficacy of HEU children in South Africa (Mueller et al., 2011). Children attending the program increased significantly in self-efficacy but they did not show any improvement in self-esteem, depression, and emotional and behavioural problems (Mueller et al., 2011).

Another study from South Africa (Visser et al., 2012) introduced an intervention to build positive relationships between parents and their children. The aims were to promote the well-being of HIV-positive mothers and their interactions with children. Many activities were created to make bonds between them. In fact, by tradition, African parents do not play much with their children. Three-month follow-up showed that there was an increase in parent-child communications. Parents felt more open to understanding their children without using any physical punishment and they were able to help their children with homework.

A longitudinal, quasi-experimental design evaluated the impact of two home-visiting program models on the psychological health of HIV-affected children and their caregivers in South Africa over two years (Thurman et al., 2014). Models were made by a group of paraprofessionals and a group of volunteers. After the two years follow-up, both models did not show any improvement in psychological health, but it continued to persist and worsen. The intervention highlighted the challenges of HIV-affected families and the need for strong psychological support.

Betancourt et al. (2014) developed the Family Strengthening Intervention (FSI) in Rwanda. Betancourt's FSI study was done initially to assess the acceptability and feasibility of the intervention to reduce mental health problems and boost resilience among children living in households affected by caregiver HIV in Rwanda. They adapted the intervention to the Rwandan context and the culturally relevant mental health problems. It also included

psychoeducation on genocide-related trauma and attention to the integration of past experiences and present resilience. The FSI had four key components: building parenting skills and improving family communication; developing a family narrative, providing psychoeducation on HIV transmission, prevention, and normative responses; strengthening problem-solving skills; and social support. The intervention was conducted by counselors who first met families separately and then all the components together. Results from post-intervention and six months follow-up indicated that caregivers reported improvements in self-esteem, perseverance, depression, and decreased anxiety and irritability. Children and caregivers also reported a reduction in harsh punishment after the 6 months follow-up.

An economic intervention with cash grants had been used to improve depressive symptoms on HIV-positive caregivers and the results showed great improvement in Uganda (Han et al., 2013). Three other studies examined the implementation of cash grants to enhance school outcomes. The first, from Uganda, promotes an intervention based on monetary saving (Sseswamala et al., 2016). Results showed positive effects on academic performances and indicated that children that received economic support had high possibilities to achieve their educational aims (Sseswamala et al., 2016). The other two studies, both based in South Africa and Malawi, explored the effect of cash grant's influence on HEU children outcomes both in educational risk and in cognitive development. Children in households receiving grants exhibited higher rates of regular attendance at school with a low number of absences and decreased possibility to engage in risk behaviour (Sherr, et al., 2017a). Findings on cognitive outcomes showed that cash grants have potential effects on cognitive abilities, based on the standard test presented in Table 1 of the present review. Furthermore, the authors evidenced that a combination of good parenting and grant cash was a strong predictor of a higher score on cognitive performances (Sherr et al., 2017b).

Discussion

The aim of this paper was to explore and systematize the psychosocial well-being of HIV-affected and HEU children and their association with school outcomes. In particular, this review examines the dynamic process of individual, family, and social factors, and interventions that shape school performances and educational outcomes.

It has been shown that in HIV-affected families, children's depression and resilience are causally related to caregivers' or parents' behaviour. The more parents are mentally or physically ill, the more children become vulnerable with anxiety, depression, and at risk for behavioural problems (Collishaw et al., 2016; Small et al., 2019). This may lead to poor school performances, concentration problems, and school failure (Cluver et al., 2012; Orkin et al., 2013; Skovdal et al., 2016).

The family intervention seems to be the key to relieve children's psychosocial well-being in HIV-affected families (Betancourt et al., 2014; Thurman et al., 2014). In particular, when delivered by counselors (Betancourt et al., 2014), it has been shown to achieve high improvement of the relationship between parents or caregivers and their children.

Other successful interventions were those using cash grants or account saving for families and children (Sseswamala et al., 2016, Sherr et al., 2017a; Sherr et al., 2017b). Among them, the more successful seemed to be those utilizing good parenting (increasing family quality time between child and parent) in combination with cash grants (Sherr et al., 2017b). Cash grants given to the parents in this context will help to build self-confidence among parents and allow them to feed their children well. Lastly, Sseswamala et al. (2016) highlighted the importance of parents having the opportunity to use the money to send their children to school without affecting their extremely limited resources.

Child sex was also relevant, particularly in different outcomes and responsibilities. In HIV-affected families, girls often take the entire house burden, resulting in increasing school

absence and school dropout, but with the financial support, they showed improvement in school outcomes compared to boys (Orkin et al., 2013; Hensels et al., 2016). Boys were less likely to be engaged in household activities, but they were more at risk to leave school and start working, especially if parents were sick and unable to work. Overall, boys seem to show more difficulties in school concentration and performance even when cash grants or money were implemented (Orkin et al., 2013).

Several studies highlighted the dual role of the school, as a risk and as a protective factor. In fact, besides the family and the socio-economic context, the school environment may be seen as the largest source of risk factors, such as bullying, stigma, and lack of teachers' support, as in the cases of Botswana (Anabwani et al., 2016; Phaladze et al., 2017) and Zimbabwe (Campbell et al., 2014).

Furthermore, few studies explored cognitive abilities in primary school children (Milligan & Cockcroft, 2017; Sherr et al., 2017b), but more investigations need to be done to understand if poor school outcomes are caused by biological factors (as the exposure to the virus and HAART in *utero*) or because of social circumstances. Exploring the cognitive abilities of school-aged children will be important, especially in the African context.

Alternatively, schools may also play a role as a protective factor, providing relief to children (Campbell et al., 2014; Watkins et al., 2014) and especially for those with a family burden and problems (Watkins et al., 2014 and Scorza et al., 2017). In the absence of easily available psychological support, schools are the unique place where children can address their needs (Anabwani et al., 2016). In fact, teachers may be a focal point for offering support and create an inclusive environment among classmates and peers. As a result, student's academic potential, self-efficacy, and self-esteem may become more strongly associated with academic outcomes (Cvencek et al., 2018). In summary, it has been shown that the more children

establish a positive relationship with teachers, the more resilient they are, and the more their school performance increases (Adler, 2016).

Furthermore, several studies evidenced how HEU children at the age of 24 months may exhibit developmental delay especially in the language-related area (Wedderburn et al., 2019). Considering that language impairment are the core of learning disabilities and usually, they do not disappear with time (Peterson et al., 2020), it is important to intervene and train teachers to cope with these problems.

We must remember that a good education can lead to a chance to have a good job in the future, reduce the risk to engage in risky behaviour, and also reduce the risk to become HIV-positive (Betancourt et al., 2013; Hensel et al., 2016).

Limitations

Due to their characteristics and themes, the review shows some limitations. The number of papers is low, and the topic still needs further investigation. Studies controlling for cognitive abilities are primarily done outside of African countries and if they are based in Africa, the sample age is focused on infants. Similarly, the topic of psychological well-being itself is already present in many studies, but not yet related to school performances and outcomes.

Conclusions

Overall, it is evident that HEU children experience several psychological, family, and social factors that seem to cause different problems with school performances and outcomes. Parents, caregivers, and teachers should cooperate to invest in good education. There is a need to focus more on the school environment to create a safe place for HEU children where they feel understood by teachers and peers. Providing the opportunity for HIV-affected children (including HEU) to meet their educational needs is of extreme relevance and different programs should be implemented to address the educational needs.

An inclusive environment should be created to assist children with schoolwork and support them whenever they have difficulties. It is important to address the needs of HEU children in the school environment and create a welcoming space where they feel accepted by teachers and peers.

Similarly, there is a need to implement evidence-based school programs to guarantee robust learning for HIV-affected children and increase their chances to access to success in the future.

These programs are increasingly urgent as the SARS CoV-2 pandemic disrupts education and healthcare systems in Africa and worldwide.

Chapter 2. Improving the reading skills of children with neurodevelopmental disabilities: preliminary study from Botswana

The paper summarizing this research has been published in the *Journal of Intellectual Disabilities*, in Nov 2020 online ahead of print.

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Abstract

In Botswana, Special Needs Education has been implemented for twenty-five years with some success, but there is still a need for evidence-based methods like Frequency Building, behavioural fluency, and Precision Teaching used to measure and improve school performance and learning. We explored the impact of these behavioural technologies on the reading performances of four children with a learning disorder (ADHD, speech impairment, and acquired brain disorder) in a special school in Gaborone. At the assessment, two children were unable to read letter sounds and two could not read sight words. Reading performances were measured with frequency and displayed on a standard celeration chart. During the intervention, the length of the tasks was reduced and then augmented. Findings revealed that after three months of intervention children significantly increased their score stimulating self-

confidence and enthusiasm during activities. This work demonstrates that behavioural technologies can be applied in Africa without using expensive or time-consuming resources.

Keywords: Botswana, behavioural fluency, case study, Frequency Building, Precision Teaching.

Introduction

People with disabilities, adults, and children are a marginalized group worldwide. Most Western countries have developed policies and interventions for people with disabilities. In developing countries, as are most African countries, many children and adults with neurodevelopmental disabilities are neglected and experience social exclusion. These appalling facts are well documented. In the news media, a CNN documentary ‘Locked Up and Forgotten’ (Mackenzie, 2011) detailed widespread poverty, poor health care, and how infectious diseases (such as HIV, malaria, and meningitis) and malnutrition promote dangerous living conditions and increase the likelihood of impairments among people with disabilities. The documentary focused on Kenya, but such conditions are prevalent in many other countries in and outside Africa. For example, the experiences of social exclusion of individuals with visual impairment have been reported in Namibia (Tobias and Mukhopadhyay, 2017), as well as it has been shown that people in low-income settings are disproportionately affected by disability due to increased health risks and limited access to services in West Africa (Jolley et al., 2018) and globally (Koller et al., 2017).

The United Nations General Assembly noted that an estimated 80% of people with disabilities live in developing countries (WHO, 2015). Living conditions in Botswana, a

developing country of Southern Africa, are still plagued by similar problems. The HIV rate is 20.3% in the adult population (UNAIDS, 2020) and disabled people are neglected by the public sector. Poor living conditions, poverty, undernourishment, lack of proper housing, unemployment, and violence also prevail. All these factors have a negative impact on all learners (Pottas, 2005). Botswana's government implemented a special education program in 1994 with the 'Revised National Policy on Education' (RNPE) (Otukile-Mongwaketse, 2011), where it is recognized the need to increase participation for disadvantaged groups in basic education. Disadvantaged groups in the context of Botswana were (and still are) those with various forms of disabilities, those who live in remote areas, learners from poor socio-economic backgrounds, individuals affected by HIV/AIDS, orphans, and girls who drop out of school due to early pregnancy (Modimakwane et al., 2015). Botswana runs five systems to meet the education and training needs of learners who have special educational needs. The systems include stimulation centres, special schools, and centres, special units attached to regular schools, resource classrooms, and inclusive arrangements within regular schools (Otukile-Mongwaketse, 2011).

Data about learning disorders are scattered. According to a local survey, in 2014 the total number of learners with disabilities in primary schools was 7,305, and they were divided into: intellectual disability, 2,287 (31%); visual disability, 1,473 (20%); speech disability, 603 (8%); physical disabilities, 472 (7%); hearing disability, 596 (8%); other health-related, 1,458 (20%); multiple disabilities, 416 (6 %) (Modimakwane et al., 2015). The teacher-to-student ratio is still very low (1:40-50) and there is not a differentiated curriculum and appropriate assessment for learners with special educational needs (Modimakwane et al., 2015).

In order to address the needs of disabled people in Botswana, a clear definition of what constitutes a learning disorder is needed. Learning disorders comprehend in this study both specific learning disorders and intellectual disabilities. The Diagnostic and Statistical

Manual of Mental Disorders (DSM–5) describes Specific Learning Disorder (SDL) (American Psychiatric Association, 2013). as “characterized by persistent and impairing difficulties with learning foundational academic skills in reading, writing, and/or math. The individual's performance in the affected academic skills is well below average for age, or acceptable performance levels are achieved only with extraordinary effort” (American Psychiatric Association, 2013: 32). In particular, students with learning disorders struggle to develop reading fluency, and their common core problems are the ability to read sight words (high frequencies words), decode words, and read phrases and sentences automatically and rapidly (Chard et al., 2002).

It has been shown that students enrolled in mainstream primary and secondary schools in Botswana, without mention of possible disabilities, experience several reading problems (Commeyras and Mazile, 2011; Commeyras and Ketsitlile, 2013; Ketsitlile and Commeyras, 2014; Shepherd, 2018). A literature review focusing on reading in Botswana indicates that primary school students, especially in the first grade, seem to read words without understanding their meaning, with poor quality reading instruction or help to understand difficult words encountered during reading (Commeyras and Ketsitlile, 2013). Furthermore, there is a lack of methods for teaching reading, and teachers do not emphasize comprehension. Teachers have not been trained on how to conduct informal reading assessments that would enable them to identify individual students' abilities and needs. Another outstanding complication includes English in Botswana being a second or third language for some children. Reading in English is more difficult than learning to read in the local language, Setswana since English and Setswana have many phonological differences (Commeyras and Ketsitlile, 2013). It should be pointed out that like other post-colonial African countries, the Botswana government continues to maintain bilingualism and multilingualism whilst at the same time encouraging immersion into English (Shepherd, 2018). Additionally, 'Botswana is not a reading nation', more

importance is given to the oral communication, so even for teachers sometimes it is difficult to show interest in reading (Commeyras and Mazile, 2011).

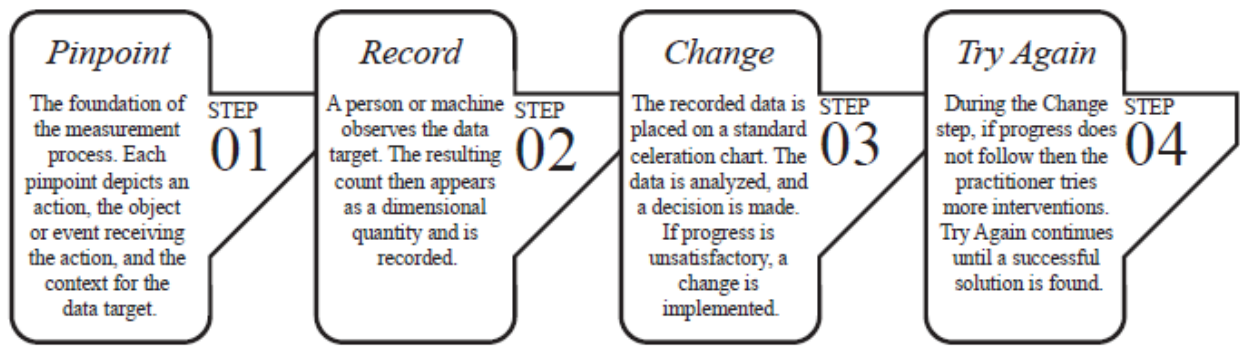
In secondary schools, reading performance results are still low both in speed and comprehension. The importance of training teachers on skills and strategies to assist all students, especially for those whose English is a second or third language, should be stressed (Ketsitlile and Commeyras, 2014). Overall, literature in the field leaves the impression that teaching reading in primary school classrooms requires improvement and an emphasis on quality approaches as the present pilot study seeks to examine. Considering the technological development of society, reading is viewed as crucial to a person's ability to develop fully as an individual. The lack of reading skills contributes to lower performance in other subject areas, such as mathematics, science, and geography (Moeller, 2016). Moreover, if students spend too much time decoding words, they are not always able to follow the meaning of sentences in narrative and expository texts. The experience will result in frustration and may lead students to an aversion towards reading in the future (Stevens et al., 2017).

Developing reading fluency is paramount for all students but especially those with disabilities. The reading literature defines reading fluency as the accuracy, speed, and prosody of a student reading connected texts (Kuhn et al., 2010). A similar concept is behavioural fluency, first described by Starlin (1971) and later refined by others (Binder, 1996; Haughton, 1972; Johnson and Layng, 1992). Behavioural fluency refers to the combination of accuracy plus speed of responding, that enables competent individuals to function efficiently and effectively in their natural environments (Binder, 1996). When students achieve a certain frequency of accurate performances they seem to retain, maintain, and meet the real world requirements, even in the face of distraction. Another hallmark feature of behavioural fluency is the ability to adapt and combine previous learning to the more complex subject matter.

Behavioural fluency has a long history and has contributed to the understanding, improvement, and practical applications of reading. Fluent readers can retain their relative rate of reading, and they will be able to apply their reading ability to novel passages and/or more complex reading passages. For example, it has been demonstrated that repeated reading interventions improve reading rate, accuracy and comprehension and that repeated reading interventions were more effective for reading comprehension (Chard et al., 2002). Furthermore, Brosnan et al. (2018) highlighted the importance of fluency in foundational reading skills for reading development. The study from Brosnan et al. (2018) and other reading research studies (Griffin and Murtagh 2015; Kubina et al., 2008; Mannion and Griffin, 2018) provide evidence that behavioural fluency using Precision Teaching (PT) can be used to target foundational reading skills.

Precision Teaching is a behavioural technology based on positive techniques and a systematic method of evaluating instructional tactics and curricula developed by Ogden Lindsley during the late 1960s (Johnson and Street, 2013). Precision Teaching has its roots in the behavioural science, specifically in the definition of ‘free-operant conditioning’, a learning process through which the strength of a behaviour is modified by an event (Vargas, 2013). Precision Teaching seeks to carefully record student data and present it in a way that teachers are able to quickly ascertain if the current instruction is working or not. If not, then changes are made and systematically observed to see if they affect a student’s performance and learning positively. As stated earlier, many researchers have examined academic skills through the lens of PT. The four steps of PT are shown in Figure 1.

Figure 1. Four steps of Precision Teaching



A special intervention called Frequency Building (FB) was developed through Precision Teaching and demonstrated positive experimental results (Kubina and Yurich, 2012). Frequency Building is defined as the timed repetition of selected behaviours followed by performance feedback (Kubina, 2019). Frequency Building ends when students have reached a performance standard or fluency goal which signifies the attainment of behavioural fluency. Studies applying the FB approach to reading skills have shown substantial improvement across a range of learners with and without disabilities (Cavallini et al., 2010; Griffin and Murthag, 2015; Hughes et al., 2007; Kostewicz et al., 2016; Kubina et al., 2008; Mannion and Griffin 2018).

As an example, in a case study run in the UK for ten weeks, PT and FB were applied to an intervention group where eventually the students were capable of reading 4 to 5 times more words correctly than the comparison group with endurance and stability (Hughes et al., 2007). Cavallini et al. (2010) provides another quality example using the most frequently used Italian words. Participants became proficient reading high frequency words, they also showed a significant difference between their pre- and post-test scores (Cavallini et al., 2010). Kostewicz and Kubina (2011) demonstrated that students with disabilities can improve oral reading fluency using a science textbook to practice repeated reading and retelling information. Moreover, a mixed quantitative and qualitative study showed that PT facilitated word-identification skills. The study also emphasized the motivational characteristics of PT with the

immediate positive feedback it gives to the students (Griffin and Murtagh, 2015). Furthermore, positive reinforcement added during the instruction can strengthen FB and increase the motivation to work as described in the principle of the science of behaviour (Vargas, 2013). The use of positive reinforcement can be a novel concept for some African countries, where punishment tends to be the norm in classrooms (Tilahun et al., 2016).

When PT is used in a classroom, students and teachers keep records of their academic or non-academic performances and use the record to guide their work. The records tell the students how their performance changes during the time on a standard celeration chart (SCC). The visual display is a ratio chart that shows different behaviour frequencies from 1 per day to 1000 per minute. The ratio scale makes it possible to measure the rate of learning. (Lindsley, 1990). The SCC differs from the more commonly used linear graph by showing how behaviours change relative to each other. Additionally, the SCC allows data to be quantified along other dimensions of change such a variability, average rates of behaviour or level, and how much improvement has occurred (Kubina, 2019).

In light of the significant hurdles faced by students with learning difficulties and disabilities in Botswana, FB, behavioural fluency, and PT offer several meaningful tools for teachers and students alike. Thus, the SCC component provides a visual display that fairly shows progress, or the lack thereof, for each individual student. Meanwhile, the FB component allows students to accelerate their growth with targeted skills and reach behavioural fluency. In combination with PT it offers a hopeful intervention for students with and without disabilities. It is the aim of the present small case study to examine how PT in combination with FB and positive reinforcement (i.e., FB reading skills, graphing data on SCC, and working toward behavioural fluency) would affect reading performances in students with disabilities in a school in Botswana.

Methods

Participants

The study took place in a private special school in Gaborone, Botswana, during 2017. The school count was approximately thirty-five students, but the number changed continuously due to new enrolments and dropouts. Four students from the same class were included: student A (a boy) was 6-years-old with Attention Deficit Hyperactivity Disorder (ADHD); student B (a girl) was 5-years-old with learning disabilities; students C and D (two girls) were 7-years-old, one with speech impairment and the other one with an acquired brain disorder as a result of meningitis.

In Botswana, formal diagnosis for children with neurodevelopmental disabilities is not readily available for learners who may need it. Therefore, students for this study were selected based on paediatrician's information and school assessments. All four students were in the same class identified as 'Lower Primary,' comprised of one teacher, one assistant teacher, and a total of eight students. The school benefited from a speech language therapist and a special education counsellor (the researcher) who both were able to offer individual sessions once a week for every student, as well as group sessions every day. The students involved in the study were chosen after numerous requests for help from the class teacher to the special education counsellor.

Student A had been rejected by two mainstream schools; when enrolled in the special school he was not able to read and recognise any letters or sit for more than two minutes at a time. He had been diagnosed with ADHD by the paediatrician. Student B was in the special school without any diagnosis, but she showed learning difficulties. She was able to match all the 26 letters of the alphabet, but she was unable to read the letter sounds. Student C was diagnosed with speech impairment and possible intellectual disabilities by the speech therapist. Student D had meningitis at the age of 2 years and 9 months and subsequently had a long

history of seizures. Both students C and D were already able to read Consonant Vowel Consonant (CVC) words. However, both students struggled with the 45-sight words component of the Botswana Syllabus (Government of Botswana, 2002).

Formal ethical approval for the study was granted from the Botswana Ministry of Basic Education [Ref: SER 1/15/2 XVI (121)]. Oral and written informed consent was obtained from the school, and all parents gave their written consent for the intervention administered to their children. Each participant was reminded that their responses would be regarded as confidential and that they could terminate their participation in all or part of the study at any time.

Setting

The sessions took place in a small, quiet office inside the special school. Each student underwent an individual session of FB and PT with a special education counsellor and a teacher assistant for 15 minutes. The students were already familiar with the location and material. Students were taken from their classes by the teacher's assistant and brought to the special education counsellor's office. For students A and B, a small table and 4 chairs were set. There was also a pile of wooden letter cards, a digital timer set to 1 minute, and a data collection sheet where the assistant teacher registered the score for each child. For students C and D, a desk was set with the worksheets of the 45 sight words part of the Botswana Curriculum (Government of Botswana, 2002). A digital timer set to 1 minute and a data collection sheet was also present.

Teaching materials and instructions

Materials

Teaching materials for students A and B consisted of 26 wooden flashcard letters with a square-shape of 10X10 cm. The lower-case letters were on one side and etched with sandpaper. Students C and D read a list of 45 sight words that should have been achieved at the end of standard 1 according to the Botswana Syllabus (primary school curriculum). The words were printed on three worksheets and each one had a different word order. Figure 2 shows the list of the words from the Botswana Syllabus in the English folder (Government of Botswana, 2002). Lastly, the same materials were used during baseline and condition (FB timing).

Figure 2. List of sight words from the Botswana Syllabus (Government of Botswana)

I	go	come	went	up	you	day	was	look
are	the	of	we	this	dog	me	like	going
big	she	and	they	my	see	on	away	mum
it	at	play	no	yes	for	a	dad	can
he	am	all	is	cat	get	said	to	in

Dependent variables

Two dependent variables were used to measure reading. First, students were asked to read aloud the letter sounds (students A and B) or the sight words (students C and D) in a 1-minute timed interval. The assistant teacher recorded students' performance on a data sheet as words read correctly and incorrectly. Self-corrected letter sounds were counted as

correct, but omissions, substitutions, and skipping lines or words were counted as incorrect. Second, the correct words or letter sounds were calculated subtracting the incorrect words/letters from the total number presented. The same procedure occurred for students C and D, namely two dependent variables were used. First, they were asked to read aloud the sight words in a 1-minute timed interval. The assistant teacher recorded sight words read correctly and incorrectly. Self-corrected sight words were counted as correct, but omissions, substitutions, and skipping lines or words were counted as incorrect. Second, the correct sight words were calculated subtracting the incorrect sight words from the total number presented.

Procedures

Baseline

Every student received three components of explicit instruction (Archer and Hughes, 2011). The first component was modelling and it was introduced to the student as “my turn”; the student listened to the teacher’s instruction and the teacher’s modelling of reading. The second component was prompted or guided practice, and presented to the student as “our turn”; the student and teacher read together, and the teacher provided prompts and corrections if needed. The third component was unprompted or independent practice converted to a frequency building trial and identified by “your turn.” During the third component, the student read aloud the words or letter sounds alone as fast as possible in 1-minute and the teacher assistant recorded the correct and incorrect words or letter sounds on the datasheet. All the students repeated the three instructional components three times, for a total of six instructional and three frequency building trials. The best score among the three reported trials was then transferred into the SCC. The order of the letters changed randomly and the sight words were read in a different way at each component. Each worksheet presented for individual sessions also had a different position of the words.

Condition Changes

In response to the students' data at baseline, condition changes were applied, in order to improve the learning outcomes. A package intervention made by PT, FB, and positive reinforcement with explicit instruction was used. In particular, letter sounds, and sight words were reduced and then increased, and a tangible reinforcer was added in the learning experience to increase the student's willingness to work. Before starting every session, students received an explanation about what would happen during the meeting and what would be expected from them. The reinforcer was used when students achieved a better score (even if marginal) on reading at each instructional component. The researcher, in conjunction with the teacher, established the reinforcer based on what was available (toys, chocolates, candies, chips) in the special education office. If students were not able to meet the criteria for any of the instructional components, they did not receive anything and had to wait for another session.

Data and analysis

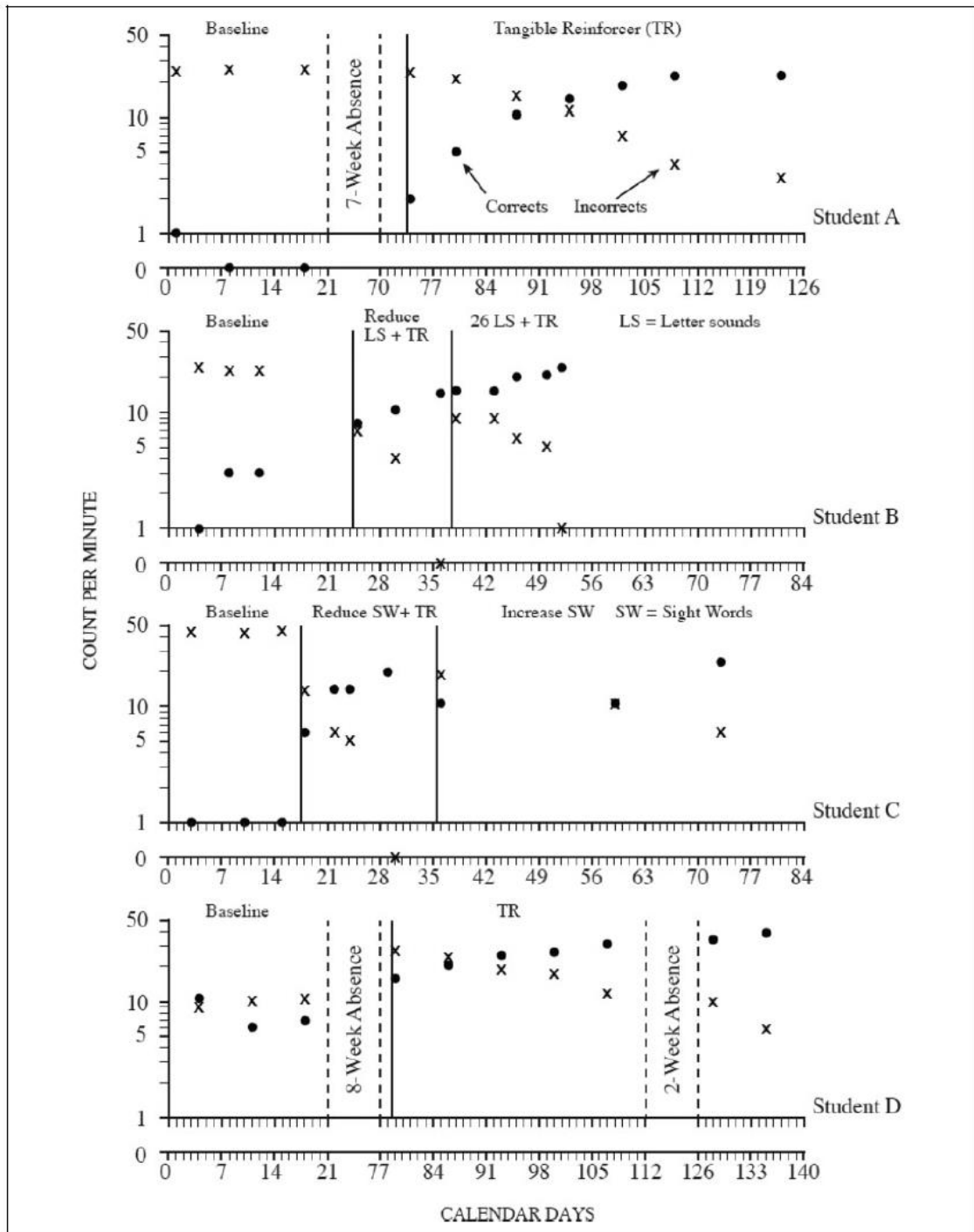
Students were monitored for the number of correct and incorrect letter sounds or sight words read per minute. The performance standard or fluency goal for the pilot study was set at reading 26 letter sounds per minute; a criterion that corresponded to the letter on wooden flashcards (students A and B). Reading 45 sight words out loud on a worksheet for 1-minute time (student C and D) was chosen as the performance standard or fluency goal.

The approach made by the intervention package used different teaching conditions developed for each individual student based on their specific needs and characteristics.

The results are displayed according to baseline and intervention conditions, each condition is separated on the SCC segment (Figure 3) through a full line that specifies the type of intervention that has been applied. Baseline data were collected once a week for three weeks, for a total of three sessions, and each child completed the session in 15 to 20 minutes.

During baseline, the same instructional episode was used for all students, no reinforcers were added nor were letter sounds or sight words changed. Due to their different school attendance rates, all students' baseline was done at different times during the school year. Each student had their own chart for a total of four SCCs on the PrecisionX app (Central Reach, 2020). A dot was used to mark the correct answers and an X to mark the incorrect answers (White and Neely, 2004).

Figure 3. Standard Celeration Chart Student A, B, C, and D.



Student A and D had one intervention condition change lasting seven sessions of 15 to 20 minutes each for seven weeks for a total of two months corresponding to a whole school term (removing the holidays). For both students, a condition change was the

introduction of FB and a reinforcer. Student A chose a toy before starting the three 1-minute FB trials by himself (“your turn”) and he had permission to play with it for a minute, measured with the digital timer if he beat his score. The researcher allowed him to choose reinforcers before starting the session because he wanted assurance he would receive something if he surpassed his score and because he needed to be reminded that he was working for that toy. Student D also received a handful of chocolate cereals after the three 1-minute FB trials (“your turn”) whenever she overcame her previous score. Student B and C had two intervention condition changes.

The first intervention condition for student B lasted for three sessions of 15 to 20 minutes each for three weeks. For student B the two conditions were: (1) decreasing the length of the task through the reduction of the number of letter sounds from 26 to 15, and (2) allowing her to play with a bead maze for one minute whenever she overcame her previous score. The intervention condition regime was then switched when the student reached the aim on the SCC that consisted of reading correctly all the 15 letter sounds. The second intervention condition for student B lasted for four sessions of 15-20 minutes for four weeks. The second condition was: increasing the number of letters sounds from 15 to 26 and allowing her to play with the bead maze game every time she overcame the previous score for the three times 1-minute reading by herself (“your turn”).

For Student C the first intervention condition lasted four sessions of 15 to 20 minutes each for four weeks. The number of sight words was decreased from 45 to 20 and the intervention condition was switched when the student reached her aim. She received a jellybean as a reinforcer every time she read by herself during the three frequency building trials if she exceeded her previous score. The second intervention condition lasted for three sessions of 15 to 20 minutes each for three weeks. The sight words were then increased to 45 from the baseline and the reinforcer was maintained.

All students' data were elaborated using a within condition analysis. A within condition analysis shows how behaviour changes within a condition (Kubina, 2019). The analysis measures were level, celeration, and improvement index.

Level is the average response rate of behaviour in a condition. In particular, it measures the responses for correct words and incorrect words during baseline and intervention conditions (phase of FB).

Celeration is a basic unit of behaviour change represented as the count for a time unit over a time unit (count/time over time) (Kubina and Yurich, 2012). Celeration values were calculated for correct and incorrect replies during baseline and intervention conditions. A behaviour with an upward slope, acceleration, requires a times symbol (\times), whereas a behaviour with downward slopes, deceleration, uses a divide symbol (\div) (Kubina and Yurich, 2012). The celeration reference values are reported in Table 1.

The improvement index is a measure of the change in the accuracy of behaviour from the beginning of an intervention phase to the end and it is used to analyse concurrent celeration data (e.g., correct and incorrect performances) (Kubina, 2019). The improvement index captures the ratio of the concurrent acceleration and deceleration values for each condition (Table 2). The numerical value of the improvement index states the degree of progress across time and communicates exactly how the behaviour changes for correct and incorrect answers (Kubina and Yurich, 2012). The significance of the improvement index is shown in Table 2. In the present study, the level was calculated using the geometric mean of correct answers. The PrecisionX (Central Reach, 2020) software uses linear regression with a logarithmic transformation for celeration. The improvement index was similarly calculated by the software.

Table 1. Growth classification based on celeration values (Kubina & Yurich, 2012)

Celeration values range	Percentage weekly growth	Growth classification
x3.0	201% + weekly growth	Super-massive growth celeration
x2.0 - x3.0	101 - 200% weekly growth	Massive growth celeration
x1.8 – x2.0	80 - 100% weekly growth	Exceptional growth celeration
X1.4 - x1.8	41 – 79% weekly growth	Robust growth celeration
x1.25 – x1.4	25 – 40% weekly growth	Acceptable growth celeration
x1.0 – x1.25	0 – 24% weekly growth	Unacceptable growth celeration

Table 2. An index of the significance of improvement values (Kubina & Yurich, 2012)

Improvement index	Significance
x1.0	No change
x1.0 – x1.2	Very slight accuracy improvement
x1.2 – x1.3	Small accuracy improvement
x1.3 – x1.5	Adequate accuracy improvement
x1.5 – x2.0	Substantial accuracy improvement
x2.0 – x3.0	Exceptional accuracy improvement
x3.0 +	Extraordinarily remarkable accuracy improvement

Statistical analysis

The researchers also conducted a Yates corrected chi-square test to find if the proportions of correct and incorrect responses varied between the initial (baseline) and final (condition) steps of the PT procedure. Alternatively, Fisher’s exact test was performed when data outputs had a value less than five in the 2X2 table. These are standard tests that were used

to further validate the results of the study. The smaller the associated *P*-value for the statistics, the stronger the evidence of a significant change in the rate of responses between baseline and condition results, considering a *P*-value less than 0.05 as statistically significant. The researchers compared baseline and condition absolute numbers of correct and incorrect responses. In the case of two conditions being applied, a comparison was made between baseline and condition 2 results. Evaluation of Yates corrected chi-square and Fisher's exact tests was performed using the Social Science Statistics software (freely available at <https://www.socscistatistics.com/tests/>).

Results

Level

The average correct responses during one-minute timing for student A showed a rise from 0.71 correctly read words during baseline to 10.58 during the intervention. Also, incorrects dropped from an average of 25.49 to 9.62. Student B had 2.08 average corrects per minute during baseline that rose to 10.97 in the first condition and 19.11 in the second condition.

The drop in incorrects for student B went from 23.65 to 2.41 during the first condition, and to 4.97 during the second condition. Student C's corrects went from 1.44 to 12.60 and 15.82 from baseline to the first and the second condition, respectively. Incorrects changed from 43.32 to 3.81 and 11.96. Student D started with a level of 7.73 average corrects during baseline to 27.32 during the condition. Incorrects went from 9.97 to 14.98 during the condition. All data are shown in Table 3.

Celeration

It was observed that during the various intervention conditions students showed important learning changes. Student A's acceleration rate for correctly identified letters grew

by $\times 1.32$ per week and the deceleration rate for incorrectly identified words decelerated by $\div 1.33$ per week (after seven sessions). Table 3 shows this improvement after the approach was switched from baseline to intervention condition.

In the case of student B, during the first intervention condition the acceleration rate for correctly identified words was $\times 1.44$ per week and the deceleration rate for incorrectly identified words fell sharply from $\div 1.08$ to $\div 4.83$ per week (after three sessions). During the second intervention condition the acceleration value remained relatively steady compared to the first intervention condition but it was still consistently growing with an acceleration rate of $\times 1.26$ per week and a deceleration rate of $\div 2.8$ per week (after four sessions), as shown in Table 3.

Student C showed an acceleration rate of $\times 1.77$ per week and a deceleration rate of $\div 5.36$ per week after four sessions under the first intervention condition. The respective rates of acceleration and deceleration were $\times 1.16$ per week and $\div 1.24$ per week after three-session under the second intervention condition, as shown in Table 3. Lastly, student D showed an acceleration rate of $\times 1.08$ per week and a deceleration rate of $\div 1.16$ per week after seven sessions under the first intervention condition, as shown in Table 3. Compared to baseline, student D acceleration grew gradually, and the deceleration has an acceptable trajectory.

Improvement Index

Student A showed an improvement index of $\times 1.75$ (Table 3), Student B showed an improvement index of $\times 6.94$ on the first intervention and $\times 3.54$ during the second intervention condition (Table 3). Student C had an improvement index of $\times 9.48$ under the first intervention condition, while under the second intervention condition it was $\times 1.45$ (Table 3). Lastly, student D had an improvement index of $\times 1.26$.

Finally, significant *P*-values associated with the tests (Fisher or Yates corrected chi-square) of the comparisons between the initial (baseline) and final (condition) absolute numbers of correct and incorrect responses were found, thus confirming the efficacy of the intervention (Table 3).

Table 3. Baseline and positive reinforcement condition results for Student A, B, C, and D.

Student		Level		Celeration		Improvement Index	Answers		Fisher exact test
		Acceleration	Deceleration	Acceleration	Deceleration		Correct	Incorrect	P-value
A	Baseline	0.71	25.49	÷2.19	x1.05	÷2.29	2	24	< 0.00001
	Condition	10.58	9.62	x1.32	÷1.33	x1.75	22	4	
B	Baseline	2.08	23.65	x2.83	÷1.08	x3.06	3	23	< 0.00001
	Condition 1	10.97	2.41	x1.44	÷4.83	x6.94	15	0	
	Condition 2	19.11	4.97	x1.26	÷2.8	x3.54	25	1	
C	Baseline	1.44	43.32	x1.13	÷1.01	x1.14	14	31	0.0029
	Condition 1	12.60	3.81	x1.77	÷5.36	x9.48	20	0	
	Condition 2	15.82	11.96	x1.16	÷1.24	x1.45	29	16	
D	Baseline	7.73	9.97	÷1.25	x1.11	÷1.39	17	28	< 0.00001 (chi-square statistic with Yates correction = 20.8456)
	Condition	27.32	14.98	x 1.08	÷1.16	x1.26	39	6	

Discussion

The study demonstrated that the intervention package made by PT, FB, and positive reinforcement with explicit instructions improved the reading skills of four students with a range of disabilities in a special needs school in Gaborone, Botswana. Results for all students (Figure 3) showed a marked difference between baseline and intervention conditions and, according to the literature, the significance of the improvement index is considered 'extraordinarily remarkable' (Kubina and Yurich, 2012). Overall, all students reached the range of the fluency goals as shown in Figure 3 and Table 3, despite having received intervention spaced out across time. Only student C had several correct words slightly lower at the second condition, visible also by looking at the acceleration line and improvement index on the second condition (Figure 3). Fisher exact test associated *P*-value was also less (but still highly) significant compared to the other students' outcomes (see Table 3) in line with the other indices.

Student A greatly benefited from the package intervention. The structure of the instructional episode in combination with PT and FB defined exactly the teacher's requests, while the positive reinforcement made him able to work more effectively. His reinforcer condition was playing freely for one minute with one of the toys available in the office. While he did not have a favourite toy, he was at all times under instructional control and accepted the offered reinforcer, playing with it appropriately every time he beat his score. When the timer sounded after the break, he did not need to be called but remained seated at the table ready to start the trials and saying '(...) and then we play again!'. Looking at his SCC segment the acceleration score for correct answers quickly grew, meaning he learned rapidly. The improvement index, $\times 1.75$, was also indicative of a substantial improvement (Kubina and Yurich 2012).

Student B was exposed to two separate interventions still made by the intervention package but with two different conditions. The first condition consisted of reducing the letter sounds from 26 to 15. The second intervention condition began when acceleration or deceleration scores reached the pre-determined level score (15 letter sounds in 1-minute time). The application of FB, the practice through the time repetition and reducing the letter sounds' numbers to decode, gave to the student the ability to build her skills. The improvement index indicated a marked improvement (x6.94 in the first condition, x3.54 in the second condition) while acceleration and deceleration scores changed rapidly. By all accounts, Student B benefited greatly from the intervention.

Student C, like student B, showed an important improvement, especially after the first intervention condition exposure. Looking at the SCC segment, reducing the number of words read incorrectly and adding a reinforcer, produced an improvement of the deceleration score for incorrect responses. The same pattern was apparent after exposure to the second intervention condition, where acceleration scores increased, and deceleration scores decreased gradually. The improvement index was remarkable on the first condition with a x9.48 improvement and acceptable for the second condition, x1.45. Unlike the other students, students B and C were exposed to two types of intervention conditions; decreasing the length of the task seemed to be a factor in reducing the guessing of letter sounds and words, while the reinforcer was helpful in keeping motivation high. Student D scores were not as high as the previous students, but she still shows improvement with deceleration and acceleration respectively of x1.08 and ÷1.16 and a small improvement index. Notably, students did not have the opportunity to receive daily sessions. Instead, students had a less intense presentation of one session per week. The students frequently skipped school (except student B) mostly due to financial constraints. Despite the spread of sessions across time, the consistent improvement of students' growth of corrects words per minute and subsequent reduction of incorrect words per

minute highlights the power of the intervention package. Increasing the frequency of sessions each week may result in greater growth rates and accelerated learning.

The primary finding of the pilot study showcases a meaningful increase in the sight words and letter sounds following the seven-week FB and PT intervention. We emphasize the use of SCC because it was easy to read, informative, and provided real-time feedback (Griffin and Murtagh, 2015). It has been considered a model to rely on by teachers and school personnel who participated or assisted the procedures. Through the intervention package, students had the chance to benefit from an evidence-based approach and an advanced measurement/decision-making system. For the first time in Botswana, the results made teachers and school personnel willing to continue to apply those interventions. The results are in line with other studies in this field from Western countries (Cavallini et al., 2010; Griffin and Murtagh, 2015). Achieving the basic reading skills for the students is of paramount importance and this is truer in an African context. Letter sounds identification is the first component skill of sounding out words. Students who fluently read letter sounds may sound out words more quickly than students who could not fluently. Similarly, students who could sound out words fluently can read passages more easily (Kubina et al., 2008). Children with learning disorders in Botswana can be a marginalized group. Becoming a better student and a better reader can allow them to have a brighter future and access to work. Poverty and marginalization in sub-Saharan African countries easily result from engaging in problem behaviours (drug addiction, gang activity, sexually aggressive behaviour, etc) or being an easy victim of problem behaviours (Hensels et al. 2016; Small e al., 2019). Using an evidence-based approach with a visible structure, that gives an immediate result, made students and school staff aware of the feasibility of the work. The use of positive reinforcement was an example of adding motivation to the students without using harsh and corporal punishment, a problem

already underlined in other studies in Botswana (Phaladze et al., 2018) and still present in many African countries.

Due to the characteristics of the environment, this study had some limitations. First, a lack of specialised teacher/assistant personnel was combined with a low number of sessions and reading practice during the week. Second, a delay between baseline and intervention for some of the participants may have impacted the results. Third, using an AB experimental design warrants caution when interpreting the results. A fourth limitation was that the school was private and parents were always struggling to send their children to school regularly due to financial constraints. Moreover, the school was in a continuous cycle of dropouts and new enrolments that made the work difficult. It was not possible to do a proper follow-up to check for retention, endurance, stability, and application (Hughes et al., 2007). Despite the limitations, the students involved made measurable improvements in their reading performance in only seven sessions with 15 to 20-minute sessions per week. The level of maintenance was high and their performance improved every week. We stress this was a pilot study that confirmed the value of explicit instruction, PT, FB, and the addition of positive reinforcement within the context of Botswana. Both PT and FB are applicable to most of the school curricula and they can be useful techniques either for special or mainstream schools in Botswana. More able students can even monitor the learning by themselves or in dyads, potentially providing a fruitful mutually supportive learning environment. The possibility of such cultural shifts, especially in government schools where classrooms are overcrowded and individual sessions are difficult to set, is tremendously exciting. Moreover, it will be of interest to explore their application together with inclusive strategies such as peer tutoring in mainstream school. The use of positive reinforcement in this pilot study was essential to achieve the results and it should become an example to follow both for special and mainstream schools.

In a country like Botswana, the implementation of PT and FB can empower the students needing special education to properly access information and promote access to education for people with disabilities also on the prevention and awareness of HIV as underlined on the HIV and disabilities document (UNAIDS, 2020). Reducing barriers (informational barriers, communication difficulties, access to education and literacy, and misconceptions about the health of people with disabilities) for children with disabilities and facilitating a better coping with most of the communicable and non-communicable diseases (WHO, 2015) is potentially within reach with the judicious application of PT.

To conclude, four students with disabilities were exposed to a customized FB and reinforcement intervention combined with PT that resulted in a marked improvement in reading performance in all cases. However, to fully evaluate the impact that such an approach can have, a larger sample study will be needed in Botswana.

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Chapter 3. Improving the reading performances and the psychological wellbeing of children with learning disabilities in a context of high HIV exposure: the case of Botswana

This research essay, in the form of a scientific manuscript, will be electronically submitted for publication at *AIDS Care*, and it is now *in the preparation* stage.

Mensi, M., Solimini, A., Otukile-Mongwaketse, M., Baiocco, R., Paganotti, G.M., Kubina, M.R. Improving the reading performances and the psychological wellbeing of children with learning disabilities in a context of high HIV exposure: the case of Botswana.

Introduction

Evidence-based teaching (EBT) refers to techniques and approaches to teaching based on the best available scientific evidence. Schools and teachers model their approaches based on research results, rather than tradition, personal judgment, or other subjective influences. In low and middle-income settings, like are many African countries, the need for EBT is compelling to avoid time and resource consuming and reducing frustration in students, especially those with learning disabilities that often come from poor environments and/or from contexts where infectious diseases as HIV deeply impact on the wellbeing of families.

Currently, little has been done in Africa on evidence-based educational approaches. To our knowledge, one in South Africa and one in Botswana (Robbins et al. 2000; Mensi et al., 2020), both showing positive outcomes on the use of the EBT techniques, namely Frequency Building (FB).

Botswana has 20.7% of adults living with HIV (15-49 years), the fourth-highest HIV prevalence in the world (UNAIDS, 2020). It is well known that in African countries, children

HIV negative but coming from an HIV affected family (defined as HIV-exposed uninfected children, HEU) show a high risk of withdrawal from school, decline in school enrollment and attendance, and are at risk of numerous psychological and physical problems, including fear, isolation, depression, anxiety, grief, low self-esteem, and trauma (Betancourt et al., 2014, Islam et al., 2014, Sherr et al., 2017).

However, it has been shown that many students (independently by their HIV exposure) enrolled in mainstream primary and secondary schools in Botswana have difficulties with reading (Commeyras & Mazile, 2011; Commeyras & Ketsitlile, 2013; Ketsitlile & Commeyras, 2014; Shepherd, 2018).

Applying measurable, effective, low-cost, and sustainable techniques capable of generating self-esteem improvements, happiness, and hope, through gains in school performance can be an essential model for Botswana and other low- and middle-income settings.

The EBT of interest in this study were Direct Instruction (DI), Frequency Building (FB), and Precision Teaching (PT). Direct Instruction is a model of teaching through well-developed and planned lessons. The philosophy principles of DI are: “*I*) all children can be taught; *II*) all children can improve academically and in terms of self-image; *III*) all teachers can succeed if provided with adequate training and materials; *IV*) low performers and disadvantaged learners must be taught at a faster rate than typically occurs if they are to catch up to their higher-performing peers; *V*) all details of instruction must be controlled to minimize the chance of students' misinterpreting the information being taught and to maximize the reinforcing effect of instruction” (NIFDI, 2015). The model contains specific teaching instructions written for teachers to follow every day. The approach seems to be more effective when combined with PT and the Standard Celeration Chart (SCC) (Kubina et al., 2009).

Precision Teaching is a system to measure precisely and continuously dimensional features of behaviour, and graphing and analysing behavioural data on the SCC to make timely and effective data-based decisions to improve behaviour (Evans, 2018). The SCC is a specialized ratio chart that displays different behaviour frequencies from 1 per day to 1000 per minute. Through PT, a special intervention called FB was developed that demonstrated positive experimental results (Kubina and Yurich, 2012). Frequency Building is defined as the timed repetition of selected behaviours followed by performance feedback (Kubina and Yurich, 2012).

Preliminary data from a special school in Gaborone, Botswana, showed that PT in combination with FB applied to children with learning and intellectual disabilities from 6 to 9 years of age, were able to significantly improve reading abilities in a single school term (Mensi et al., 2020). The present study aimed to explore if DI and FB, in combination with PT, were able to improve the reading performances of children with reading difficulties in primary schools in Gaborone. We were also aiming to study the potential impact of perinatal HIV exposure by knowing children's HIV status (HEU and HUU). The study also intended to assess if, through school gains, the self-esteem, happiness, and hope for the children's future would increase in scores.

Methods

Participants

Students enrolled in this study were from three different government primary schools, located in a different area of Gaborone, the capital of Botswana. Schools are identified with three codes: school 1, located in the central area of Gaborone, school 2, located in a poor/slum area, and school 3, in a commercial area of the city.

At the time of the study, the students were enrolled in standard 3 and standard 4 with

an age range between 8 and 10 years. All of the students were informally identified by the class teacher as being students with learning disabilities. Parents provided consent for running the study. The HIV status of the mothers was disclosed and kept confidential. Oral and written informed consent was obtained from the school, and all parents gave their written consent for the intervention administered to their children. Each participant was reminded that their responses would be regarded as confidential and that they could withdraw from the study at any time. Formal ethical approval of the study was granted from the Botswana Ministry of Basic Education [Ref: SER 1/15/2 XVI (121)] and the Ministry of Health [Ref: HPDME13/18/1 VI (18)].

Research design

To test the efficacy of interventions, a pre-test, and post-test control group design was implemented. The 50 students were randomly divided into two groups: after the pre-test one group received the intervention and the second group did activities as usual and receive the intervention a second time. Pre- and post-test design offers the chance to evaluate the intervention using the combination of DI, FB, and PT.

Materials

Before starting the intervention, the investigator and her assistant explained to the students in each school what was going to happen and what was expected from them. After the presentation, the assessors individually administered the psychological test in a quiet classroom or quiet place in the schoolyard. Assessors also explained the written questions in Setswana or English whenever they did not understand.

The researcher and research assistant implemented the DIBELS assessments for the measure available in grades 3 and 4. For each measure, written directions were on top of the

scoring booklet, that the examiner verbally explained to the students. Self-corrected words were counted as correct, but omissions, substitutions, and skipping lines or words were counted as incorrect.

Pre-test, together with socio-demographic information and post-test assessments, were obtained for all students. Three questionnaires for psychosocial wellbeing, namely the Rosenberg Scale (Rosenberg, 1965), the Subjective Happiness Scale (Lyubomirsky, 1999) and the Hope Index (Herth, 1992) were administered. In addition, to assess the reading skills, the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) (University of Oregon, 2018) was administered. Only the investigators knew whether students were HEU or HUU. All the psychological wellbeing tests were translated into Setswana, the local language, and back translated to English to guarantee the accuracy. The investigator, with a local research assistant, helped students to fill the questionnaire in English or Setswana according to their language confidence and ability.

The Rosenberg Scale evaluates the self-esteem, it has 10 items answered on a four point scale ranging from strongly agree to strongly disagree. Scores below 15 indicate low self-esteem, scores between 15 and 25 are within a normal range, and scores above 25 suggest above average.

The Lyubromsky Happiness Scale is a 4-item instrument designed to measure subjective happiness; each item is completed by choosing one of the 7 options that finish a given sentence fragment. The options are different for each of the four questions. Scores range from 1 to 7, a higher score suggests higher happiness.

The Hert Hope Index is a 4-point scale that ranges from 1 (strongly disagree) to 4 (strongly agree). Scores range from 12 to 48, a higher score denotes higher level of hope.

Lastly, DIBELS was used to assess reading. The grade 3 and 4 DIBELS folders were used, and both of them were subdivided in three benchmarks according to three different time

period: beginning, middle, end. Different assessments make the grade 3 assessment, but for the purpose of this study only the Oral Reading Fluency (ORF) made by a passage was taken. The grade 4 assessment was made by an ORF passage.

Half of the students underwent the intervention procedure. The intervention was made using DI (Engelman, 1983), and the FB was applied in combination with PT based on the lists of words provided from the same textbook. The sheets set were printed on landscape view, 2 sheets for every lesson, each sheet having 100 words in random order.

A digital timer was used to check students' reading time, and a sheet to collect scores for each student was used. During the intervention, students' individual scores were recorded on a SCC. For the purpose of the study, each student had his/her own chart.

Intervention

Assessment and intervention in school 1 were done outside the classrooms, in the yard, whereas for schools 2 and 3 they were done in a library and an empty classroom, respectively. Students were called from the classroom every day from Monday to Thursday. The intervention was made by 45 lessons, one lesson per day.

Direct Instruction (Engelmann, 1983) presents written precise instructions for all the activities in the lesson. Three different types of the script to follow are presented: a script, printed in red, indicates exactly what teachers have to say. A script, printed in black, within quotation marks, states what children should answer to produce a correct response. A script, printed in black, within parenthesis, indicates what teacher and child should repeat together.


The first 8 lessons were about letter sounds and Consonant -Vowel-Vowel-Consonant (CVVC) words. Then, a small list of words was mixed with letter sounds. In this phase, words are mostly phonetic and slowly they move to non-phonetic words using a "funny alphabet" that

help students to read more easily.

The FB words reading started from lesson 9. Figure 1 shows how the sheet is presented.

The everyday session was organized by 20 minutes of DI lesson followed by FB words reading.

Figure. 1. Example of Fluency Building worksheet to accompany the book “Teach Your Child to Read in 100 Easy Lessons” (Engelmann, 1984). Gently provided by J.K. Robbins.

		P.E.E.R.		PARTNERSHIPS FOR EDUCATIONAL EXCELLENCE AND RESEARCH		See/Say Words -- Lesson 34				
duck	I	gun	rag	luck	win	rug	sun	with	got	»
with	sun	rug	win	luck	got	I	gun	rag	duck	»
luck	rag	I	win	with	got	duck	rug	sun	gun	»
duck	rug	rag	sun	luck	gun	I	with	got	win	»
sun	got	duck	with	gun	rag	luck	I	win	rug	»
gun	got	win	with	duck	I	luck	sun	rag	rug	»
sun	with	rag	I	rug	got	duck	win	luck	gun	»
with	win	luck	sun	I	gun	duck	rag	rug	got	»
duck	rag	I	win	got	luck	rug	with	sun	gun	»
luck	I	rag	with	rug	duck	gun	got	win	sun	»

Version 1 of 2

Children read the words as fast as they can in 1 minute: self-corrected words were counted as correct, but omissions, substitutions, and skipping lines or words were counted as incorrect. The exercise was repeated three times. The two sheets were read from left to the right, and their third reading was on the first sheet from the bottom to the top. The three times scores were written on a datasheet and the highest score was registered on a SCC. Results on the SCC are divided into Level, Celeration, and Improvement Index (I.I.). From lesson 9 to lesson 45 the geometric mean of single scores was calculated on the SCC.

The level is the average response rate of behaviour in a condition. In particular, it

measures the responses for correct words and incorrect words. Celeration is a basic unit of behaviour change represented as the count for a time unit over a time unit (Kubina and Yurich, 2012). Celeration values were calculated for correct and incorrect replies. A behaviour with an upward slope, the acceleration, requires a times symbol (\times), a behaviour with downward slopes, deceleration, needs a divide symbol (\div) (Kubina and Yurich, 2012).

The I.I. is a measure of the change in the accuracy of behaviour from the beginning of an intervention phase to the end and it is used to analyse concurrent celeration data (e.g., correct and incorrect performances) (Kubina and Yurich, 2012). The Improvement Index captures the ratio of the concurrent acceleration and deceleration rates for each condition. On the SCC it represents the wideness between the acceleration line and deceleration line.

Statistical analysis

Descriptive statistics were expressed as mean and standard deviation (SD) for continuous variables and as frequency for categorical ones. We used analysis of covariance (ANCOVA) to estimate the differences in the post-test score between groups, after adjusting for socio-demographics and student characteristics. A *P*-value <0.05 was used to flag statistically significant results.

Comparison of ORF words correct during follow-up time was carried out with a mixed model, using children as random components and school, sex, age, follow-up time, and HIV status as fixed effects. The HIV status was entered as a crossed term with follow-up time to test for differences between HUU and HEU children. All of the statistical analyses were performed using R version 4.0.2. (R Core Team, 2020).

Results

The average age for all children was 9.3 years, 32 being boys and 17 girls. HIV- exposed uninfected children were 32 (boys and girls) and HUU were 17 (boys and girls), subdivided into the intervention and non-intervention group (see Table 1 for student’s characteristics) .

Table 1. General characteristic of the studied population.

Characteristic	Intervention group	Group without intervention	Total
Gender			
Male	14	18	32
Female	9	8	17
Child age	9.3	9.15	9.2
School grade 4	13	11	24
School grade 3	10	15	25
HIV STATUS			
HIV-exposed uninfected	12	20	32
HIV-unexposed uninfected	11	6	17
MOTHER’S MARITAL STATUS			
Single	17	19	36
Married	5	6	11
Divorced	0	1	1
MOTHER’S EDUCATION LEVEL			
Primary	10	3	13
Secondary	3	11	14
University	5	4	9
College	1	4	5
Unknown	4	3	7
SCHOOLS			
School 1	9	9	18
School 2	5	5	10
School 3	10	11	21

Table 2. Results of psychological and reading tests. SD: standard deviation; HUU: HIV-Unexposed Uninfected; HEU: HIV-Exposed Uninfected; ORF: Oral Reading Fluency

		Intervention, average score (SD)		No Intervention, average score (SD)	
		Pre-test	Post-test	Pre-test	Post-test
Psychological tests					
	HUU	17.00 (6.81)	20.18 (3.34)	18.17 (2.86)	20.00 (1.79)
Self-esteem	HEU	18.58 (3.03)	21.08 (2.68)	17.70 (4.78)	18.55 (1.93)
	Overall	17.83 (5.13)	20.65 (2.98)	17.81 (4.36)	18.88 (1.97)
	HUU	4.77 (1.87)	6.14 (1.07)	5.42 (0.34)	5.30 (0.94)
Happiness	HEU	5.29 (0.75)	6.27 (0.64)	5.20 (0.71)	5.13 (0.90)
	Overall	5.04 (1.39)	6.20 (0.86)	5.25 (0.64)	5.17 (0.89)
	HUU	20.00 (7.44)	24.45 (2.66)	20.67 (6.41)	20.83 (6.43)
Hope	HEU	22.33 (4.72)	21.92 (5.04)	20.30 (6.33)	22.70 (4.44)
	Overall	21.22 (6.14)	23.13 (4.19)	20.38 (6.22)	22.27 (4.89)
Reading assessment					
ORF total words correct grade 4		8.00 (4.17)	17.69 (20.76)	6.90 (5.63)	10.00 (17.10)
ORF total errors grade 4		8.30 (4.63)	8.76 (7.57)	10.54 (7.76)	6.90 (4.68)
ORF total words correct grade 3		10.60 (10.45)	28.10 (26.31)	4.57 (5.52)	6.30 (11.07)
ORF total errors grade 3		10.10 (7.92)	9.30 (5.26)	4.00 (3.99)	4.33 (7.36)

No differences between the intervention and the non-intervention groups were found in the Rosenberg scale and the Hope Index, after adjusting for sex, age, school, and HIV status of the mother (ANCOVA, time x intervention interaction, both $P > 0.05$; Table 3). However, there was a tendency of growth in Self-esteem, when treatment was applied between pre-and post-test score (Table 3 and Figure 2), whereas a significant improvement in the Subjective Happiness Scale with a mean difference of around 1 point (ANCOVA, time x intervention interaction, $P = 0.003$) (Table 3 and Figure 3), with the overall value of pre-test and post-test

average scores \pm SD being 5.04 ± 1.39 and 6.20 ± 0.86 , respectively (Table 2). There was also an important reduction in the Hope Index for school 3 (Table 3).

Table 3. Analysis of Covariance of Rosenberg scale (Self-esteem), Subjective Happiness Scale, and the Hope Index. Table reports betas, standard error, and t-test *P*-values. Estimate (beta): mean difference; SE: standard error; HUU: HIV-unexposed uninfected children

Factor	Self-esteem Estimate (beta) \pm SE (<i>P</i>)	Happiness Estimate (beta) \pm SE (<i>P</i>)	Hope Estimate (beta) \pm SE (<i>P</i>)
Gender (male)	0.99 ± 0.64 (0.13)	-0.08 ± 0.19 (0.66)	-0.31 ± 1.02 (0.76)
Age	-0.18 ± 0.30 (0.55)	0.06 ± 0.09 (0.53)	0.25 ± 0.47 (0.60)
HIV status (HEU-HUU)	-0.04 ± 0.61 (0.94)	-0.04 ± 0.18 (0.84)	-0.26 ± 0.96 (0.79)
School 2	-1.00 ± 0.67 (0.14)	0.03 ± 0.21 (0.88)	-1.00 ± 1.07 (0.35)
School 3	-0.50 ± 0.80 (0.52)	-0.08 ± 0.24 (0.73)	-4.18 ± 1.26 (<0.01)
Time	0.39 ± 0.77 (0.61)	-0.08 ± 0.23 (0.71)	1.18 ± 1.21 (0.33)
Intervention	0.26 ± 0.81 (0.75)	0.003 ± 0.24 (0.99)	1.02 ± 1.29 (0.43)
Time x intervention	1.62 ± 1.12 (0.15)	1.029 ± 0.34 (0.003)	-0.13 ± 1.77 (0.94)

Figure 2. Tendency of growth in Self-esteem at the pre-test and post-test times (see Tab. 3 for statistics).

Ordinate represents average values of Self-esteem (according to the Rosenberg Scale); treat 0: represent the category of students that do not undergo intervention; treat 1: represent the category of students that undergo intervention.

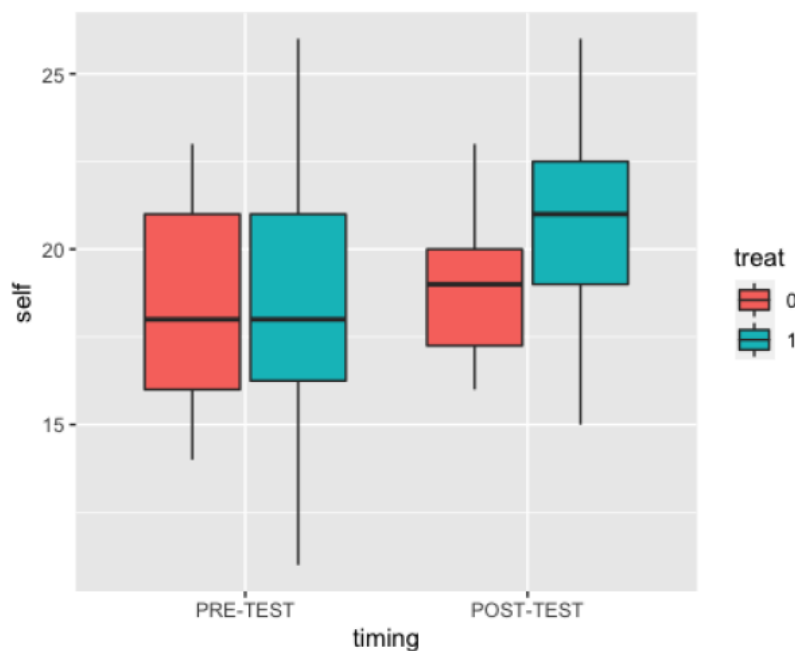
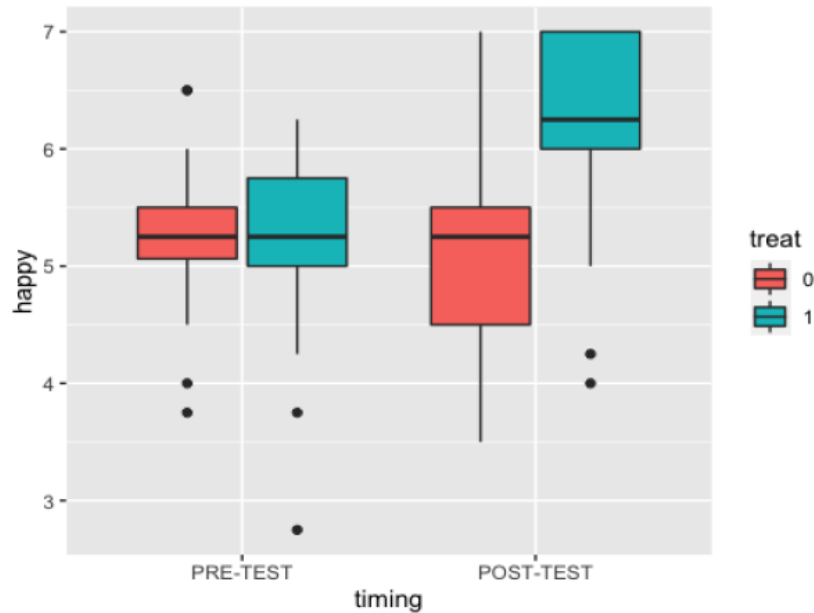


Figure 3. Significantly growth in Happiness at the pre-test and post-test times (see Tab. 3 for statistics).

Ordinate represents average values of Happiness (according to the Happiness Scale); treat 0: represent the category of students that do not undergo intervention; treat 1: represent the category of students that undergo intervention.



Statistical significant differences between pre-test and post-test in the intervention group compared with the non-intervention group (for both grade 3 and 4 students) were found for ORF total correct words (ANCOVA, time x intervention interaction, $P > 0.03$; Table 4), after adjusting for sex, age, school and HIV status of the mother, with the overall number of pre-test and post-test number of words correct \pm SD being 8.00 ± 4.17 and 17.69 ± 20.76 for grade 4, and 10.60 ± 10.45 and 28.10 ± 26.31 for grade 3, respectively (Table 2).

Table 4. Analysis of Covariance of ORF scale. Table reports betas, standard error, and t-test *P*-values. ORF: Oral Reading Fluency; Estimate (beta): mean difference; SE: standard error; HUU: HIV-unexposed uninfected children

Factor	ORF	
	Words correct Estimate (beta) ± SE (<i>P</i>)	Words incorrect Estimate ± SE (<i>P</i>)
Gender (male)	-2.07 ± 3.06 (0.50)	-0.14 ± 1.91 (0.94)
Age	-1.55 ± 1.39 (0.27)	0.50 ± 0.87 (0.57)
HIV status (HEU-HUU)	6.06 ± 2.82 (0.03)	-1.57 ± 1.76 (0.37)
School 2	-10.07 ± 3.26 (0.003)	1.47 ± 2.04 (0.47)
School 3	-15.02 ± 3.59 (<0.001)	0.08 ± 2.24 (0.97)
Time	3.14 ± 3.71 (0.40)	-2.81 ± 2.32 (0.23)
Intervention	5.05 ± 3.78 (0.18)	0.72 ± 2.36 (0.76)
Time x intervention	11.70 ± 5.28 (0.03)	4.73 ± 3.29 (0.15)

Therefore, children that received the intervention showed a significant improvement. On average, the difference of correct words between HEU and HUU children was 6.06. Other variables did not show statistically significant results except for school (Table 4). No differences were shown for the word incorrect ORF scale (Table 4). On average, HUU children improved slower than HEU children during follow-up (Mixed model, interaction time x HIV status, $P < 0.001$) (Table 5).

Table 5. A mixed model of words corrects during follow-up. Table reports betas, standard error, and *P*-values of fixed effect variables. Children were entered into the model as a random effect.

ORF: Oral Reading Fluency; Estimate (beta): mean difference; SE: standard error; HUU: HIV-unexposed uninfected children.

Factor	ORF: words correct Estimate (beta) ± SE (<i>P</i>)
Sex (male)	-0.01 ± 0.10 (0.95)
Age	-0.10 ± 0.13 (0.44)
HIV status (HUU)	-0.27 ± 0.30 (0.35)
School 2	-0.46 ± 0.33 (0.16)
School 3	-0.66 ± 0.36 (0.07)
Time	0.003 ± 0.0002 (<0.001)
Time x HIV status (HUU)	-0.002 ± 0.0004 (<0.001)

The results of the intervention using DI, FB, and PT have been displayed on the SCC and summarized in Table 6. School 1 showed a Level's geometric mean of 21.06 during the first condition and 22.6 during the second condition, the Celeration was x1.13 on the first condition, and x1.06 on the second condition; the Improvement Index was x1.4 on the first condition and ÷0.95 on the second condition. School 2 showed a Level of 14.72 on the first condition and 14.15 on the second condition, the Celeration was x1.06 on the first condition and x1.49 on the second condition; the Improvement Index was x1.17 during the first condition and x1.33 during the second condition. School 3 showed a Level of 27.4 during the first condition and a Level of 34.13 during the second condition, a celeration of ÷0.95 on the first condition, and x1.03 during the second condition, the Improvement Index was ÷0.60 in the first condition and x1.05 during the second condition.

The mean scores (geometric mean) of HEU children were: 28.59, x1.10, and x1.28 for Level, Celeration, and Improvement Index respectively for the first condition and, 24.78, x1.02, ÷0.96 respectively for the second condition. The mean scores (geometric mean) of HUU

children were: 19.03, x1.06, and x1.14 for Level, Celeration, and Improvement Index respectively for the first condition and, 34.13, x1.16, and x1.04 for the second condition.

Table 6. Geometric Mean of all students' scores. To calculate the geometric mean, all the value was converted in a decimal form, when the result value was less than 1 it was converted by doing 1/value and added divide (\div) symbol before. When the value was greater than 1, the symbol time (x) was added before the value. Scores are divided into first and second conditions according to the intervention time: the first condition before holidays, second condition after holidays. The two conditions are divided into Level, Celeration, and Improvement Index. The level is the average response rate of behaviour (reading) in a condition; Celeration is the ratio between correct and incorrect replies; Improvement Index is a measure of the change in the accuracy of behaviour from the beginning of an intervention phase to the end. HEU: HIV-exposed uninfected children.

Data by schools (geometric mean)						
First Condition				Second Condition		
	Level	Celeration	Improvement Index	Level	Celeration	Improvement Index
School 1	21.06	x1.13	x1.41	22.6	x1.06	\div 0.95
School 2	14.72	x1.06	x1.17	14.15	x1.49	x1.33
School 3	27.4	x0.95	\div 0.60	34.13	x1.03	x1.05
Data by HIV exposure (geometric mean)						
First condition				Second condition		
	Level	Celeration	Improvement Index	Level	Celeration	Improvement Index
HEU children	26.17	x1.04	x1.20	27.07	x1.07	x1.02
HUU children	18.04	x1.03	x1.07	21.03	x1.19	x1.11

Discussion

This study showed that an intervention applying DI, FB, and PT, besides impacting positively on the Happiness scores of primary school children from Gaborone, Botswana, significantly improves their reading performances, especially among HEU children.

All students (independently of their HIV exposure) that undergo DI, FB, and PT intervention significantly improved their reading score. Both HIV-exposed and non-exposed groups had significant growth in Happiness after the intervention, while Self-esteem and Hope did not change. Nevertheless, the self-esteem score showed a (non-statistically significant) trend of growth of 1.62 times (Table 3 and Figure 2). On the SCC, reading performances

showed an “adequate” Improvement Index for all children of $x 1.41$ in school 1, and a “very slight accuracy” Improvement Index of $x1.17$ in school 2 during the first condition. In the second condition school, 2 showed a robust growth celeration mean of $x1.49$ and an adequate Improvement Index mean of $x1.33$. The statistical analysis (MANCOVA) confirms the significant improvement during the intervention and a significant improvement on the post-test for the correct numbers of words (Table 4 and Table 5).

It is relevant to underline that reading pre-tests (independently from being into the intervention or nonintervention group) showed an extremely low average of correct words per minute, ranging from 4 to 10.6 (Table 2). These scores are extremely low if compared to the USA Curriculum-Based Measurement data, where students in grade 4 have to read correctly 99 words per minute (Hosp et al., 2007). In the Botswana syllabus (Government of Botswana, 2002) is specified that students at the end of standard 4 have to read 195 high-frequency words, together with a non-specified number of words considered as part of daily life. Students involved in the study were listed by the class teacher as students with learning disabilities. Those who followed the intervention had different ways of improvement: some increased gradually the reading scores while some showed a higher increase in reading score already from the first day of the FB. An example was student 34 who was able to read 93 words correct in 1 minute from the FB sheet that accompanied lesson 9 (Supplementary Table). Looking at the SCC, the student showed every day a remarkably high level of words corrects per minute, therefore, the intervention structure made the student able to learn. More in general, it could be observed a Level and Celeration both in the first and second conditions for the three schools have an inverse relationship (Table 6).

Psychological questionnaires showed a slightly low-level score on children's happiness of 5.06, while the normal range should be 5.6 (Lyubomirsky, 1999). Self-esteem had a score of 17.83, considering that the normal range is between 15 and 25, they were in the normal range

but with a low score. The Hope Index showed an average score of 21.22, as well as within the normal range.

A result that could be considered novel was that after the intervention, students showed a significantly higher score on Happiness (Table 2). Furthermore, Happiness was the only test that showed in the pre-test an average score slightly below the normal range (5.04, Table 2). No studies are evaluating the psychological impact of this type of intervention to the best of our knowledge. The importance of beating the previous scores, during the FB part of the intervention, and the rhythm and emphasis in which the method was administered, and the fact that children received attention, may be responsible for the increase in Happiness. Regarding Self-esteem, results suggest that a wider number of students' self-esteem could reach a significant result. This may demonstrate that explicit instruction in a school environment increases students' psychological health.

The results illustrated in this study are in line with other studies employing DI, FB, and PT in Western countries, and another pilot study was already done in a Special School in Gaborone (Mensi, et al., 2020). It should be stressed the importance of school as an easy-to-use place where children may address their needs, especially for those with family burdens (Anabwani, et al., 2016; Campbell et al., 2014; Watkins et al., 2014). It is also important to underline that better school performances are good contributions to creating psychological well-being at school to create an inclusive environment where HEU and HIV-affected children and HUU children may learn with the same opportunity.

In summary, this study applied DI, FB, and PT were used in Botswana, a middle-income country severely affected by HIV. Results confirm the values of those techniques and validate their importance in a setting where English was not technically the first language, but only officially.

General conclusion

The work shown in this thesis lies on two main aims: *i*) to review and explore the possible impact of HIV on children's school performances in Botswana, and *ii*) the implementation of evidence-based approaches to improve reading skills (and therefore scholastic performances) and consequently psychological well-being among those children. Currently, the literature on how HIV exposure in children interplays with family problems, cognitive development, and mental health is growing, whereas the literature on school behaviour performance, enrolment, and dropout is still scattered.

This work firstly attempted to fill a gap in the problem's knowledge (through a systematic review) and suggested some possible solutions (aim 1). The second aim was achieved through an initial pilot study to prime the technologies, adapt them to an African context, and subsequently apply them to a larger scale in three governmental schools.

The academic success of school-aged children in Botswana, a country with a high HIV rate, appears to be an appropriate indicator of wellbeing and resilience. The first chapter describes the suffering of children affected by HIV in different circumstances: because of living with an HIV-positive caregiver or who had a caregiver die of AIDS, resulting in a burden of psychological distress comparable to that of children living with HIV.

The second chapter of this thesis showed that the use of FB, PT, and positive reinforcement increased the reading performance of children from a special school in Gaborone. The students at the end of the intervention were able to read letter sound and sight words with speed and accuracy. Results were remarkable and encouraging to experiment with a similar intervention package on another group of children.

This was explored in the third chapter, the case-control study, where a reading intervention made with DI, FB, and PT was implemented on HEU and HUU children with learning disabilities. Although literature reports that HEU children are at a disadvantage with HUU children, results of this study showed that HEU children with learning disabilities performed significantly better than their HUU children counterparts, before and after the intervention. However, the reading score level was extremely low for both groups. The happiness score increased significantly for both groups after the intervention. This last result is noteworthy, as for the first time it was possible to measure the impact of the aforementioned package intervention on a psychological wellbeing scale. Nevertheless, results showed a significant decrease in Hope's score in one of the schools. It has been shown that psychological interventions in Botswana schools (Katsi, et al. 2019) significantly improve future aspirations. In our case, likely, school interventions are not enough for all to increase hope for the future. It is, therefore, advisable that a psychological intervention, combined with parent strengthens and, if possible economic incentives, should be implemented. This is in line with the main conclusions of the systematic review reported in chapter 1.

Major conclusions that may be drawn are that the participants (independently from their HIV exposure status) were able to significantly increase their reading performance using the evidence-based approaches proposed and that this result was linked to a significant improvement of their psychological well-being.

The two experimental studies suggest that evidence-based approaches and techniques developed in North America and also implemented in Europe are applicable and useful in an African context and particularly in Botswana.

As far as we know, no previous studies have looked into these issues, and this is the first work employing Applied Behavioural techniques and Direct Instruction to enhance reading performance and psychological well-being.

It is crucial to highlight that more longitudinal studies need to be carried out on HIV-affected children, especially when they present learning disabilities, to explore the impact of reading intervention and the link between this and well-being.

Finally, it will be also useful to implement DI, FB, and PT to disadvantaged children (including HEU) in more African countries to develop programmes and policies. It is also essential that these interventions will be rigorously evaluated with a larger number of students to determine their effects on psychology and performances.

Limitations

The three studies presented several limitations. The systematic review (chapter 1) is based on only 50 papers. There is a lack of studies exploring the school performances related to HIV-affected students, and it is still tricky to make a comparison between previous and new results.

The pilot study (chapter 2) being carried out in a local private school, presents limitations, especially due to family financial constraints.

Another limitation present in the second (chapter 2) and the third study (chapter 3) was the timing and delays from assessment to intervention.

Finally, the disclosure of the mother's HIV status (chapter 3) impacted the enrolment process, since in Botswana this has to do with social stigma, therefore not all parents responded.

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APPENDIX I

MEASURES

Socio-demographic data – please circle one choice per box.

001	<p style="text-align: center;">Marital status of</p> <p>mother</p>	<p>1. Married</p> <p>2. Widow</p> <p>3. Divorced</p> <p>4. Single</p> <p>5. NA- mother not alive</p> <p>6. Other</p>	<p style="text-align: center;">m</p> <p>arital</p>
002	<p style="text-align: center;">Education level</p> <p>(completed) of the</p> <p>mother</p>	<p>1. None</p> <p>2. Primary (grades 1-7)</p> <p>3. Secondary (grades 8-12)</p> <p>4. Tertiary colleges</p> <p>5. University</p> <p>6. NA- mother not alive</p>	<p style="text-align: center;">ot</p> <p>h_ed</p>
003	<p style="text-align: center;">Occupation of the</p> <p>Mother</p>	<p>1. Salaried Employed</p> <p>2. Self Employed</p>	<p style="text-align: center;">m</p> <p>oth_occ</p>

		3. Housewife 4. NA- mother not alive 5. Other	
004	Education level (completed) of the father	1. None 2. Primary (grades 1-7) 3. Secondary (grades 8-12) 4. Tertiary colleges 5. University 6. NA- father not alive or not present	fat h_ed
005	Occupation of the father	1. Salaried Employed 2. Self Employed 3. <u>Un</u>employed 4. NA- father not alive or not present 5. Other	fat h_occ
006	Number of children in the household	<input type="text"/> <input type="text"/>	no _child

Socioeconomic data continued – please circle one choice per box

007	Source of household drinking water	1. private tap 2. community tap 3. borehole 4. well 5. othery	w ater
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008	Type of toilet	1. Private indoors 2. Private outdoors 3. WC shared between several families 4. Pit latrine (private or communal) 5. Other	toilet
009	House ownership	1. Own own house 2. Rented accommodation 3. Live with relatives 4. Live with friends	own_rent

	Does your family own?		
010	car	1 Yes 0 No	car
011	Bicycle	1 Yes 0 No	bicycle
012	telephone/mobile phone	1 Yes 0 No	phone
013	refrigerator	1 Yes 0 No	fridge
014	television	1 Yes 0 No	TV
016	DSTV on television	1 Yes 0 No	DSTV

017	radio/music system	1 Yes 0 No	rad io
018	electric fan	1 Yes 0 No	fan

Feeling about yourself (Rosenberg scale)

Please indicate how strongly you agree or disagree with each statement.

	Strongly Agree	Agree	Disagree	Strongly Disagree
1. On the whole, I am satisfied with myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. At times I think I am no good at all.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I feel that I have a number of good qualities.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I am able to do things as well as most other people.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I feel I do not have much to be proud of.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I certainly feel useless at times	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. I feel that I'm a person of worth, at least on an equal plane with others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I wish I could have more respect for myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. All in all, I am inclined to feel that I am a failure.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. I take a positive attitude toward myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Subjective Happiness Scale (SHS)

For each of the following statements and/or questions, please circle the point on the scale that you feel is most appropriate in describing you.

1. In general, I consider myself:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

not a very happy person very happy

2. Compared to most of my peers, I consider myself:

1	2	3	4	5	6	7
---	---	---	---	---	---	---

less happy very happy

3. Some people are generally very happy. They enjoy life regardless of what is going on, getting the most out of everything. To what extent does this characterization describe you?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

not at all a great deal

4. Some people are generally not very happy. Although they are not depressed, they never seem as happy as they might be. To what extent does this characterization describe you?

1	2	3	4	5	6	7
---	---	---	---	---	---	---

Not at all a great deal

Tick the face that better describe your level of happiness during last year:



Herth Hope Index (HHI)

Listed below are a number of statements. Read each statement and place an [X] in the box that describes how much you agree with that statement right now.

	Strongly Agree	Agree	Disagree	Strongly Disagree
1. I have a positive outlook toward life.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I have short and/or long-range goals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I feel all alone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. I can see possibilities in the midst of difficulties	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. I have a faith that gives me comfort.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. I feel scared about my future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. I can recall happy/joyful times	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I have deep inner strength.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I am able to give and receive caring/love.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. . I have a sense of direction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. I believe that each day has potential	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. I feel my life has value and worth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Setswana version

Ditlhotlhomiso tsa itsholelo ya motho go lebeleletse dingwaga tsa gagwe, kwa a nnang teng le gore o dira eng – tswee-tswee agelela tse o ditlhopphileng mo lebokosong

b001	<i>A mme o nyetswe kana ga a nyalwa?</i>	7. Married (<i>o nyetswe</i>) 8. Widow (<i>ke motlholagadi</i>) 9. Divorced (<i>o tlhadilwe</i>) 10. Single (<i>ga a nyalwa</i>) 11. NA- mother not alive (<i>ga a mo botshelong</i>) 12. Other (<i>tse dingwe</i>)	marital <i>lenyalo</i>
b002	<i>Mme o tsene sekole go ema kae?</i>	7. None (<i>ga a tsene sekole</i>) 8. Primary (grades 1-7) (<i>dithuto tse di potlana [mophato wa ntlha (1) go ema ka wa bosupa (7)]</i>) 9. Secondary (grades 8-12) (<i>dithuto tse dikgolwane [form 1 to form 5]</i>) 10. Tertiary colleges (<i>dikole tsa ithutelo tiro</i>) 11. University (<i>mmadikole</i>) 12. NA- mother not alive (<i>mme ga a mo botshelong</i>)	moth_ed <i>thutego ya ga mme</i>
b003	<i>Tiro ya ga mme</i>	6. Salaried Employed (<i>o hirilwe</i>) 7. Self Employed (<i>o a ipereka</i>) 8. Housewife (<i>o nna mo lapeng</i>) 9. NA- mother not alive (<i>mme ga a mo botshelong</i>) 10. Other (<i>tse dingwe</i>)	moth_occ <i>tiro ya ga mme</i>
b004	<i>Rre/ntate o tsene sekole go ema kae?</i>	7. None (<i>ga a tsene sekole</i>) 8. Primary (grades 1-7) (<i>dithuto tse dipotlana [mophato wa ntlha (1) go ema ka wa bosupa (7)]</i>) 9. Secondary (grades 8-12) (<i>dithuto tse dikgolwane [form 1 to form 5]</i>) 10. Tertiary colleges (<i>dikole tsa ithutelo tiro</i>) 11. University (<i>mmadikole</i>) 12. NA- father not alive or not present (<i>rre ga a mo botshelong/ga a yo</i>)	fath_ed <i>thutego ya ga rre</i>
b005	<i>Tiro ya ga rre</i>	6. Salaried Employed (<i>o hirilwe</i>) 7. Self Employed (<i>o a ipereka</i>)	fath_occ

		8. <u>U</u> nemployed (<i>ga a bereke</i>) 9. NA- father not alive or not present (<i>rre ga a mo botshelong/ga a yo</i>) 10. Other (<i>tse dingwe</i>)	<i>tiro ya ga rre</i>
b006	<i>Palo ya bana mo lwapeng</i>	_ _ _	no_child <i>pala ya bana</i>

Socioeconomic data continued – please circle one choice per box

b007	<i>Mo lwapeng go nowa metsi a a tswang kae?</i>	6. <i>pompo ya mo lwapeng</i> 7. <i>pompo ya morafe</i> 8. <i>petse</i> 9. <i>sediba</i> 10. <i>tse dingwe</i>	<i>metsi</i>
b008	<i>Mofuta wa ntlwana ya boitiketso</i>	6. <i>ntlwana e e mo teng ga ntlo</i> 7. <i>ntlwana e e kwa ntle e sa disiwe ke batho botlhe</i> 8. <i>ntlwana e e dirisang metsi e tlhakanetswe</i> 9. <i>ntlwana ya boithomelo ya lehuti [ntlwana ya boithomelo e e sa dirisiweng ke mongwe le mongwe kana e e dirisiwang ke mongwe le mongwe]</i> 10. <i>tse dingwe</i>	<i>ntlwana/ya boitiketso</i>
b009	<i>Ntlo ke ya ga mang?</i>	5. <i>ntlo ya me</i> 6. <i>e e hirisitsweng</i> 7. <i>ke nna le masika</i> 8. <i>ke nna le ditsala)</i>	<i>ya me_ khiriso</i>

	<i>A ba lelwapa la gago ba na le?</i>		
b010	<i>koloi</i>	(ee) 1 Yes (nnyaa) 0 No	<i>koloi</i>
b011	<i>baesekele</i>	(ee) 1 Yes (nnyaa) 0 No	<i>baesekele</i>
b012	<i>mogala/mogala wa letheta</i>	(ee) 1 Yes (nnyaa) 0 No	<i>mogala</i>
b013	<i>setsidifatsi</i>	(ee) 1 Yes (nnyaa) 0 No	<i>setsidifatsi</i>
b014	<i>thelebishini</i>	(ee) 1 Yes (nnyaa) 0 No	<i>thelebishini</i>
B016	<i>DSTV mo thelebishining</i>	(ee) 1 Yes (nnyaa) 0 No	<i>DSTV</i>
b017	<i>seromamowa/seletswa</i>	(ee) 1 Yes (nnyaa) 0 No	<i>seromamowa</i>

b01 8	<i>lefetlha phefo la motlakase</i>	(ee) 1 Yes (nnyaa) 0 No	<i>lefetlha phefo</i>
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KAKANYO KA GA GAGO (SEKALE SA GA ROSENBERG)

Tswee-tswee supa gore o a dumalana kgotsa ga o dumalane mo dintlheng tse di latelang.

	<i>Ke dumalana thata</i>	<i>Ke a dumalana</i>	<i>Disagree Ga ke dumalane</i>	<i>Ga ke dumalane gotlhelete</i>
11. <i>Ka kakaretso ke a ikgotsofalela.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. <i>Nako dingwe ke akanya gore ga ke na tshiamo gotlhelele.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. <i>Ke akanya gore ke na le boleng.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. <i>Ke kgona go dira dilo jaaka batho ba bangwe ba ka di dira</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. <i>Ke akanya gore ga ke na go le gontsi mo ke ka ikgantshang ka gone.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. <i>Nako tse dingwe ke ikutlwa eketse ga ke na mosola gotlhelele.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. <i>Ke akanya gore ke motho wa tlhwatlhwa, ho o tshwanang fela le ba bangwe.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. <i>Ke eletsa e kare ke ka itlotla go feta.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. <i>Ka kakaretso ke na le kgogedi ya go akanya gore ke paletswe.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. <i>Ke iteba ka mokgwa o o eletsegana.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

SEKALE SE SE KALANG BOITUMELO JWA MOTHO (SHS)

Mo ditsetlaneng kana dipotso tse di latelang, tswee-tswee agelela ntlha mo sekaleng e o akanyang gore e maleba go go tlhalosa.

1. *Ka kakaretso ke akanya gore ke:*

1	2	3	4	5	6	7
----------	----------	----------	----------	----------	----------	----------

motho yo *o sa itumelang*

motho yo o t hata *gotlhelele*

2. *Fa ke itshwantshanya le balekane ba me, ke akanya gore:*

1	2	3	4	5	6	7
----------	----------	----------	----------	----------	----------	----------

ge ke a *ke itumetse*

ithumela thata *thata*

3. *Go na le batho ba ba nnang ba itumetse. Ba itumelela botshelo go sa kgathalesege gore go diragala eng, ba itumella sengwe le sengwe fela. Sekale se se fa tlase se go tlhalosa jang?*

1	2	3	4	5	6	7
----------	----------	----------	----------	----------	----------	----------

*ga ke itumelele
botshelo gotlhelele*

*ke itumelela
botshelo thata*

4. *Go na le batho ba ba nnang ba sa itumela. Le ntswa ba sena kgatelelo ya maikutlo,
ga ba ke ba itumela jaaka go tshwanetse. Sekale se se fa tlase se go tlhalosa jang?*

1	2	3	4	5	6	7
---	---	---	---	---	---	---

*ga ke itumelele
botshelo gotlhelele*

*ke itumelela
botshelo thata*

*Tshwaya sefatlhego se se supang botoka selekanyo sa gago sa boitumelo mo
ngwageng o o fetileng:*



Herth Hope Index (HHI)

Fa tlase go na le dintlha di le mmalwa. Di bale mme o beye [X] mo lebokosong le le supang gore o dumalana go le kae le ntlha eo gone jaana.

	<i>Ke dumalana thata</i>	<i>Ke a dumalana</i>	<i>Ga ke dumalane</i>	<i>Ga ke dumalane gotlhelele)</i>
13. <i>Ke na le tsholofelo mo botshelong.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. <i>Go na le dilo tse ke batlang go di dira mo bogautshwaneng/kana mo isagong</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. <i>Ke bolawa ke bodutu</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. <i>Ke ipona ke fenya fa gare ga mathata.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. <i>Ke na le tumelo e e nkgomotsang.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. <i>Ke utlwa ke tshosiwa ke bokamoso jwa me.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. <i>Ke na le go gakologelwa dinako tsa me tsa boitumelo</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. <i>I have deep inner strength. Ke na le thata e e tseneletseng.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. <i>Ke kgona go neela le go amogela lorato.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. <i>Ke na le ponelopele/ke itse kwa ke go yang.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. <i>Letsatsi lengwe le lengwe le na le bokgoni.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. <i>Ke akanya gore botshelo jwa me bo na le boleng le tlhwatlhwa.</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Examiner script	Reminders	
Please read this (point to passage) out loud.	Start timer	When student says first word.
If you get stuck, I will tell you the word, so you can keep reading. When I say 'Stop' I may ask you to tell me about what you read, so do your best reading.	Prompts	Student hesitates: wait 3 seconds; give correct word; mark the missed word as incorrect.
Start here (point to first word of first paragraph of passage). Ready? Begin.	Discontinue	Student does not get any words correct within the first line: discontinue ORF.

Sponges

Most people have a sponge or two in their kitchen. A sponge (12)
 is handy for washing dishes and wiping counters. Most of our (23)
 sponges are made by machines, out of wood fiber or plastic. But (35)
 before man - made sponges were invented, people used natural (44)
 sponges. (45)

A natural sponge is, in fact, an animal. It lives in the ocean. It (59)
 has no eyes or mouth. It has no organs at all. It cannot swim. It is (75)
 anchored to a rock and feeds on the bacteria in the water that flows (89)
 through it. (91)

For hundreds of years, people in the Greek islands fished for (102)
 sponges. A sponge diver dove from his boat wearing only a rope (114)
 around his waist. He carried a heavy stone, which took him quickly (126)
 to the ocean floor. He could hold his breath for three to five (139)
 minutes at a time. He used a small curved knife to cut the sponges (153)
 from the rocks. He took as many as he could before his breath ran (167)
 out, and put them in a net bag. (175)

When diving suits were invented, sponge divers began to use (185)
 them. The suits let them stay on the ocean floor longer. They could (198)
 dive deeper. They brought up more sponges than they had been (209)
 able to before. But, the divers had to be careful to avoid (221)
 decompression sickness, which could kill or injure them. (229)

Now there are very few sponge divers left. Most people use (240)
 man - made sponges, which are cheaper. Also, the number of (250)
 sponges living in the ocean has been reduced by pollution. (260)

Total words read _____ Total errors _____ Total words correct _____

Examiner script	Reminders	
<p>Please read this (point to passage) out loud.</p> <p>If you get stuck, I will tell you the word, so you can keep reading. When I say 'Stop' I may ask you to tell me about what you read, so do your best reading.</p> <p>Start here (point to first word of first paragraph of passage). Ready? Begin.</p>	Start timer	When student says first word.
	Prompts	Student hesitates: wait 3 seconds; give correct word; mark the missed word as incorrect.
	Discontinue	Student does not get any words correct within the first line: discontinue ORF.

Trees

A tree is a tall plant that is made of wood. Trees can live for many, many years. A tree has roots, a trunk, branches, and leaves. (15)

The roots are underground, but sometimes you can see them sticking out of the dirt. The roots help to keep the tree in place and they also get the food that the tree needs from the soil in the ground. The roots send the food to the trunk. The trunk is like a water pipe. It carries the food to the branches for the leaves. (27)

Some trees never lose their leaves and their leaves always stay green. These trees are called evergreen. The leaves on most other trees change colors when the seasons change. In the autumn you will see red, yellow and orange leaves. In the winter, you will see a lot of trees without any leaves at all. (37)

Leaves change colors because the tree does not get a lot of light from the sun. Trees need to save some food to live when there is not much sun and so they cannot give it all to the leaves. The leaves cannot live without the food and that is why they fall off. (52)

(66)

(80)

(92)

(102)

(113)

(124)

(137)

(147)

(159)

(173)

(188)

(201)

Total words read _____ Total errors _____ Total words correct _____

Examiner script	Reminders	
Please read this (point to passage) out loud.	Start timer	When student says first word.
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Start here (point to first word of first paragraph of passage). Ready? Begin.	Discontinue	Student does not get any words correct within the first line: discontinue ORF.

The Raft

The girl crouched barefoot on the moving raft. The boy stood silent (12)
 and pushed it along in the slow current with a long bamboo pole. (25)
 Mountains rose on all sides. The mountains were green close by, blue (37)
 far off. (39)
 Monkeys howled in the trees. Mist rose in soft waves from the river. (52)
 The boy wiped drops of rain from his face with a sleeve of his white linen (68)
 shirt. His hair was soaked, and so was the shirt. (78)
 He leaned on the bamboo pole with all of his strength. Whenever he (91)
 pushed, he let out a grunt. And each time he pushed, the boat surged forward (106)
 on the river. There was no other sound but the howling of monkeys, and rain (121)
 pattering quietly on the dark river. (127)
 The girl meantime crouched in silence, peering off into the jungle. (138)
 She was shivering. She pulled the colorful shawl tighter over her bony (150)
 shoulders. Her dark earlobes were beaded with rainwater. (158)
 The boy did not know where he was pushing this raft to on the dark, (173)
 misted river in a deep jungle under the cold and incessant rain. (185)
 The girl had an idea of where they might end up together, if only the (200)
 boy was strong and patient enough to keep on pushing the raft, but she didn't (215)
 speak even a word about it. (221)

Total words read _____ Total errors _____ Total words correct _____

Examiner script	Reminders	
Please read this (point to passage) out loud.	Start timer	When student says first word.
If you get stuck, I will tell you the word, so you can keep reading. When I say 'Stop' I may ask you to tell me about what you read, so do your best reading.	Prompts	Student hesitates: wait 3 seconds; give correct word; mark the missed word as incorrect.
Start here (point to first word of first paragraph of passage). Ready? Begin.	Discontinue	Student does not get any words correct within the first line: discontinue ORF.

Sunset at the Beach

The sun was setting now. The whole beach was empty except for a few seagulls. It was low tide and waves were rolling in slowly and breaking in long curves of surf. (13-32)

Tommy and Linda and their parents had retired to their tent after a wonderful afternoon of swimming and eating sandwiches and drinking lemonade on the beach. It had been hot that day, and they were all tired. (45-69)

They would go out on the beach again tomorrow. Their father had already promised to help the two children build a sand castle the next day. But that was tomorrow. Right now, they sat by their campfire and watched as the sun sank into the sea. (81-115)

As waves rushed up the beach they made a hissing sound on the hard, cold, wet sand. Then the waves hissed again as they withdrew, leaving trails of small bubbles behind. One after another the bubbles popped. (129-152)

It got colder as the sun sank, coloring the sea red. Some of the gulls were crying cree cree cree! Tommy shivered, grateful for the fire's heat. Linda shivered, too, but more because the seagulls sounded so sad in the quickly darkening evening. She was glad for the fire's light. (167-202)

Two small gulls with black heads and speckled bodies walked up and down nervously at the tide line where the waves were foaming and hissing. Another gull stood still and silent, just looking out at the thin evening clouds and the darkening sea. It reminded Linda of herself. (214-250)

Total words read _____ Total errors _____ Total words correct _____

