NATIONAL EDUCATION COLLABORATION TRUST

edhub

sandbox

Sandbox Research Compendium 2020

Emerging insights from the Sandbox Schools Project

The Sandbox Schools Project is a multi-year research project that seeks to explore what "education for a fast-changing world" can look like in South African public schools

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Executive Summary

Key insights from the Sandbox Schools Project 2020

The world we live in is in constant flux and has often been described as "VUCA": Volatile, Uncertain, Complex, and Ambiguous. In light of this, there is growing recognition that education systems need to evolve to better equip young people with a range of social, emotional, and cognitive competencies to enable them to succeed in an uncertain future.

With this imperative in mind, the NECT's EdHub was formed to assist the basic education sector in responding to the demands of the fast-changing world through research and advocacy. This work happens primarily through the Sandbox Schools Project, a multi-year research project that prototypes, trials, researches, and iterates interventions in 11 quintile 1-3 schools to learn about their potential for developing a range of competencies in learners and teachers. The Sandbox Project seeks to explore how we can deliberately, systematically, and demonstrably embed these "competencies for a changing world" (also called "21st Century competencies") into teaching and learning so that all South African learners are equipped for life in the 21st Century and beyond.

As the Sandbox commenced its first year of research in 2020, the COVID-19 pandemic highlighted the volatility and unpredictability of the fast-changing world and foregrounded the urgent need for education systems to better prepare learners and teachers for this reality. The events of 2020 also highlighted the importance of all components of the education ecosystem – including curriculum, the broader learning environment, the home environment, initial teacher education, and in-service professional development – coming together in support of a shared vision.

The Sandbox Schools Project was designed with these imperatives in mind and, despite disruptions experienced in 2020, the team implemented and conducted initial research on several interventions in the Sandbox Schools. Key insights from the research are presented below, with more detailed articles accompanying this summary.

Sandbox Schools Project Team

Key insights from Sandbox Research 2020

Teacher Perceptions

Baseline survey and interviews with a sample of teachers to gauge perceptions about teaching and learning in a fast-changing world
Timeframe: Jan-Feb 2020

Knowledge, Teaching, and Learning:

There is a lack of clarity among many teachers regarding definitions of knowledge, teaching, learning. Teachers have different understandings of how learning happens.

Common challenges:

Many teachers highlighted overcrowded classrooms, behavioural issues, caregiver engagement, and learners' varying abilities as common challenges they faced in the classroom.

Joy and satisfaction linked to learner outcomes and relationships:

Teachers reported feeling satisfaction when their learners grasped concepts, were actively engaged in class, and when they were happy and showed respect.

Variety of perceptions about teaching and learning in a changing world:

Teachers have many different ideas of how teaching and learning should change for today and the future. Some of these ideas include a greater emphasis on technology, the incorporation of 21st century skills, greater curriculum flexibility, fewer curriculum changes, a less managerial style of education, and a greater focus on practical skills in the curriculum.

Competency-based Learning Programme (CLP)

21st Century competency-infused structured learning programme in Grade 1 Home Language, consisting of daily lesson plans, classroom resources, quarterly training, and ongoing support
Timeframe: Jan 2020 Onwards

The programme is well-designed, practical, and relevant:

Teachers described the materials as easy to use and understand, and the training as practical and relevant to their classroom experiences.

Improvements in knowledge; challenges in implementation:

The programme appears to have improved pedagogical content knowledge related to literacy. However, teachers reported challenges implementing the programme in the classroom, despite these short-term gains.

More clarity, emphasis, and support needed relating to 21st century competencies:

Despite an increased awareness of competencies for a changing world, teachers still lack a common understanding of the importance of the competencies and how they are deliberately infused into the programme through its routines and methodologies.

School Culture

Series of participatory workshops with school leaders to co-create an environment conducive to learning in a fast-changing world

Timeframe: March 2020 Onwards

Leading a culture of learning in schools for the future requires relationship-building and community:

The pandemic highlighted the need for all school stakeholders to come together in support of a common vision for education. Principals strengthened partnerships within their schools and with external organisations in 2020 to make learning possible despite constraints.

Leaders must be lifelong learners:

Principals highlighted the need for ongoing professional development and demonstrated this practically in their commitment to learning online, co-authoring articles, and participating in research with the Sandbox team.

"Maslow before Bloom":

The pandemic highlighted the need for school leaders to view learners holistically and address multiple needs – including physical and emotional needs – beyond a narrow focus on academics.

Every voice counts:

Principals were encouraged to listen to feedback from teachers and learners in creating a culture of learning for the future at their schools. Principals also shared ideas for distributed leadership models and co-authored articles on the Sandbox blog.

Mindful Schools

COVID-response mini-intervention consisting of daily 5-10 minute mindfulness activities for teachers to facilitate with learners, in response to heightened anxiety and stress during the pandemic.

Timeframe: Aug-Nov 2020

It is possible:

Educators demonstrated and reported that they can plan and implement daily mindfulness activities with learners.

Appetite and impact:

Learners enjoyed the activities and wanted to see more activities included in their routines. Slight positive changes were reported in emotional well-being for educators and learners.

Teacher training and support needed:

Teachers have varying understandings of what mindfulness is and expressed a desire for more in-depth workshops and support materials – particularly as it is a relatively unfamiliar concept for most.

Increased variety and tailoring of mindfulness activities:

Mindfulness activities should be tailored according to the age of learners (e.g. different activities for Foundation, Intermediate, and Senior phase) and could include a broader variety of exercises than those in the original mini-intervention.

Mixed methods research design:

While feedback from the mini-intervention is promising, richer insights could be gained through a mixed methods research design in 2021.

Sandbox@Home

COVID-response mini-intervention consisting of a resource pack of home-based learning activities for families of Grade 1 learners, designed to facilitate learning during school closures through stories and play.

Timeframe: Aug-Nov 2020

Complexities of the home environment:

Home environments can vary widely even within a single school – including linguistic, cultural, socioeconomic variations – which all influence the type of learning that takes place in the home.

Multiple challenges for project team and caregivers:

The project team encountered challenges in establishing contact with caregivers and ensuring their understanding of the programme. Caregivers were juggling competing commitments and many struggled to grasp the fundamentals of the programme.

Learning through play:

Feedback suggests that many caregivers do not understand that learning can happen through play and, therefore, did not prioritise the playful learning aspects of the programme.

Simplicity:

Caregivers indicated difficulty understanding the programme's structure and intentions. This points to a need to simplify both the programme and communication strategies so that the key messages are clear, accessible, and easy to understand.

Appetite for home learning:

Most families interviewed indicated that they enjoyed the experience and would like to continue to support learning at home.

Initial Teacher Education in a fast-changing world

Sandbox-aligned studies conducted by postgraduate students at the University of Johannesburg, focussed on teacher preparation in the 21st century.

Timeframe: Jan 2020

Deliberate lesson design:

Lesson design for student teachers should explicitly articulate principles about how people learn and should outline how to deliberately infuse competencies into the teaching of content. This helps student teachers understand the learning principles underpinning their practice and helps them develop competencies in themselves and their learners. Collaborative lesson design builds competencies among student teachers.

Practice what you preach:

The design of ITE courses should also be based on principles of how people learn to enable deeper learning for transfer, and to bridge the "theory-practice divide". E.g. courses on playful learning should be based on a pedagogy of play.

Potential for coding to foster competencies in teachers and learners:

An experiment with coding classes for student teachers indicates the development of competencies like creativity, critical thinking, collaboration, and curiosity, among others.

The Sandbox Project 2020:
Ambitious plans and a pandemic

Parts of this article draw from: Gravett, S. & Eadie, S. (2021). The Sandbox project: Developing competencies for a changing world in South African schools (Chapter 10), In C. Mcnaught & S. Gravett (Eds). Embedding Social Justice in Teacher Education and Development in Africa. Routledge

After more than two years of rigorous planning, the Sandbox team was eager at the beginning of 2020 to commence implementation and research of interventions at the pilot schools – and then the pandemic intervened.

Conceptualisation of the Sandbox

The Sandbox was conceptualised as a multi-year design-based research project, consisting of a variety of interventions, set up to address the need to educate for a fast-changing world through embedding competencies for a changing world (sometimes referred to as 21st-century skills/competencies) purposefully in teaching. It aimed to set up a 'laboratory' for experimentation: a space where interventions with transformative potential in schooling are designed, trialled, and researched.

The name 'Sandbox' was one that fitted well with the approach and ethos of the project. A Sandbox is a dedicated space of free play, interaction, and exploration. However, 'play' does not imply an absence of seriousness. Play is indeed a very serious matter for children. This notion of play, which is about exploration and learning, is one that is embedded throughout the Sandbox, both in the project name as well as the approach.

The view of some is that the focus in South African education should be on getting the basics right, more specifically so in the foundation phase of schooling. The Sandbox view is that improving the so-called universal fundamental skills of our children, namely literacy and numeracy, is indeed vital. But foregrounding these does not need to preclude fostering the other competencies that children will need to negotiate an uncertain future. Competencies for a changing world should be intentionally developed in tandem with the development of foundational literacies so that no child is left behind.

The work of the Sandbox is informed by the 'Four-dimensional education framework' developed by the Centre for Curriculum Redesign (CCR). The framework breaks down educational goals into four dimensions, namely: knowledge (what we know and understand); skills (how we use knowledge – what we do with what we know); character (how we behave and engage in the world); and meta-learning (how we reflect and adapt).

We concur with the CCR view that, in teaching and learning, the four dimensions are entwined. The competencies are to be learned through and with the learning of content knowledge.

This, of course, provides a challenge: teachers must be able to teach in ways that will enable the simultaneous learning of content knowledge and competencies. Teaching practice is a pertinent focus of the Sandbox. We aim to learn about the type of teaching required for effectively combining teaching of knowledge with purposeful teaching of competencies. We are also interested in exploring the types of professional development that teachers would need to enable this kind of teaching.

Selecting the Sandbox Schools

The decision was made to implement the Sandbox Project in the Foundation Phase (Grades R-3), given the growing national focus on this phase in establishing a solid educational base for learners from a young age. Eleven schools were selected to participate in the Sandbox; ten of these schools are in peri-urban and township areas in Limpopo, with the eleventh school in Soweto – a school associated with the University of Johannesburg. The addition of this school allows for 'deep dive' research.

Sandbox interventions

Five interventions were planned for implementation and research in 2020:

Intervention	Grade	Description
Competency-based Learning Programme (CLP)	1	Competency-infused structured learning programme in Home Language, consisting of curriculum-aligned daily lesson plans, classroom resources, and training.
Example Video Lessons	R, 2, 3	Professional development intervention comprising of competency-infused designed and videoed example lessons. The intervention involves teachers in analysing the lessons and using the learnings to gradually transform their teaching practices.
Creative Coding	3	An intervention employing the graphic programming language 'Scratch' **(https://scratch.mit.edu/)** was planned to be implemented in the Soweto school only, to explore its potential to develop creativity and deepen understanding of curriculum themes.
Robotics Clubs	4-7	Extra-curricular clubs for project-based robotics & coding activities.
School Culture	School leadership	Series of catalytic, participatory workshops with school leaders aiming to understand and co-create the conditions required for an environment supportive of competency-infused teaching and learning.

Of these planned interventions, two (CLP and School Culture) were implemented in an adjusted form in 2020, along with two COVID-response mini-interventions:

Intervention	Grade	Description
Sandbox@Home	1	The classroom-based CLP was used as a basis for an intervention to support learning at home during the time of school closure. The intervention involved providing a pack of printed stories, conversation guides, daily mindfulness and reflection routines, and playful learning activities to participating households. This pack was distributed to caregivers of Grade 1 learners in Sandbox Schools.
Mindful Schools	Whole school	This intervention was a response to anticipated heightened learner and teacher anxiety during the COVID-19 infection peak. It introduced short daily mindfulness exercises as a tool for anxiety reduction during the pandemic.

2020 Experiences and 2021 Plans

Despite disruptions experienced this year, which impacted significantly on the planned activities and research, the Sandbox team implemented and conducted initial research on several interventions in 2020. These insights are shared via the articles in this compendium and a brief update on 2021 plans is shared below.

Competency-infused Learning Programme (CLP)

- Although implementation and research were disrupted in 2020, feedback from teachers suggests that the materials and initial training were helpful in developing awareness of both the literacy and competency-infusion components of the programme. More time and support are needed to translate this awareness into deeper understanding and classroom implementation
- Implementation and research of the CLP will continue in 2021
- The CLP materials are simultaneously undergoing a rigorous review process, involving inputs from experts on 21st century education, as well as local expert teachers and Sandbox School teachers. The intention of this review is to strengthen the infusion of competencies into the programme

School Culture

- The school culture programme continued virtually in 2020 with a high level of engagement from school principals. Principals co-created a working definition of school culture and have developed school-specific plans for implementation in 2021. They have also formed a learning community, and some participated in writing articles on the Sandbox Blog
- The programme will continue in 2021, with the gradual inclusion of SMT and SGB members. Principals will be supported as they implement and monitor their school-specific culture interventions

Sandbox@Home

- This intervention highlighted the complexities of the home environment and the multi-faceted challenges associated with facilitating organised learning at home. It also shed light on the need and potential for home-based learning activities, gave insight into caregivers' understandings of learning through play, and highlighted how programmes like this can be better designed to increase uptake

Mindful Schools

- Data gathered from the schools shows the high levels of anxiety experienced during the pandemic. Schools' experiences and feedback on the mini-intervention suggest that there is interest in, and potential for, a more structured intervention of this nature going forward
- This intervention is under consideration for implementation in 2021, in an evolved format based on feedback from 2020

Initial Teacher Education

- Given school closures, and the resultant inability to conduct data collection, many of the postgraduate students who had planned to conduct research on the Sandbox interventions pivoted their studies to focus on initial teacher education instead, with a focus on preparing teachers for a fast-changing world. Though these studies do not form part of the Sandbox, they are Sandbox-aligned
- The studies cover the following topics: Lesson design for a fast-changing world, Pedagogy of Play, Creative Coding, and Infusing robotics in lessons design

Robotics & Coding

- The EdHub is in discussions with the DBE and other collaborators on the possible introduction of a Robotics & Coding intervention at the Sandbox Schools in 2021, in support of the new Robotics & Coding curriculum.

Learning through Play

- The Sandbox is collaborating with the DBE's Entrepreneurship, Employability, Education (E3) initiative to co-create and research a play-based project at the Sandbox Schools in 2021.

Teacher perceptions about teaching and learning in a fast-changing world

The Sandbox Schools Project aims to explore what teaching and learning for a changing world could look like in South African public schools, and what steps we could take to get there. As such, much of the project involves working directly with teachers to support them in deliberately incorporating competencies for a changing world into their teaching, and collaborating with them to improve the various interventions introduced at schools.

As part of this work, we conducted baseline interviews and surveys with a sample of teachers in 2020 to gain insight into their perceptions about teaching and learning, before they engaged with any of the structured interventions. Interviews were conducted with nine Foundation Phase teachers from two Sandbox Schools in Limpopo and one in Soweto, which is affiliated to the University of Johannesburg's Faculty of Childhood Education (COVID-related school closures affected our ability to conduct interviews with the remaining five teachers from the sample). The questions focussed on teachers' perceptions of knowledge, learning, and teaching, and they also asked teachers to consider if and how teaching should change in today's world. The interviews were recorded and transcribed and, where they were not conducted in English, they were subsequently translated into English. Surveys were also conducted with 104 teachers from all 11 Sandbox schools. The survey included both open-ended questions and closed questions in the form of a Likert questionnaire. We discuss below some emerging themes from analysis of teachers' responses to the three open-ended questions and the interview questions.

Given that knowledge about a certain topic does not necessarily translate into practice, our intention was for these initial interviews and surveys to be followed by regular classroom observations, which would allow us to explore the relationship between teachers' perceptions and their teaching practice. Because of the lockdown and COVID-19 safety regulations at schools, this was not possible in 2020, but these initial insights are helpful for understanding more about the teachers we are working with at the Sandbox Schools and provide a platform for further exploration through observations and conversations in 2021.

Emerging themes and insights

Many different themes emerged from the conversations with teachers and responses to the open-ended survey questions, a few of which are highlighted and discussed briefly below.

Blurred lines between knowledge, teaching, and learning

Since teachers facilitate learning almost every day, it is easy to assume that they share a comprehensive understanding of how people learn, what knowledge is, and how to teach effectively. Insights from these conversations indicate, however, that this is not always the case and that teachers sometimes conflate definitions of knowledge, teaching, and learning. This can be seen in some of the quotations below:

I think knowledge, it's for me to say I know something, so it involves my ability to listen and to listen in a way that will make me able to relay the message, to convey, like to pass it on, to pass on what I've learnt. (Gr 2 teacher, Gauteng)

...Learning is to share your knowledge with the learners. (Gr 1 teacher, Limpopo)

I can say that [learning is] how a learner encode or listens and understand how do you deliver a lesson. (Gr 3 teacher, Gauteng)

Differences in perceptions of teaching

Teachers also seemed to have different perceptions of how knowledge is acquired, and of the teaching process. Some teachers, for example, placed emphasis on the role of the teacher as 'imparting new knowledge' to the learner:

I think teaching is where a person gives another person knowledge, information [...] When a person imparts to another knowledge, and information (Gr R teacher, Limpopo)

[Teaching] is to guide. Meaning the learner comes here to school for the first time not knowing anything. I must teach him, I must guide. (Gr 2 teacher, Limpopo)

Others conceived of the process slightly differently, describing how a teacher engages with the prior knowledge of the learner, correcting misconceptions and introducing new concepts:

Teaching is about [...] delivering. You deliver, you get the pre-knowledge, you add on that pre-knowledge, and you engage with learners. You allow them to make mistakes, and you do the corrections. After they have done the mistakes. (Gr 3 teacher, Gauteng)

You want to know how far do they know. Because of a child is not an empty tin, or just a white paper [...] So I believe that each and every child has a knowledge and knows something. When the child comes to school, the child comes with a pre-knowledge.
(Gr 3 teacher, Gauteng)

Challenges

Teachers highlighted some of the following challenges about their profession:

Overcrowded classrooms

Without exception across all schools, and irrespective of grade taught or teaching experience, the majority of teachers raised the issue of overcrowding. Large classes with diverse learners were said to make it difficult to provide individual assistance.

Classroom management and discipline

Some teachers mentioned that they struggled to maintain control in their classes and deal with disruptive behaviour effectively. In some cases, this was also linked to the challenge of large class sizes and the consequent inability to provide individual attention to learners who require it. This was mentioned by teachers across all Limpopo schools.

Differentiating instruction for learners' different abilities

Teachers described the challenge of teaching a class of learners with a wide range of abilities and needs. This includes providing adequate support to learners who are struggling, while continuing to manage and teach the rest of the class.

Parental engagement and relationship

A number of teachers highlighted problematic relationships with learners' caregivers as a challenge. While some teachers – especially those in the Limpopo schools – spoke of a lack of engagement from parents (e.g. not attending meetings or responding to communication from the school), others in the Gauteng school highlighted different challenges, such as parents refusing to accept that their learner may need additional support, or parents completing their children's homework instead of guiding the child to complete it themselves.

Learners' lack of preparedness for school

Many teachers from the Limpopo schools stated that learners are often not school- or grade-ready, or they are underage. This issue of unpreparedness was not raised by the teachers at the school in Gauteng, although the sample size was small.

Curriculum challenges

Some teachers expressed frustration at the pace and inflexibility of the curriculum, describing the challenge of sticking to the prescribed timetable for curriculum coverage even when they felt learners had not yet mastered content.

Teacher satisfaction linked to learners' understanding and positive relationships

When asked what brought them joy or satisfaction as a teacher, most teachers spoke about learners grasping concepts and/or enjoying themselves in class. Teacher satisfaction was clearly linked to outcomes at the learner level, conceived of both in academic terms (e.g. demonstrations of conceptual understanding or performance in assessments) and in terms of classroom dynamics or social-emotional outcomes (e.g. seeing learners enjoying themselves and being "happy").

> *One thing that gives me satisfaction is seeing my learners grasping the content that I'm teaching and when they engage with the concept and ja, when they participate. (Gr 2 teacher, Gauteng)*

Given the challenges that the teachers cited, it is unsurprising that the opposite thereof is what brings teachers joy and satisfaction, namely "when they [learners] respect me", "having enough resources", and "having managable [sic] class(ratio)". Respect included learners paying attention, participating in class activities, and following the teacher's instructions.

Variety of perceptions about teaching for a changing world

Teachers were asked the question, "The Sandbox is about teaching and learning in and for a changing world. In what way do you think teaching should change (if at all)?" While a variety of different themes emerged from responses to this question, a key theme was policy issues.

Some teachers were so disillusioned with the current curriculum and their experiences of teaching that they spoke about going back to older ways of teaching. A less managerial style of education was sought, so that teachers could focus on teaching rather than on administrative work. Teachers also wanted fewer curriculum changes, and a less prescriptive curriculum. Teachers in the Gauteng school stressed the importance of the curriculum being suitable for the "needs of an African learner", with teachers being involved in curriculum design for this purpose.

Other key themes

- **Increased use of digital technology to enhance teaching and learning:** This was a common response among teachers. Comments generally focussed on the need for children to acquire digital literacy, and for the increased use of digital gadgets (e.g. smartboards, laptops) in the classroom.
- **Broader "21st Century skills":** This idea was mentioned by a few teachers, who described the importance of developing social, emotional, and cognitive competencies like critical thinking and collaboration to prepare learners for the future.
- **Increased relevance of the curriculum:** Some teachers spoke of the need for content to be contextually relevant for South African learners, while also developing their global and intercultural understanding by introducing them to different cultures.
- **Flexibility of the curriculum:** One teacher described the current curriculum as "prescriptive" and others also suggested that the curriculum needs to become more flexible to allow teachers to innovate and add to it.
- **Focus on practical skills:** Education should be extended to impart not only theory but also more practical skills, such as building a house, running a business, and other life skills to enhance learners' employability upon leaving school. It should also incorporate real world objects with which learners are familiar, and arts and crafts studies.

Looking ahead

These initial interviews and survey responses give some insight into the variety of perceptions around teaching and learning, as well as commonalities in some of the challenges articulated by teachers and the conflation of concepts like knowledge, teaching, and learning. These insights will be further analysed, in combination with responses to the Likert questionnaire items, to form a baseline for the interventions being introduced at the Sandbox Schools. We will continue to track teachers' perceptions of teaching and learning in a fast-changing world throughout the implementation of these interventions over the next few years.

Infusing competencies into Foundation Phase literacy education: Insights from the Competency-based Learning Programme

In the context of what some have termed a "reading crisis" in South African basic education (Spaull and Pretorius, 2019, p.8), the Sandbox Schools Project seeks to understand how we can deliberately and systematically infuse social, emotional, and cognitive competencies into the teaching of foundational literacy skills. Our view is that these two imperatives – building foundational skills and developing competencies for the fast-changing world – can work in tandem and complement one another, towards the vision of equipping all learners in South Africa to successfully navigate life in the 21st century.

As part of our work to understand how this could happen in practice, the Sandbox team designed and launched the Competency-based Learning Programme (CLP) intervention for Grade 1 Home Language in 2020. The key competencies that the CLP seeks to inculcate include critical thinking, collaboration, mindfulness, ethics, growth mindset, and meta-cognition.

A bridge between present and future

The CLP seeks to bridge the gap between where the system currently is and where we believe it could be, in terms of competency development in the classroom. Drawing on research about changes in teachers' behaviour and attitudes over time (Guskey, 1986), the programme embeds specific competencies into a structured, CAPS-aligned tool that many public school teachers are relatively familiar with (structured learning programmes – SLPs), thereby providing teachers with the necessary scaffolding to deliberately infuse these competencies into their teaching.

SLPs have experienced positive results in recent years as an approach to improving classroom practice and learner outcomes (Department of Basic Education, 2017; Fleish et al., 2016). The CLP incorporates these evidence-based literacy methodologies, with the addition of deliberate routines, methodologies, and themes to support the development of selected competencies: critical thinking, collaboration, mindfulness, ethics, growth mindset, and meta-cognition.

The programme consists of materials for teachers – including a book of themed stories per term, detailed lesson plans, and supporting classroom resources – and quarterly training on how to implement the methodologies. It is based on a weekly routine, shown in Figure 1 below, which highlights the components that are unique to the Sandbox CLP:

Figure 1: CLP Weekly Routine

Monday		Tuesday		Wednesday		Thursday		Friday	
Morning Mindfulness	5	Morning Mindfulness	5	Morning Mindfulness	5	Morning Mindfulness		Morning Mindfulness	5
Goal setting	15								
Oral Activities	15			Oral Activities	15			Oral Activities	15
		Phonics	15	Phonics	15	Phonics	15	Phonics	15
Handwriting	15	Handwriting	15	Handwriting	15				
Shared Reading: Pre-read Problem Identification and Solving	15	Shared Reading: Read 1	15			Shared Reading: Read 2/ Formulating Questions	15	Shared Reading: Post-Read	15
Writing	30			Writing	30				
Group Guided Reading	15	Group Guided Reading	15	Group Guided Reading	15	Group Guided Reading	15	Group Guided Reading	15
Group Guided Reading	15	Group Guided Reading	15	Group Guided Reading	15	Group Guided Reading	15	Group Guided Reading	15
End of day Reflection	5	End of day Reflection	5	End of day Reflection	5	End of day Reflection	5	End of week Goal Review and Reflection	15
1h45min		**1h15min**		**1h45min**		**1h**		**1h15min**	

2020 Experiences

The CLP was implemented in the 11 Sandbox Schools in 2020, with 48 Grade 1 teachers and Foundation Phase Departmental Heads, and four Curriculum Advisors. Due to the disruptions experienced this year, the first CLP training took place in Term 1 and did not take place again for the remainder of the year. While virtual training was considered as an alternative, we opted not to pursue this option for the following reasons:

- Most teachers in the Sandbox Schools do not have access to a personal laptop and facilitating virtual sessions with a handful of shared devices was logistically difficult

- Teachers were participating in an above-average number of virtual workshops from the District, related to the revised Annual Teaching Plans (ATPs). Conducting an additional CLP training risked overwhelming teachers and duplicating efforts.

Therefore, teachers continued to receive the CLP materials throughout 2020, but taught lessons according to the revised ATPs, as part of the DBE's Education Recovery Plan, and worked with a rotational timetable whereby learners attended school between one and three times per week.

CLP research activities were also disrupted, and we were unable to conduct much of the planned data collection, including classroom observations and interviews with teachers. We did, however, conduct two surveys and gather informal verbal feedback to understand teachers' experiences of the initial CLP training and materials, which give us some insight into what teachers thought about the programme and some of their challenges.

Emerging themes and insights

Practical training programme and materials

Teachers' feedback indicated that one of the most useful aspects of the training programme was that they were shown how to use the materials and apply them in practice: *"The workshop was useful because it was practical"* (Grade 1 teacher)

Respondents also indicated that the training and materials had real-world applicability to their lived practices of teaching. This feedback aligns with the responses to closed questions in Figures 2 and 3 below, in which all respondents agreed that the content and training were organised, easy to follow, helpful, relevant, and well-facilitated.

Figure 2: Responses to Term 1 post-training survey (n=37)

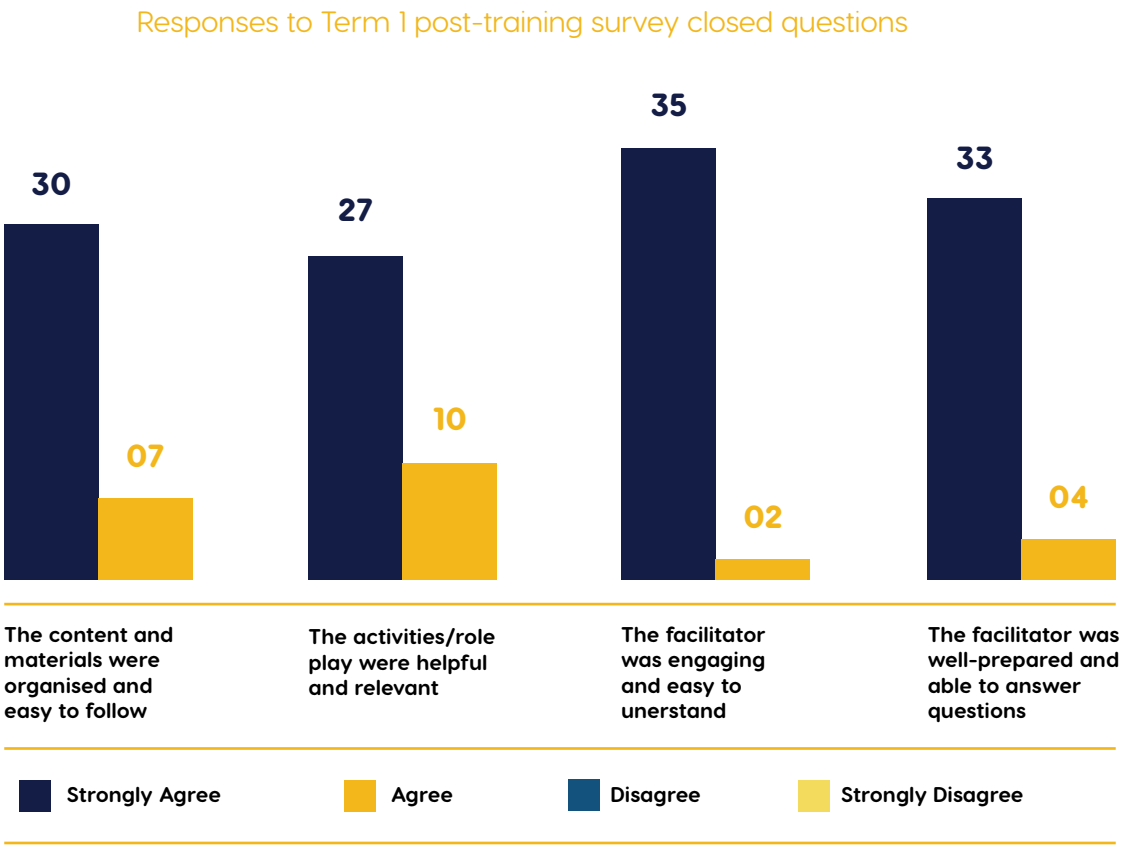
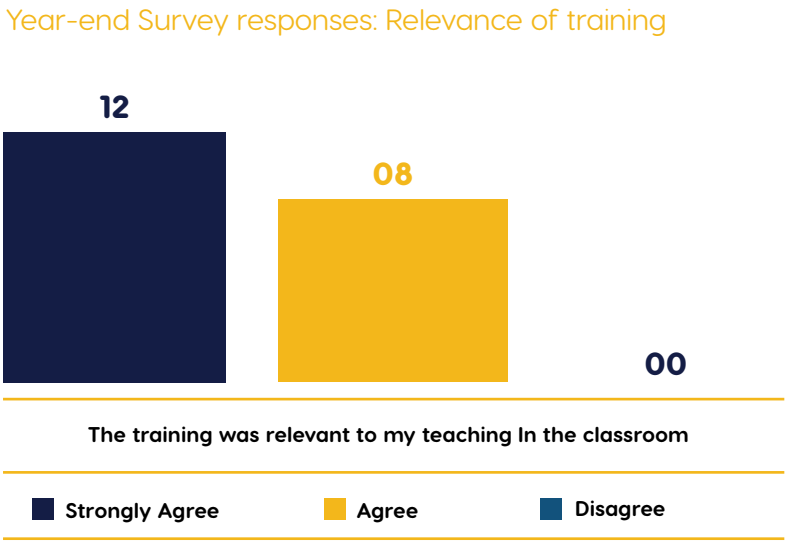


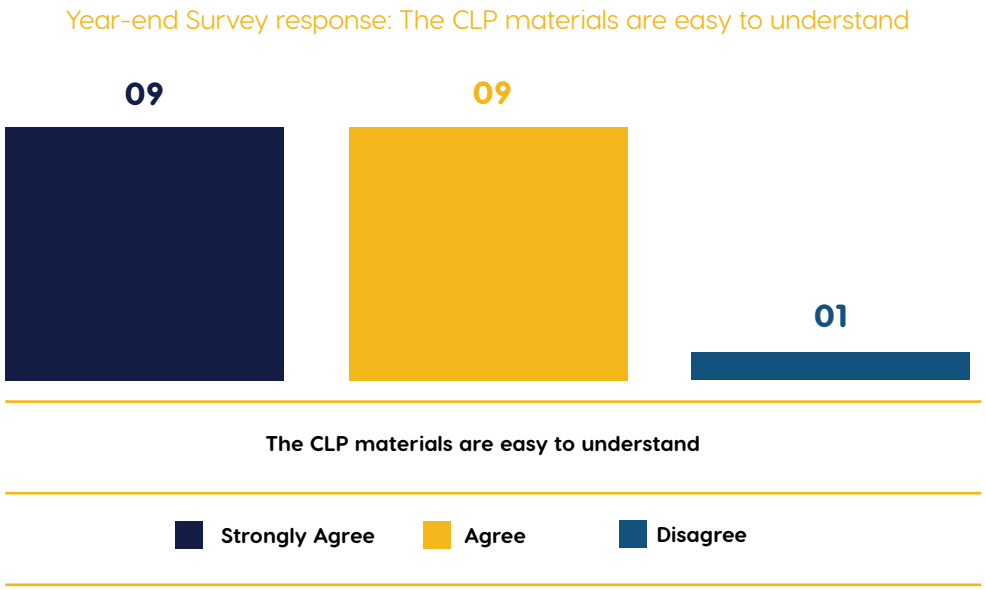
Figure 3: Responses to year-end survey questions on CLP training (n=20)



Simplification of teaching and 'user-friendly' materials

Another theme was the appropriate pitch of the materials for teachers, and what one teacher called their "user-friendly" design, which enabled teachers to navigate and understand the materials relatively easily. Three teachers mentioned that this usability helped to "[make] teaching simple" for them.

Figure 4: Responses to year-end survey questions on CLP materials (n=20)

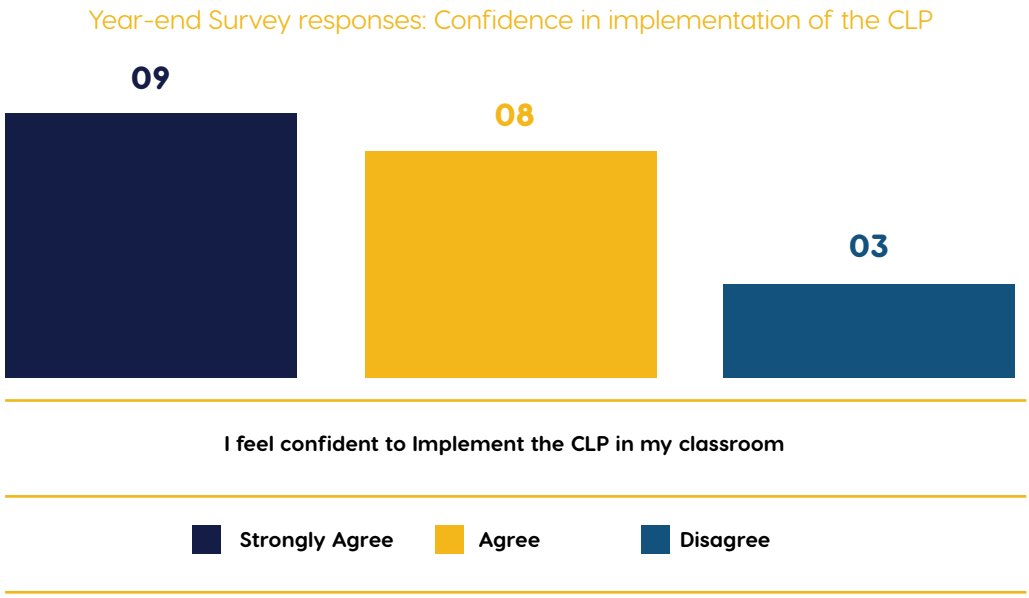


Implementation challenges

Experience with other structured learning programmes has shown that, while teachers appreciate the high-quality training sessions and are often motivated to implement the programme afterwards, they encounter challenges in the classroom that can discourage them. Although most respondents to the year-end survey indicated that they feel confident to implement the CLP (see Figure 5 below), they articulated challenges around implementation in the open questions and informal verbal feedback. These challenges included:

- Materials (e.g. shared reading stories) being too difficult or long for learners to cope with, resulting in slower learners falling behind, or in time for teaching of other subjects being eroded; and
- Individual activities being unsuitable for Grade 1 learners as they are considered unable to work independently yet or unable to complete certain tasks.

Figure 5: Responses to year-end survey questions on CLP implementation (n=20)



This feedback aligns with experiences documented through other structured learning programmes globally (Piper & Dubeck, 2021) and locally, which speak to the challenges teachers encounter in mastering the routines and methodologies, understanding the cyclical nature of the programme, managing time, and managing classroom dynamics in large classes.

Focus on reading

When asked what was most helpful about the programme in both the first and second survey, one common theme was the improvement of teachers' pedagogical content knowledge – i.e. knowledge of teaching strategies for Home Language literacy, especially in the area of reading.

Particular mention was made of group-guided reading, which is one of the more complex and challenging components of the Home Language weekly routine (Cilliers et al, 2020). Informal feedback from teachers suggests, however, that many of these strategies remain a challenge to implement despite their improved knowledge of the pedagogical practices.

Competency-development

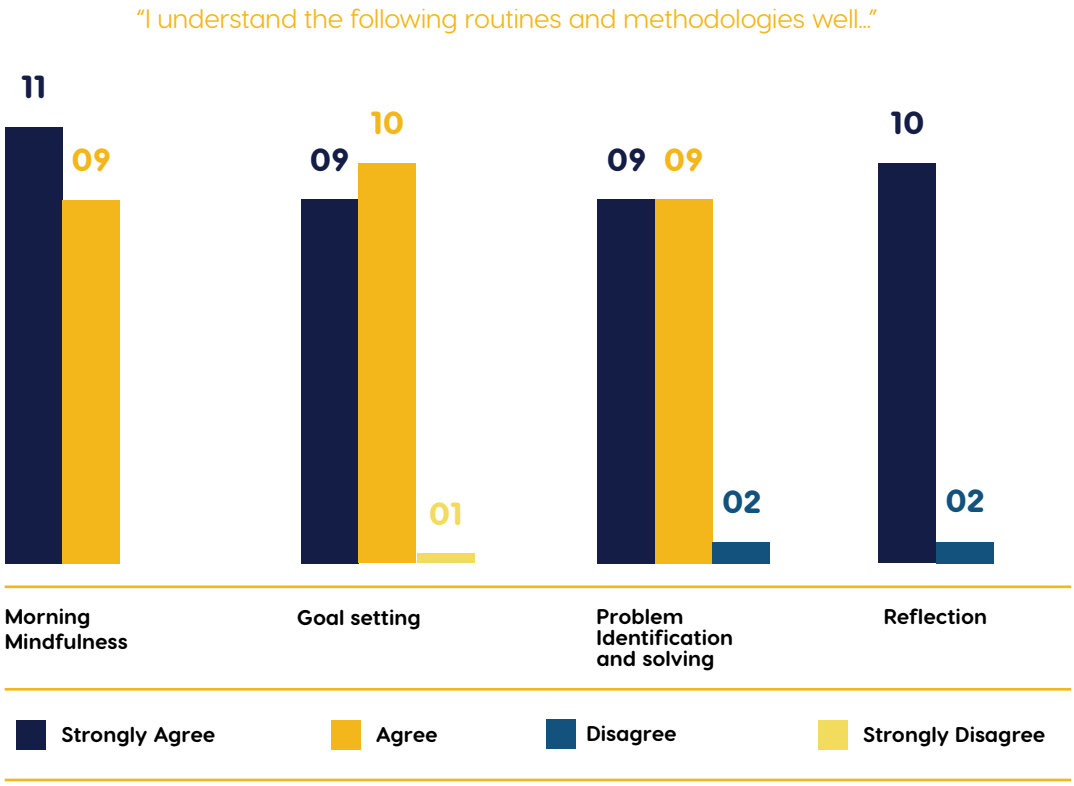
Baseline conversations and surveys of Foundation Phase teachers across the Sandbox Schools indicated a wide variety of perspectives about how teaching and learning should change in the 21st century. Some teachers mentioned competencies for a changing world, but the majority did not, which indicates a lack of awareness and consensus about these competencies before the introduction of the CLP.

The Sandbox Schools indicated a wide variety of perspectives about how **teaching and learning should change in the 21st century**

From responses to the CLP survey's open-ended question, "What did you find useful about this training workshop?", gains appear to have been made in awareness of and general pedagogical knowledge related to these competencies, as some teachers mentioned appreciating the mindfulness, reflection, and problem-solving activities. However, only a handful of teachers from the Gauteng school mentioned intending to use this knowledge in the classroom, which indicates that the awareness was not necessarily translated into practice for most teachers.

Similarly, in responses to the second survey's closed questions, teachers reported a transfer of knowledge regarding methodologies like morning mindfulness (see Figure 6 below). Despite these indications, however, these competences were mentioned only once in the second survey's open-ended questions, and this was in the form of a negative comment: the respondent regarded the morning mindfulness activities as unhelpful.

Figure 6: Responses to year-end survey questions on methodologies related to competency-development (n=20)



What can we learn from 2020?

Some initial insights from this preliminary feedback include:

- The programme is helpful for teachers insofar as the materials are easy to understand and the training is practical and relevant to their classroom experience
- The programme appears to have been most successful in increasing pedagogical content knowledge in the content areas of reading and phonics
- Despite apparent gains in pedagogical content knowledge, teachers still seem to face implementation challenges in the classroom, with most citing the complexity and/or length of the stories and learner activities as the main issue
- While there seems to be a growing awareness of competencies among teachers, there is a lack of clarity in understanding what the specific competencies are and how to incorporate them into teaching practice.

When building on these insights, it is important to remember both the context in which the Sandbox project is being implemented – i.e. Quintile 1-3 schools in peri-urban and township areas – as well as the fact that the CLP was not implemented as planned, including a drastic reduction in the training dosage for 2020. Participating teachers, like most South African Foundation Phase teachers, were probably underperforming in terms of equipping learners with the foundational skills of reading and writing. This makes the adoption of the CLPs even more challenging: as well as learning, understanding, and implementing a literacy programme, these teachers had the additional challenge of dealing with competencies in an explicit way. The expected change in behaviours and practice is thus relatively large, and it will likely take place over years of implementation with consistent training, mentoring, and the recognition of improvements in learning over time.

The Sandbox team plans to conduct deeper research on the CLP and its implementation in 2021, which will enable us to gain a richer understanding of teachers' experiences, and further insight into how we can improve the programme. We are also currently undergoing a critical review of the CLP in collaboration with the Center for Curriculum Redesign (CCR), a group of local expert teachers, and teachers from the Sandbox Schools with the intention of strengthening the programme. We look forward to developing a deeper understanding over the next few years of the CLP's potential as a bridge to the future we want.

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Evolving school culture to respond to the fast-changing world: Initiating Culture of Learning Conversations with School Leaders

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According to Peter Senge, a learning organisation is one that is continually expanding its capacity to create its future. Years of research and practice confirm that cultivating a learning culture requires deliberate leadership intervention to devise a co-created learning architecture with and for all education stakeholders, making learning central to all activities and decision-making at schools. In other words, learning must form part of the school's DNA: ever-present, ever-felt, and permeating all experiences and relationships that exist in the school. The school culture stream in the Sandbox Project began with the seeding of leadership conversations through participatory research in 2020. To create an environment that catalyses innovation towards skills development for a constantly changing world, the leaders of the Sandbox Schools had to be invited into a space of knowledge creation in service to learning and its recipient – the learner.

A participatory research design

Participatory research, closely linked to the design-based research approach adopted across the Sandbox interventions, comprises a range of methodological approaches with the objective of handing "power" over the research process from the research team (the Sandbox team, Prof Kat Yassim, and her PhD students) to the research participants (the Sandbox School principals). In this way, the school principals were empowered to participate and not only direct the inquiry process, but also find actionable solutions that should follow good research. In designing the facilitation process with the school principals, a Systems Theory approach was later embedded within a Theory of Constraints, which was deemed appropriate given the disruption caused by the COVID-19 pandemic. The Theory of Constraints advocates for three processes: (1) learning to learn; (2) learning to think; and (3) learning to lead.

Initial plans discussed by the UJ and Sandbox teams had to be re-innovated towards redirecting the site-based research data collection process to an online participatory process, guided by the research team from afar. Three virtual workshops and one visit to schools were possible in 2020, laying the groundwork of creating a leadership professional learning community and then working towards creating a personalised transformation agenda for each school in 2021. This signals a move away from a "one-size-fits-all" mentality that has been pervasive in the South African transformation agenda.

Three virtual workshops and one visit to schools **were possible in 2020**

What follows is a short discussion of the various milestones that were achieved in 2020. Through a visual participatory process, principals were invited into the Sandbox on 'playdates' that inducted them into the three processes mentioned above: learning to learn; learning to think; and learning to lead.

Learning to learn

In this phase of the engagement, principals participated in a metaphor drawing and a collage design exercise in which they grappled with co-creating a definition of a "culture of learning" which, according Smirich (1985), is elusive and difficult to describe. In response to the prompt, "Draw what a culture of learning is to you", principals created metaphor drawings. These drawings revealed three themes that provided insights into what a culture of learning meant to them and how this looked, felt, and was experienced at their respective schools:

- **Relationships**: People, community, and relationship-building (based on a distributed leadership model) emerged as a major theme. Relationships are the basis of a living systems theory approach to school as an organisational process. Such an approach can be seen in the Sandbox school principals' description of what is integral to creating a learning culture in their respective contexts.

- **Vision co-creation:** Another theme that emerged was that of anchoring teaching and learning through a co-created vision and mission through which creativity, innovation, and learning goals are supported

- **Adaptability:** The third theme involved cultivating cycles of processes that evolve as needs, conditions, and technologies change.

Collectively, these three themes resulted in a co-created definition of "culture of learning" that forms the bedrock of the programme. For the Sandbox School principals, a learning culture is defined as:

"A living system of relationships – a way of being – built by every member of the school community, including the learner, so that the core of teaching and learning supports the changing goals of education and capitalises on every resource available (digital or otherwise) that makes schools in any context conducive spaces for innovation in, of, and from learning."

Second, the collage exercise required school principals to reflect on their own learning agility. It was Alvin Toffler who wrote in Future Shock that "the illiterate of the 21st century will not be those who cannot read and write but those who cannot learn, unlearn, and relearn." Here, principals felt that adopting a learning mindset and the principle of lifelong learning were important for their own growth and development overall. In other words, to lead learning requires principals to be prepared and willing to learn themselves, but also to open spaces for others to learn. In this regard, the concept of "small principals" or "shadow principals" are ways in which some of the principals enable their staff to share leadership ("to walk in the shoes of the principal"). While this assists the principal to distribute the leadership, it also means that the perspectives of younger early-career teachers can be considered during decision-making. This is particularly pertinent as the inclusion of technology increasingly becomes an imperative that cannot be ignored.

Learning to think

In learning to think, principals led a photovoice research process at their individual schools in which various stakeholders were invited to take photographs around the school that visually showed a culture of learning, and to reflect on these images in a voice note recording. Since one of the outcomes of photovoice is a social change process, principals learned how to capture stakeholder voices that could provide the evidence leaders need for how the current culture needs to be changed to enhance and support learning, based on the contextual realities that learners and teachers face.

Through this exercise, the necessity of a "Maslow before Bloom" orientation was highlighted. Learner wellbeing (physical and emotional) needed to be at the forefront of supporting learning. The disruption of the COVID-19 pandemic meant that learners' needs in terms of hunger, poverty, and trauma had to be dealt with outside of regular school time and space. Learner profiling was one measure that some schools instituted, that enabled school staff and leaders to support the more vulnerable learners. In addition, in most schools, feeding schemes were modified to provide "take-away" meals and the most vulnerable learners were identified so that teachers could personally follow up on their wellbeing and intervene if necessary. Parent and community volunteers were invited, once schools were reopened, to support the COVID-19 protocols. These volunteers supported teachers to ensure learner safety and to ensure that learners attended schools.

In addition, the rotational model meant that the school programme needed to be redesigned, with learners having to engage with self-directed learning. In this regard, many learners found learning at home a challenge as parents could not support them, and their home environments were not conducive to learning. Through the photovoice exercise, processes were put into place to support these learners to mitigate undue accrued learning losses. In some schools, an after-school programme for these learners was instituted as a possible solution, while in other cases educated unemployed community members were deployed to support such learners.

Learning to lead

The idea that "it takes a village to raise a child" was a strong theme in this phase of leading a culture of learning. All the Sandbox principles agreed that relationship building is at the heart of leadership. Learning to lead a culture of learning means that "every voice counts" is a mechanism for decision-making. In developing their leadership during the pandemic, principals sought to strengthen relationships that affect the lives of every learner. In this regard, "love" centralised as the biggest learning for these school leaders. This includes a recognition that learning cannot happen without love and consideration of how to love when it is difficult to, how to love dissenting voices, and how to love when that is all you have to give.

Conclusion

In this regard, Suerken provides an overview of the journey 2020 when she says, "[The theory of constraints] enables people to think for themselves, to solve their own problems and to use the knowledge that they have acquired with the implementation of simple and effective solutions in their everyday lives." Looking ahead in 2021, we will continue working with the Sandbox principals, together with their School Management Teams (SMTs), to design, implement, and research school-specific interventions, with the aim of contributing to our knowledge about how quintile 1-3 schools can foster a culture of learning in a fast-changing world.

Exploring the Applicability of Mindfulness in Schools

What kind of education do we need in an era of disruption and continuous change to prepare learners to flourish in times of uncertainty? Research suggests that education systems that cultivate social-emotional competencies and mindful presence in learners may be what the world needs to prepare children to withstand adversity and positively respond to challenges in a fast-changing world (Lantieri, Nambiar, Harnett, & Kyse, 2016).

The COVID-19 pandemic has created an unprecedented disruption to education systems globally and within South Africa's borders. Given the pressures experienced by learners and school staff as a result of the pandemic, resilient systems need to be built to reimagine teaching and learning (United Nations, 2020). With this imperative in mind, the Sandbox team decided to introduce the 'Mindful Schools' mini-intervention alongside other, more long-term interventions in the Sandbox Schools, to explore how to cultivate social-emotional competencies and mindful presence through daily mindfulness practice. The Sandbox Schools are 11 quintile 1-3 primary schools in Limpopo and Gauteng that have volunteered to be part of this multi-year research project. The Mindful Schools mini-intervention was conceptualised as a short-term response to anticipated feelings of anxiety and stress among teachers and learners upon their return to school, which coincided with the peak of the first wave of the pandemic in South Africa. Insights from this short exploration will guide the design of more long-term future interventions related to mindfulness practice.

The fundamental principles of mindfulness

Mindfulness – defined as paying attention in the present moment with a calm, focused, and clear mind – is both a practice and a state of mind. Mindfulness practice teaches us to manage our attention and, in turn, to manage our thoughts, altering our perception of reality. Through mindfulness, we attempt to control our minds instead of our minds controlling us, and we observe what we are thinking and feeling. The ability to control our minds enables us to perceive the world, our emotions, and other people without fight-or-flight, knee-jerk reactions, and to have better emotional resilience (Zeidan, 2015).

The benefits of mindfulness practice have also been demonstrated in school contexts. For example, the Mindfulness in Schools Project in the UK found that integrating mindfulness practice into the school day trains learners' brains to be better equipped to learn and enhances emotional regulation (MiSP, 2021). Important to the South African context, social-emotional development in school benefits all children, but it disproportionately benefits children from low-income communities. Many of these children experience higher levels of adversity and trauma resulting from insecure access to housing, food, health care and safety (Franke, 2014). These external influences can place our bodies under undue stress or high alert, which interferes with growth and learning. Teaching children the skills they need to identify and manage emotions, and to self-regulate, along with addressing physical, mental and emotional needs, can guard against these negative effects (Center on the Developing Child at Harvard University, 2016).

The Mindful Schools mini-intervention

Mindful Schools was a 12-week programme that began at the end of August 2020 and ended in November 2020. Every second week, the teachers received two mindfulness practice activities to facilitate in their classrooms daily. The activities were five to ten minutes long, and included:

01 **Seated meditation exercises:** Learners sit in an upright position with their eyes closed, and direct attention to their breathing.

02 **Body scan exercises:** This exercise draws attention to feelings and sensations in all parts of the body, bringing awareness to how each part feels.

03 **Three-minute breathing space:** Teachers interrupt normal patterns of thinking and behaviour by asking questions such as "Where am I?" and "What am I thinking?". Learners then focus on their breathing and move their awareness to how their bodies feel.

Teachers and principals were also encouraged to practice mindfulness during their staff meetings as well as in peer-to-peer engagements. Research shows that an educator is more likely to teach mindfulness practice effectively if they themselves have experienced mindfulness (Roeser, 2016).

Situating the intervention: The first questionnaire

Before the intervention, a questionnaire was administered to understand the research educators' and learners' state of mind before exposing them to daily mindfulness practice. In total, 83 participants across the eleven schools took part in the initial survey. Principals comprised 13% of the sample, while teachers comprised the remaining 77%.

Self-perceived anxiety

The results displayed in table 1 show educators' description of how they felt when arriving at school. It shows that 19% of principals and teachers felt anxious when arriving at school and that 46% – representing approximately two-thirds of the sample – indicated that they were worried.

Table 1: Educators' feelings when arriving at school

Thinking back to the last week or so of school, which of the following best describes how you felt when you arrived at school in the mornings?						
	Anxious	Worried	Okay	Good	Excellent	Total
Percent	19.3	45.8	15.7	15.7	3.6	100.0

These feeling of anxiety and worry were not surprising, given that this was at a time where COVID infections had peaked. This assumption was validated further by most participants indicating that they were worried about contracting COVID when travelling to school.

Feedback from learners showed that, overall, they reported feeling less anxious or worried than their teachers and principals. Of the 59 learner responses, 27% indicated that they were either sad or worried when arriving at school, with 40% indicating that they were happy when they arrived at school.

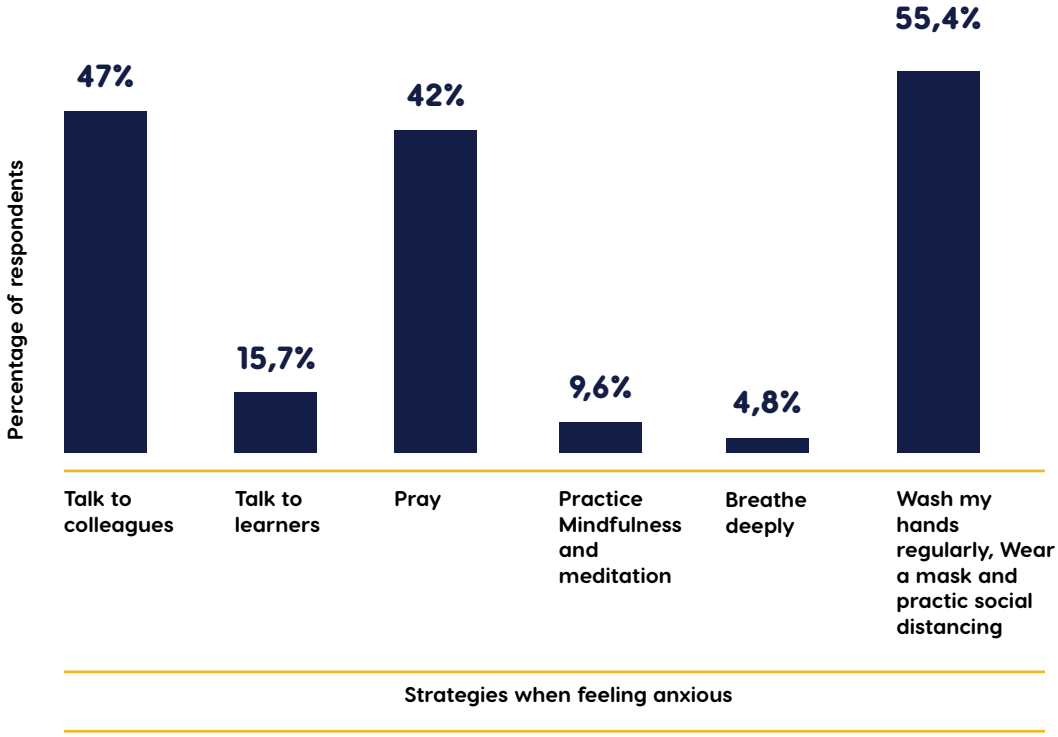
46% of educators indicated that they were worried when they arrived at school

40% of learners indicated that they were happy when they arrived at school

Dealing with anxiety and worry

Figure 1 shows that most educator participants indicated several strategies to cope with anxiety. They stated that they either talked to **colleagues (47%), prayed (42%), washed their hands regularly, wore a mask, or practiced social distancing (55%).**

Figure 1: Teachers' strategies when feeling anxious



Findings after implementation

The Sandbox team distributed a follow-up survey questionnaire to participating schools in the middle of November 2020. Unfortunately, due to the baseline's nature and purpose, the end line and the baseline results could not be compared. A total of 108 principals and teachers and 53 learners completed the questionnaire provided.

There was a minor decrease in learners feeling worried or sad after mindfulness exercises. The data also show a substantial increase in learners feeling happy after the activities.

Educators

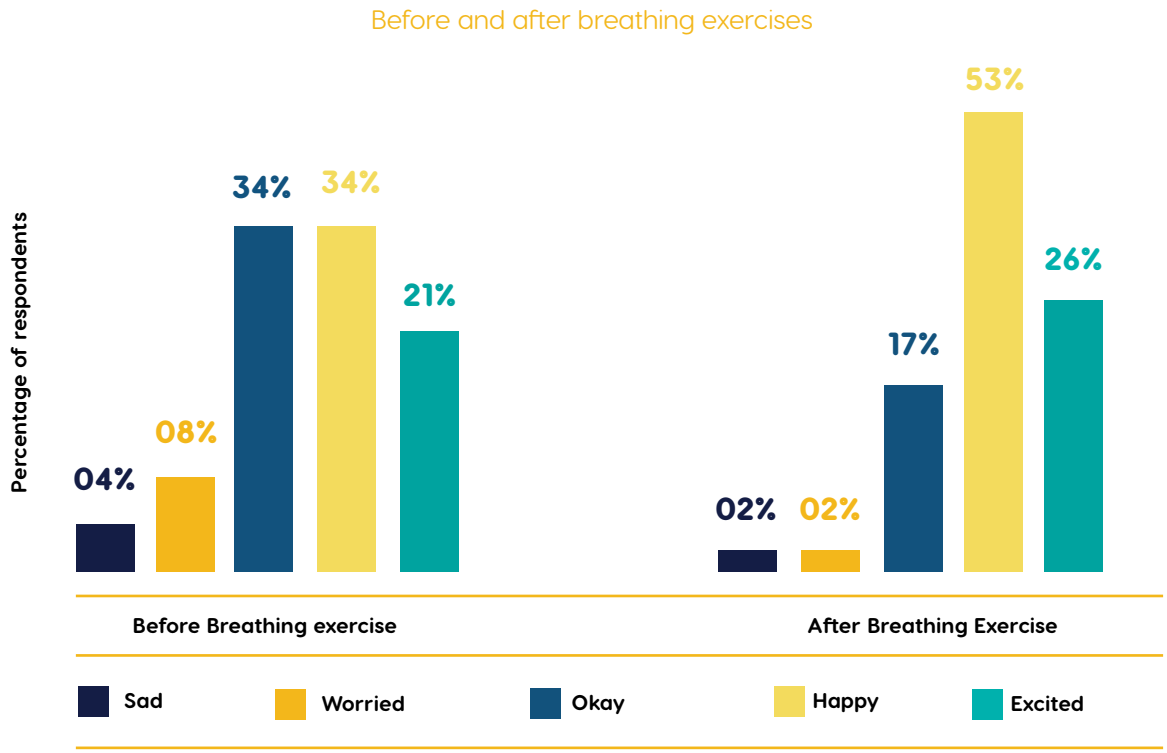
The principals and teachers seem to have varying understandings of what mindfulness is. While it appears that incorporating the activities into their daily routine and implementing the activities is possible for the teachers, careful thought is needed on how to manage the implementation.

The participants were also asked whether any other factors stopped them from undertaking mindfulness activities. There were varied responses to this question, including learners not being attentive, too often bored, and having difficulty concentrating. Feedback from the learners, however, indicates that most seemed to enjoy the activities and would like to participate in more activities of this nature.

Learners

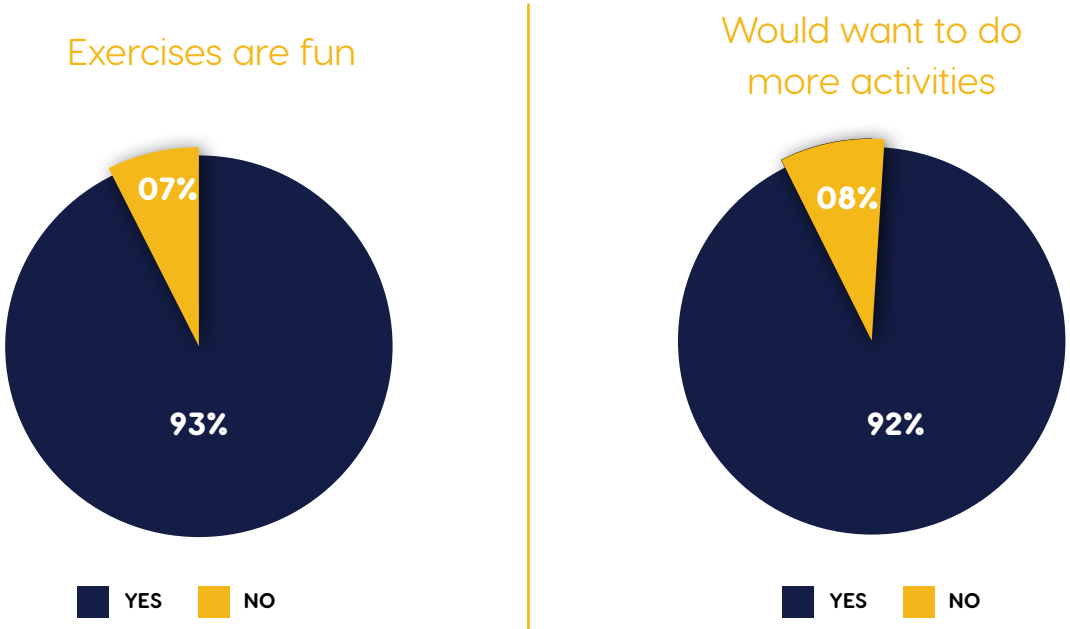
In general, learners reported feeling more positive emotions and fewer negative emotions after their mindfulness practice 'breathing exercises'. Figure 2 highlights the learners' feelings before and after the mindfulness practice activities. There was a **minor decrease in learners feeling worried (8% to 2%) or sad (4% to 2%) after mindfulness exercises.** The graph also shows a **substantial increase in learners feeling happy after the activities (34% to 53%).**

Figure 2: Learners' feelings before and after mindful practice exercises



On the whole, learners found the exercises enjoyable. The vast majority indicated that they thought the **breathing/mindfulness activities were fun (93%) and that they would want to do more mindfulness activities (92%).**

Figure 3: Learners' attitude towards mindful practice exercises



Conclusion and way forward

The Sandbox team gathered several learnings from designing and implementing the Mindful Schools mini-intervention:

01 Teachers need more upfront engagement on what mindfulness is and how to implement the activities in their daily routines. Participants in the project could also have follow-up meetings to troubleshoot any challenges and develop a community of practice.

02 Training manuals for participants to refer to may provide additional support and improve implementation standards across school contexts.

03 The mindfulness activities should be broadened to ensure age-appropriate activities are being used. This would mean a tailored intervention for the phases (foundation, intermediate and senior phase).

04 Going forward, a mixed-methods research design is suggested . Not only can progress be monitored quantitatively, but many contextual issues can be elucidated through the qualitative component.

05 Further desk research is underway to learn from successful school-based mindfulness programmes in other countries.

06 Finally, the intervention could be linked to other projects within the NECT to ensure that a common goal is reached in which academic and socio-emotional learning are both prioritised.

It is envisaged that these learnings, based on the pilot and research conducted, will support a more consistent approach to mindfulness practice at schools. Hence, it is expected that the benefits of mindfulness will be enhanced as mindfulness would be one effort for teachers to use to assist vulnerable children in coping with the many challenges they encounter daily.

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Learning at home through stories and play:
Insights from the Sandbox@Home COVID-response intervention

As national lockdowns and school closures affected millions of children around the world in 2020, there was increased spotlight on remote learning strategies. In South Africa, school closures resulted in most children missing around 40% of the school year, excluding additional days spent at home because of rotational timetabling once schools had officially reopened (Mohohlwane et al., 2020). In this context, the Sandbox Schools Project introduced a mini-intervention to explore organised learning in the home environment over a three-month period. The intention of this initial exploration was to contribute to the growing body of research on the topic of remote learning in the foundation phase of schooling, especially in resource-constrained environments.

In South Africa, school closures resulted in most children **missing around 40% of the school year**

Intervention design

The Sandbox@Home mini-intervention was conceptualised as a response to the disruption of formal schooling, which most severely affected learners without access to digital technologies. The intervention therefore consists of printed materials, designed to support caregivers - or others in the household - to facilitate learning at home with Grade 1 learners. These materials are an extension of the Grade 1 Home Language Competency-based Learning Programme (CLP), which learners would have been exposed to in class had schooling proceeded without disruption in Term 2. The Sandbox@Home resource pack was developed in three languages: Sepedi and Setswana Home Language for the ten schools in Limpopo, and English Home Language for the school in Soweto. The pack consists of:

- **Learning guideline:** Short outline of recommendations for caregivers on how to set up an environment conducive to learning, how to support learning, how to develop confidence, and how to establish a healthy learning routine
- **Story book:** CLP Big Book of stories (printed in A5). The book contains ten illustrated stories that have been locally developed to foster literacy skills and broader social, emotional, and cognitive competencies. They are designed to be read aloud to learners and they include questions to prompt deeper thinking and conversation about the story.
- **Activity guide:** Set of weekly activities related to each story, including:
  - **Mindfulness exercise**
  - **Conversation guide**
  - **Playful learning activity**
  - **Reflection question**

Implementation and research

These packs were delivered to the 11 Sandbox Schools in August 2020 and distributed by the schools to families of Grade 1 learners. The Sandbox schools are quintile 1-3 public schools in peri-urban and township areas that volunteered to participate in this multi-year research project. Ten of the schools are in the Waterberg District of Limpopo and one is a research school in Soweto, affiliated to the University of Johannesburg.

Once packs were distributed to households, caregivers were given the option to volunteer as a "research family" and participate in weekly telephonic interviews to discuss their experience of the intervention. **In total, 49 semi-structured telephonic interviews were held between mid-September and mid-November 2020 with 17 households**. Some of the interviews were held with only the caregiver, while others included the learner. Due to high attrition, some interviews were held in only one or two of the weeks, while others were held each week over a 4-week period. In all, 33 caregiver and 16 Grade 1 learner interviews were conducted to determine the caregivers' and learners' perspectives of the programme. The interviews were recorded and transcribed and, where they were not conducted in English, they were subsequently translated into English.

33 caregiver and 16 Grade 1 learner interviews were conducted

Emerging themes and insights

The following themes and insights emerged from an initial analysis of the interviews held with caregivers and learners.

Deviation from the envisaged use of materials

One of the most significant deviations from the planned programme was a common misconception that learners were supposed to read the stories independently, whereas the stories are designed to be read to the learner and discussed. This misconception was addressed during interviews with the research families, but it is likely that many other households outside of the research sample continued with the practice or abandoned the programme altogether because the materials were too difficult for learners to read independently.

In addition, most caregivers followed only part of the instruction guidelines, with one or two doing the mindfulness and play activities and none appearing to have done the reflection activities. Caregivers gave numerous reasons for not doing the activities, including that they had not progressed that far or did not know about them, that learners preferred to do their own activities, or that activities could not be done outside.

One caregiver who did the play activity for the first story seemed to have difficulties in understanding the play activities for story 3:

> *I do not understand how this spoon must be held in the hand because as soon as I place it in the hand, there is no need for it to fall. He will walk and end up where she is going without the spoon falling. So I do not understand how this spoon should be held in the hand or placed in the hand. (Caregiver, Limpopo)*

Conversely, a caregiver who had done the play activities for story 3 which she said the learner enjoyed, had not read the story:

> *We were doing our play activities... No, we were not able to read the book. She was doing other school activities about words. She had to write some words. (Caregiver, Limpopo)*

In a follow-up interview, the same caregiver said:

> *When it comes to play activities, I found that they get energised because they will go on playing. It is not the same as when you make her read. It becomes a bit difficult when it is just the matter of reading.*

This statement could indicate that the caregiver may not associate learning with play.

Many caregivers also did not use the conversation guide in the activity pack, but instead used the questions in the story book itself as a means of discussing the story with the learner. Since all these activities came in a separate document to the story book, it is perhaps an indication that caregivers prefer to use one document rather than navigating multiple resources, which can add complexity. Feedback from the interviews also suggests that the purpose and design of the mindfulness, play, and reflection activities were not fully understood by some caregivers. This indicates that instead of, or in addition to, providing written instructions, future iterations should explore providing video tutorials or conducting telephonic discussions with caregivers to clarify exactly what needs to be done and to explain the aims of the programme.

Positive responses and reported success among those who followed programme more accurately

Caregivers who followed at least some of the guidelines seemed to have had better success with the programme than those who did not, and were enthusiastic about the programme's positive impact on learners. For example, caregivers who mistakenly required the learners to read found that the learners had difficulties:

> *I made her read, but she was all over the place. (Caregiver, Limpopo)*

A learner echoed this difficulty:

> *The book is hard. It is like a Grade 2 book. (Grade 1 learner, Limpopo)*

In contrast, caregivers who generally followed the guidelines believed that the children were learning from and enjoying the programme. This can be seen in their descriptions of the shared reading process and conversations, which indicate learner engagement and enthusiasm, and suggest that learners internalised the main messages of the stories:

> *Looking at her, she looks extremely interested in these stories... we have since ended up with Story number 2...But she still remembers them. She is still talking about them. (Caregiver, Limpopo)*

> *He does ask questions. When I ask him questions, he reads the book again and again and asks me for more questions to explain.... The way I see, he is learning something from the stories. You can see that as a child, he enjoys these stories...when he is playing and does not remember the things he read, he comes back to me to tell me and then we read again and he tells me that he does not remember [...] When I ask about what then, he tells me... His mother told me about him that [name of learner] tells her the things him and I read about. It means that he grasp the material. (Caregiver, Limpopo)*

Learning 'life skills' through the stories

Regarding what learners appeared to have learned through the activities, this can best be summed up by what one caregiver referred to as "life skills". Caregivers considered that the stories resonated with learners' lived experiences and taught them moral lessons:

> *He learns about children at play, he knows how I must play with other children, he does explain all of that when you ask him. (Caregiver, Limpopo)*

Interviews with learners also demonstrated that they could, on the whole, answer interviewer's questions about the stories, and that their learnings tied in with the caregivers' findings. Specifically, learners had learnt about friendships. For example:

What did you like about the story?

> *I loved when Karabo shared his crayons... And I also share my crayons with my friend too.*

What did you learn from the story?

> *You must help the friend; you must share things when they don't have what you have. (Grade 1 learner, Limpopo)*

The feedback suggests that the stories resonated with the lived experiences of the learners, and that it is important for reading materials for the early grades to include stories that are contextually relevant for learners.

Caregivers saw the benefit of the programme and expressed a desire to continue even once schools had reopened

Most caregivers interviewed expressed appreciation for the programme and a desire to continue with it. They spoke about the programme's educational value and mentioned other benefits like providing entertainment (bed-time stories), keeping learners off the streets, promoting enthusiasm for reading, and encouraging caregivers to be more involved with children's learning.

While some caregivers found it difficult to balance homework and their own work with the programme once learners were back at school, most caregivers said that learners were not at school all the time and they therefore believed that the programme would continue to be beneficial as it could be applied when the learners were not in school and did not have homework.

Reflections on themes

- There are a number of challenges involved in successfully implementing remote learning in resource constrained environments, including:
  - **Establishing regular contact with families**
  - **Ensuring effective communication of the programme and its objectives**
  - **Navigating competing family and work demands**
  - **Working around linguistic barriers, such as children speaking a different language at home to the one they are learning at school.**
- Feedback indicates that more work should be done to engage with caregivers on the importance of learning through play, especially for learners in the Foundation Phase of schooling.
- Despite these challenges, the feedback indicates that those caregivers who followed the programme more closely indicated positive outcomes for themselves and for learners. These outcomes include learner engagement and enthusiasm, love for reading, increased 'life skills', improved patience and understanding among caregivers, and improved relationships between caregivers and learners.
- Most caregivers indicated that they would like the programme to continue despite schools reopening, given that learners did not attend school every day. While this enthusiasm may be attributed to the abnormal circumstances in which we find ourselves due to the COVID-19 pandemic, it does suggest that caregivers are interested in supporting their children's learning and can be supported to do so.

Experiences and insights gained from this short intervention have highlighted the complexities and potential of learning in the home environment. Although there are no current plans to implement a similar intervention at the Sandbox Schools in 2021, these insights contribute to developing a richer picture of remote learning possibilities in South Africa.

References

Mohohlwane, N., Taylor, S. and Shepherd, D. (2020). COVID-19 and basic education: Evaluating the initial impact of the return to schooling. National Income Dynamics Study (NIDS) – Coronavirus Rapid Mobile Survey (CRAM) Wave 2 Report.

Broader contributions
to education for a fast-changing world

In addition to the interventions being trialled and researched in the Sandbox Schools, the EdHub contributes to the growing conversation around education for a changing world by convening a variety of education stakeholders, hosting dialogues, and publishing outputs in the public sphere. In 2020, this work included hosting three webinars, strengthening local and international partnerships, contributing to a book chapter, and being mentioned in a number of opinion pieces written by members of the University of Johannesburg's Faculty of Education.

Convening conversations: Dialogues and webinars

Curriculum in a fast-changing world Seminar, 21 August:

Using the pandemic as a springboard for conversation, this seminar revolved around the question, ***How can the current urgent need for curriculum trimming and learning catch-up be approached to ensure that learners are equipped with the required knowledge, skills, and competencies during and after the pandemic, whilst gearing the curriculum for long-term future relevance?***

The seminar brought together local and international curriculum experts and policymakers to discuss how the COVID-19 pandemic could be used as an opportunity for more long-term strategic planning around curriculum for a fast-changing world. It was facilitated by Professor John Volmink, who has played a key role in the development and evolution of the South African curriculum over many decades. **Speakers included:**

- **Professor Sarah Gravett,** Executive Dean of Education, University of Johannesburg
- **Charles Fadel**, Founder and CEO, Center for Curriculum Redesign
- **Haroon Mahomed,** Chief Director: Curriculum Development and Teacher Development, Western Cape Education Department
- **Seliki Tlhabane**, Chief Director: Maths, Science and Technology (MST) and Curriculum Enhancement Programmes, Department of Basic Education.
- **Professor Anil Kanjee**, Research Professor and coordinator of Postgraduate and Research Programme, Tshwane University of Technology.

As a follow-on from this seminar, and building on work done by the EdHub in relation to competencies for a changing world, the EdHub was invited by the DBE to form part of a task team mandated with the medium-term modernisation of the South African basic education curriculum, in line with the demands of the changing world.

Emerging insights on Remote Learning, 1 September:

This webinar convened a broad range of stakeholders to explore local and international examples of remote learning, particularly in light of the ongoing COVID-19 pandemic. The event was the first in a series called "Rethinking where and how learning happens", which aimed to challenge thinking and broaden horizons in the education sector around what learning should look like in a fast-changing world, both during and beyond the pandemic.

The webinar provided a platform for panellists involved in remote learning to share their experiences and emerging insights, and to participate in a discussion on potential applications in the South African context. The event was facilitated by Dr Shafika Isaacs, a digital learning expert with a focus on promoting equity and inclusion through the use of technology in education.

Panellists included:

- **Haroon Mahomed,** Chief Director for Curriculum Development and Teacher Development at the Western Cape Education Department, who shared insights from the WCED's @homelearning initiative for rural and vulnerable learners during lockdown
- **Professor Mitchel Resnick and Rupal Jain** from the Lifelong Kindergarten research group at the MIT Media Lab, who spoke about facilitating creative learning remotely through projects and a wide variety of technologies
- **Melanie Smuts** from Axium Education, who shared how they are successfully implementing remote learning through WhatsApp classrooms in the rural Eastern Cape
- **Robert Paddock,** Founder and CEO of the Valenture Institute, a global private online high school, who shared insights from the perspective of an entirely online school
- **Leo Burd and Carolina Rodeghiero** from the Brazilian Creative Learning Network, who shared their experiences of facilitating creative learning remotely with teachers, parents, and learners in Brazil

Creative Learning, at Home or at School, 22 October:

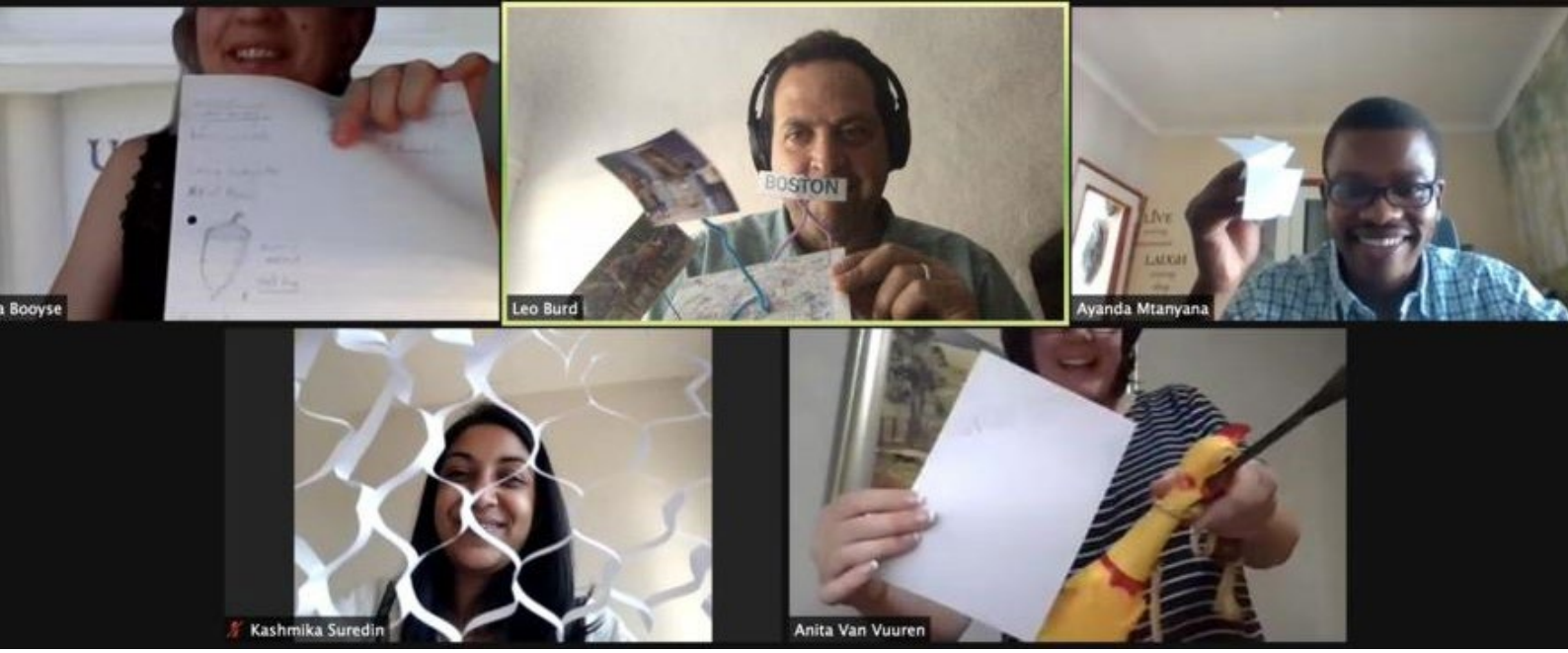
This event was the second webinar in the "Rethinking where and how learning happens" series. It aimed to engage participants in a hands-on experience of creative learning and explore three key questions:

- **What is Creative Learning?**
- **Why is it important?**
- **How can we implement it, at home or at school, in the South African context?**

The EdHub co-hosted this webinar with the Lifelong Kindergarten research group at MIT Media Lab, as part of an ongoing collaboration on research related to education for a fast-changing world. Lifelong Kindergarten's founder, Professor Mitchel Resnick, started off the event by exploring what creative learning is and why it is increasingly important in our volatile, uncertain, and complex world. He introduced a framework for facilitating creative learning, which centres around 4 Ps: Projects, Passion, Peers, and Play. As part of the interactive nature of the webinar, participants were then invited into breakout rooms to reflect on a memorable learning experience and re-create or represent the experience using materials around them. The event ended with a panel discussion, centred around how we can practically implement creative learning in South Africa. Panellists included:

- **Linford Molaodi,** lecturer at the University of Johannesburg, who spoke about his work on creative coding with student teachers at UJ;
- **Brent Hutcheson,** Director of Care for Education, who shared insights from his experiences with tinkering and play-based learning in low-income settings; and
- **Nthato Moagi,** founder of CRSP dsgn, who spoke about his experience of piloting a low-cost educational robotics toolkit in local primary schools.

The **Panel discussion** was inspiring and practical, with **many participants voicing appreciation** for the insights and advice from the panellists



Celebrating learning collaborations and partnerships

The Sandbox team continues to grow a network of local and international collaborators, who are all interested in the topic of "education for a fast-changing world". These partnerships and collaborations have strengthened the project over the past year, and we look forward to continuing the journey of mutual learning:

- **University of Johannesburg Faculty of Education**
- **Center for Curriculum Redesign**
- **Lifelong Kindergarten research group, MIT Media Lab**
- **CRSP dsgn**
- **Entrepreneurship, Employability, Education (E3) initiative, DBE**

In the media:

A number of opinion pieces have been written by faculty members of the University of Johannesburg Faculty of Education, relating to work conducted in the Sandbox Schools. These opinion pieces have been published in the mainstream media and play an important role in contributing to the growing momentum around transforming education for the demands of the fast-changing world.

Professor Sarah Gravett:

Industry 4.0 is being taken seriously, Mail & Guardian, 18 Jan 2019 — Click Here

Prune curricula to promote new learning, Mail & Guardian, 8 Nov 2019: — Click Here

A search for the meaning behind Motshekga's words, Mail & Guardian, 2 Sept 2020: — Click Here

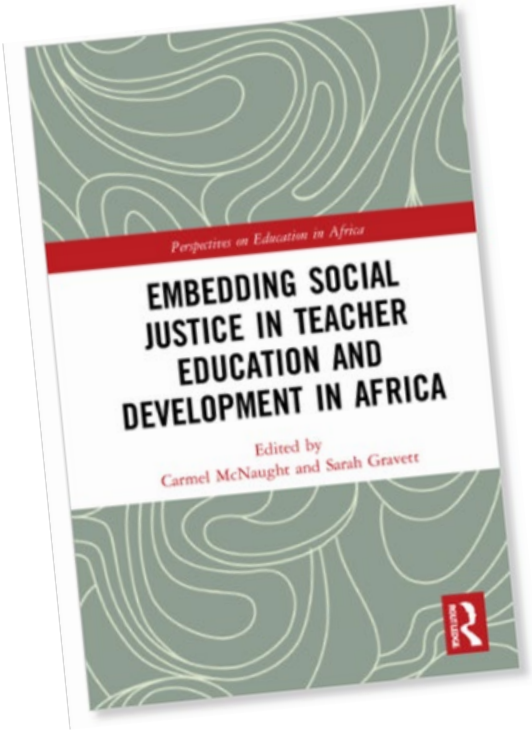
Professor Kathija Yassim:

Theory of Constraints brings benefits, Mail & Guardian, 6 Dec 2020: Click Here

An experiment in what school could be, Mail & Guardian, 17 Jan 2021: Click Here

Sandbox book chapter

The Sandbox team has recently published its first chapter in the Routledge book, Embedding Social Justice in Teacher Education and Development in Africa, edited by Carmel McNaught and Sarah Gravett. The article, written by Shirley Eadie (NECT) and Sarah Gravett (UJ), is entitled "The Sandbox project: Developing competencies for a changing world in South African schools" and it describes the rationale, objectives, and design of the Sandbox Project.



The book explores social-justice issues facing teacher education and development in Africa, using both theoretical and empirical perspectives. It considers the need for teacher education in Africa to be transformational and address both conventional pedagogy as well as the rights and duties of all citizens.

Click Here

Initial teacher education and competencies for a changing world

Dean van der Merwe, René Lang, and Professor Sarah Gravett, University of Johannesburg Faculty of Education

In 2019, **Sarah Gravett made the case for a curriculum that is structured around core concepts and essential content and for infusing so-called "21st century competencies" (also known as "competencies for a changing world") across the school curriculum**. She highlighted the importance of literacy and numeracy as fundamental skills and asserted that concentrating on these does not need to preclude nurturing other competencies that children would need to negotiate an uncertain and fast-changing world. In fact, learners may acquire fundamental skills more effectively in an education environment that nurtures for example, the 4Cs – critical thinking, communication, collaboration, and creativity.

In another 2019 article, **she wrote about reimagining initial teacher education for an increasingly complex and fast-changing world.** She contended that teacher education institutions should create programmes that will help pre-service teachers to be versatile and adaptive, no matter how the world and school curricula may change. She noted the importance of deliberately teaching 21st century literacies, namely digital literacy, information literacy and data literacy. She also suggested that teaching with Information and Communication Technology (ICT) should be a focus and that pre-service teachers should not only learn how to teach with technology, but that they should experience this type of teaching themselves.

More recently, **she wrote about the essence of teacher education programmes for student teachers to succeed as teachers across their career lifespan**. She proposed that pre-service teachers should be prepared, first and foremost, to become learning specialists. The question, however, is what teacher education institutions like the University of Johannesburg (UJ) are doing to produce teachers who have learning expertise and who are able to infuse competencies for a fast-changing world in their teaching.

Lesson design for a fast-changing world

This year, we piloted a course with final year Bachelor of Education student teachers at UJ's Soweto campus that aimed to do this. The course focused on the design of lessons that are informed by principles derived from the science of learning literature, in tandem with infusing the 4Cs and the notion of metacognition in lesson design. The latter draws mainly on the work of the Center for Curriculum Redesign: **https://curriculumredesign.org/**

The student teachers were introduced to a new lesson design template, which was different to the one they used in the first three years of their four-year Bachelor of Education programme. The lesson design template required them to explicitly state which science of learning principles and competencies had been invoked in their lessons, and how.

The course was presented remotely due to the COVID-19 pandemic. The coursework included readings, PowerPoint presentations, videos, case studies, and so forth, and it was made available on the learning management system (Blackboard). Student teachers engaged with the course content guided by learning tasks that they had to respond to, coupled with online discussions and small group reflection sessions.

In the lessons that the student teachers designed, they had to explain how the 4Cs and metacognition had been infused deliberately and demonstrably. This required them to think carefully about how the teaching of competencies could be embedded in the teaching of content.

In small group reflection sessions, the pre-service teachers shared and discussed ideas on the lesson they were designing with their peers and the teacher educator, who provided supportive and actionable feedback. Through this, they were learning the art of weaving the chosen competencies into lesson design. The dynamic process at play enabled deliberative practice and rehearsal.

In the lessons that the student teachers designed, they had to explain how the 4Cs and metacognition had been **infused deliberately and demonstrably.**

Initial insights

We monitored the implementation of the course consistently. We also analysed the lessons that the student teachers designed and interviewed some of them about their lessons, which led to the following initial insights:

- **Deeper understanding of learning and increased confidence:** The student teachers reported that they found the lesson design approach relevant in relation to what they would need to succeed as teachers, when entering the teaching profession in 2021 and in the future. They expressed a sense of confidence stemming from the understanding that they acquired of how learning occurs and how to use this understanding to guide and support learning – in classrooms and virtually. Student teachers also reported gaining knowledge of how learning can be optimised through the purposeful application of competencies such as critical thinking, creativity, collaboration, and communication.

- **Development of students' own competencies:** Requiring pre-service teachers to design lessons that aim to develop the 4Cs and metacognitive awareness, coupled with using science of learning principles, meant that they also had to employ these competencies. The student teachers noted the value of this. Teachers must be able to communicate clearly. They must able to be able to facilitate classroom conversation in a lesson to focus learner attention and elicit cognitive engagement. They must be able to communicate feedback effectively to learners in order to affirm or redirect learning. The student teachers also said that they learned the importance of working collaboratively with learners instead of "lecturing" them. Furthermore, the lesson design process necessitated critical thinking. For example, when faced with the decision of how and why to teach the content of a lesson in a particular way, they had to think critically about choice of content and teaching techniques in relation to the aim and objectives of the lesson and the learning principles invoked. They also had to think creatively about how to infuse the competencies in a lesson.

- **Greater understanding of how to deliberately infuse competencies into teaching:** The lessons showed that the student teachers had been gaining an understanding of the 4Cs and metacognition, and were also more aware of how to infuse these in the design of lessons. During an interview about a lesson, one student said: "In every section critical thinking, collaboration and communication was infused. So for example critical thinking was in the introduction was triggered when learners had to think for themselves what it meant to be a hero, and then they had to re-evaluate their answer after they watched the video. And then collaboration, that happened throughout when learners had to speak to their shoulder partners and discuss with their shoulder partners as well as when they were playing the game, because they had to collaborate to make the game work, otherwise it wouldn't have worked, if the entire class did not play the game. And the communication as well, that was during the discussions, all the learners were part of the discussions and spoke to the teacher as well as throughout the game – it was a communication game you had to talk to make the game work."

- **Improved digital literacy:** The course was designed as a contact course with elements of online engagement. When the Covid-19 lockdown occurred, all teaching had to be done remotely. The move to remote emergency online teaching presented an unplanned-for additional opportunity to develop competencies and literacies for a fast-changing world. The student teachers' digital literacy improved considerably. They also learned how to design lessons for digital teaching. The move to emergency remote teaching meant that students had to plan lessons which could be delivered in a digital format and they had to teach the lessons remotely. Thus, the student teachers experienced teaching that uses digital technology while learning how to teach with technology

The pilot course opened the door to introduce competencies for a fast-changing world to pre-service teachers. In general, we observed thoughtful, reasoned, and creative lessons and the student teachers' feedback was positive in terms of what they gained. Next year, a similar course will be offered, using what we learned this year to strengthen the course.

Dean van der Merwe is a lecturer and Rene Lang is a part-time lecturer in the Department of Childhood Education, University of Johannesburg. Sarah Gravett is a professor of education and the Dean of Education at UJ.

Learning through guided play: A course for pre-service teachers

Lerato Ndabezitha, Professor Sarah Gravett & Professor Nadine Petersen, University of Johannesburg Faculty of Education

A recent New York Times **article** quotes Lisa Feigenson, a professor of psychological and brain sciences at Johns Hopkins University. She says play may be "evolution's way of building in an insurance policy" to learn and develop. "It's so enjoyable that most kids can't resist, and along the way they develop the skills they need to succeed as adults." The skills that they need to succeed as adults will, of course, also serve them well in navigating their lives as children and youth in a world where many children face hardships.

Similarly, a 2014 Forbes article heading states: **"Why playful learning is the key to prosperity"** The article claims that in an increasingly fast-changing and technology-driven world, solutions to weighty problems require a workforce of enterprising, independent, strategic thinkers – "purposeful creators". This has implications for education. The article notes that learning through play involving "hands-on, minds-on" approaches is a powerful way forward. It states that "play gives children space to dream, discover, improvise, and challenge convention." A growing body of literature from developmental psychology and education affirms this view.

As teacher educators, we are particularly interested in how to harness play for school curriculum learning while simultaneously supporting learners to develop so-called 'competencies for a fast-changing world'. We are interested in how teachers can use guided play for this purpose. Guided play is an amalgamation of free exploration and child agency, which characterises free play, with the best elements of teacher-led teaching. With this in mind, we expect student teachers in our primary school programmes at the University of Johannesburg (UJ) to include guided play in some of the lessons that they design during the four years of the pre-service teacher preparation programme.

Building a Pedagogy of Play

The design of the course and its implementation is the focus of the PhD study of Lerato Ndabezitha. The research genre of this study is design-based research. Design-based research aims to develop theoretical insights, artefacts, and practices in tandem, through interventions which could be used in contexts beyond that in which the intervention was designed and implemented. Lerato is currently designing the first iteration of the course. The course design and envisaged implementation is informed by three inter-related principles, outlined below.

01 Bridging the theory-practice divide

The first principle is that the course must, in its design and implementation, support an integration of theoretical coursework learning with enactment of the learning. The course aims to confront a perennial issue in pre-service teacher education head-on, namely the problem of moving from students' intellectual understanding of the theoretical perspectives explored in coursework to enactment of these in practice – the so-called 'theory-practice divide'. The course invokes the distinction that the psychologist and educationist Jerome Bruner made between "learning about" and "learning to be." Arguably, much of what is taught in coursework are facts, concepts, principles, and theoretical perspectives about phenomena – thus, much of coursework learning tends to be "learning about." With his "learning to be" notion, Bruner stresses that learning should be about purposefully developing the disposition and demeanour of a competent practitioner. The course endeavours to foreground "learning to be". One of the ways in which this will be done is through using teaching practices and assessment tasks that will foster deep(er) learning – learning for transfer (the second principle that underlies the course design).

02 Deeper learning for transfer

Deeper learning enables the gradual development of expertise in a knowledge area. This implies a thorough grasp of core ideas in the knowledge area, coupled with an understanding of conditions for application. Importantly, deep learning enables one to recognise when new problems or situations are related to what has been learned before, and how acquired knowledge and skills can be applied to these problems or situations. Teaching practices that support deeper learning draw purposefully on students' existing knowledge and life worlds and stimulate deep cognitive engagement. The learning tasks that student teachers will do (individually and in collaboration with peers) include analysis of case studies and vignettes, role play, and the production of artefacts such as short videos of play activities and blogs. They will also engage in meta-learning that involves self-monitoring and reflection on their learning processes in relation to the learning objectives.

The assessment practices that will be used to support and elicit deeper learning are mainly "authentic". They require demonstration of deep understanding through performing something or producing an artefact, accompanied by an explanation of the rationale – thus, making thinking processes explicit. The planned final summative assessment task comprises a portfolio. It will include play-related artefacts that the student teachers produced (incorporating feedback they received on earlier versions), a play-focused lesson that they designed (the lesson plan, a video of the lesson as they taught it, and a reflection on the lesson), and an overall reflective statement about their learning trajectory in the course.

03 Apprenticeship learning

The third principle invokes the notion of apprenticeship learning. In apprenticeship learning, the expert (in this case the teacher educator) uses modelling, scaffolding, fading, and coaching to support the learning of the apprentices (the student teachers). These processes will be used in presenting the course with the added dimension of "cognitive apprenticeship" which implies that the teacher educator makes the thinking underlying actions visible, requiring student teachers to do the same. It means getting student teachers to articulate their thinking, reasoning, or problem-solving processes underlying an executed task, compare their performance to the features of expert performance, and relate their performance to coursework learning. The notion of modelling also refers to the exemplary role of the teacher educator. It means that the course must display playfulness in its design and implementation and that the teacher educator must intentionally serve as role model for the student teachers.

Themes for exploration

The themes that will be addressed in the course will include using play as a central pedagogy in Grade R, the characteristics of play, and different types of play. The course will also focus on using guided play to foster holistic development of children including executive functions, language and literacy development, and number awareness.

We are hoping that the learnings from the research that Lerato is conducting can inform the development of an open source course that could be used by teacher educators in South Africa. In this effort, Megina Baker and Ben Mardell, researchers on the Pedagogy of Play (PoP) project are working with us. They are based at Project Zero, the oldest research organisation at the Harvard Graduate School of Education. In addition, Megina and Ben are creating resources for teacher educators from around the world, funded by the LEGO Foundation, and they hope to include activities and assignments from the UJ course. The PoP team has previously explored what playful learning can look and feel like in three South Africa schools (http://www.pz.harvard.edu/resources/toward-a-south-african-pedagogy-of-play).

Lerato Ndabezitha is a lecturer in the Department of Childhood Education, Faculty of Education at UJ. She was recruited as a participant in the prestigious Department of Higher Education and Training New Generation of Academics Programme (nGAP) which aims to develop a new generation of highly capable scholars as new academics. Sarah Gravett is a professor of education and the Dean of the Faculty of Education at UJ. Nadine Petersen is a professor of education and Vice-Dean: Teaching and Learning, Faculty of Education at UJ.

Developing competencies for a changing world through creative coding

Linford Molaodi and Professor Sarah Gravett, University of Johannesburg Faculty of Education

In 2020, we piloted a "Scratch Coding Club" for final year BEd and PGCE pre-service teachers at the University of Johannesburg (UJ). We are excited about the potential of learning to code via the programming language Scratch for enhancing pre-service teachers' preparation for teaching in a fast-changing world.

What is Scratch?

Scratch is an open-source, block-based graphical programming language that allows for a wide range of creative expressions, including creating stories, games, and animations that could incorporate photos, music, and sounds. Scratch was developed by the Lifelong Kindergarten research group at the Massachusetts Institute of Technology (MIT) (**https://scratch.mit.edu/)**.

The name "Scratch" highlights the idea of tinkering. It comes from the scratching technique used by hip-hop disc jockeys, who tinker with music by mixing music clips creatively. Scratch enables something similar, mixing code and media clips (graphics, photos, music, sounds) in creative ways.

UJ's Scratch Coding Club

The aim of the UJ Coding Club was to enrich students' preparation for teaching through involving them in a planned creative learning experience. In addition, we wanted them to experience the affordances of Scratch for teaching curriculum themes and we wanted to enable them to teach Scratch to others. Participation in the club was voluntary and those who wanted to formalise their involvement could submit a reflective portfolio, which was assessed. These students were then awarded a certificate of successful participation.

Two staff members (Linford Molaodi and Kenneth Baloyi) and three student teachers (Vuyisile Mashele, Michelle Khumalo, and Maeketsa Mofokeng) facilitated the club meetings. The Lifelong Kinderfarten group at MIT Media Lab - in particular, Rupal Jain - supported us in this endeavour. The club meetings took place on Saturday mornings and the sessions were facilitated online due to the COVID-19 pandemic. As all teaching happened online at UJ in 2020, data was a scarce and valuable commodity. In light of this, it was heartening that approximately 60 student teachers participated regularly.

The aim of the UJ Coding Club was to enrich students' preparation for teaching through involving them in a planned creative learning experience.

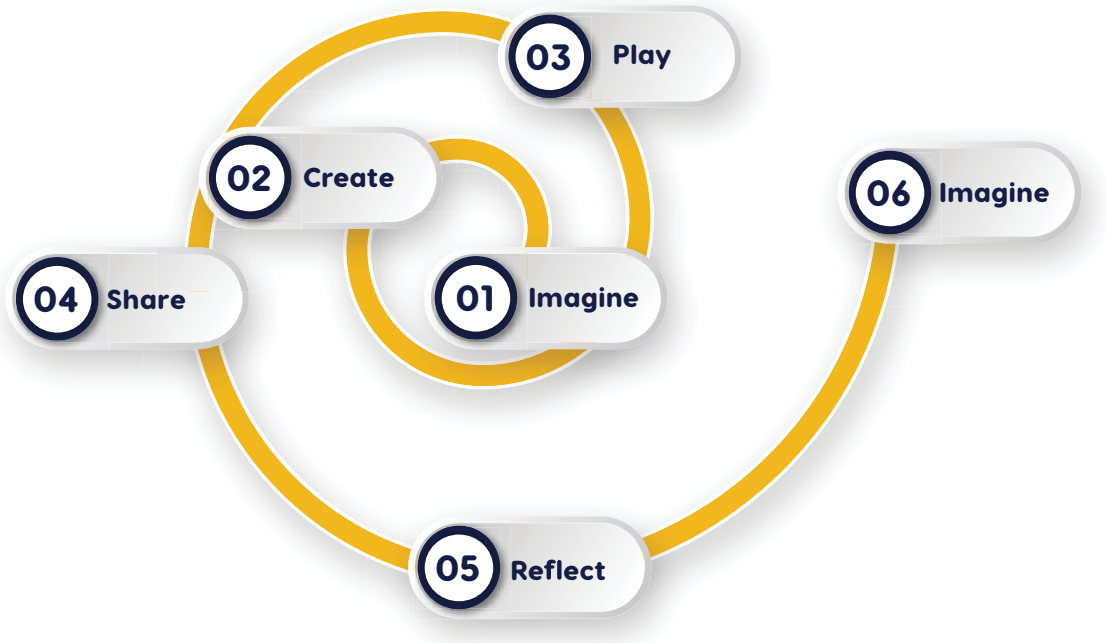
Background research: The Four Ps

We drew on research studies that relate creativity and creative thinking with robotics and computational thinking through coding. We chose to teach the student teachers "Scratch" due to its affordances to support learners in developing the creativity, collaboration, and communication skills needed to thrive in a fast-changing world. Our approach aligns with the Scratch philosophy that the development of creative thinking and computational fluency requires opportunities for learners to create projects, based on their passions, in collaboration with peers, in a playful spirit. These are the Four Ps of Creative Learning: **Projects, Passion, Peers, and Play** as articulated by Mitchel Resnick in his book, Lifelong Kindergarten. We also used these principles to guide club activities, coupled with the creative learning cycle as put forward by Resnick.

We involved the student teachers in creating projects, first allowing them free choice to pursue a personal interest, and later creating projects concerning their teaching specialisations – their professional interest. The student teachers worked collaboratively, sharing their projects, interacting with their peers' projects, and remixing one another's projects

The Creative Learning Spiral

The creative learning spiral was inherent to the club's activities. We wanted student teachers to experience the creative process: curious exploration, combined with playful experimentation and systematic reflection.



The student teachers imagined the kinds of projects they wanted to make, building on their prior knowledge. They created their preferred projects based on their imagined ideas. They played with their ideas, interacted with their peers, and tinkered with the projects they were creating. They experimented playfully. The student teachers shared their ideas/projects and reflected on their experiences, which led them to imagine new ideas. Sharing and reflecting allowed student teachers to collaborate on projects, providing critique and support, and reviewing their products.

Initial insights

We are researching the Scratch Coding Club in collaboration with the Lifelong Kindergarten group at the MIT Media Lab. Here we give a glimpse of one aspect of the research, namely what student teachers noted as learning gains, gleaned from interviews that Linford Molaodi conducted with a sample of the student teachers.

01 Development of student teachers' competencies

One theme generated from the interview data is that student teachers felt that learning to code with Scratch helped them to develop competencies that will serve them well in a fast-changing world. For example, one of the student teachers said, "During the process of learning to code with Scratch I have learnt communication, collaboration and even critical thinking..." She added that coding with Scratch was difficult, but she thrived through working with fellow students. Fellow students suggested codes to use and even remixed her projects to help her succeed. The student teachers also conveyed that coding with Scratch helped them see the power of collaboration. A student teacher reflected: "seeing others helping made me continue participating in the coding club...there was that thing...of nooo...carry on, you are not alone."

Another student teacher said that although coding with Scratch was challenging, she had to learn how to be creative because students could not completely reproduce each other's projects. She said that each one of them had to code projects that were "unique, fun, and attractive" to themselves. With reference to critical thinking, she said: "Scratch was challenging – we had to add a new feature we did not use the previous week ... and some codes did not work. So, I learnt how to be a critical thinker and think about what went wrong and how ... you find that in the previous week everything worked perfectly but after adding the new feature it was no longer working ... like you ask yourself...what happened now? And when you remove the new code it works, but you need that code." She also stated that she learned that teachers should always ask for help when they learn new competencies.

One of the student teachers articulated: "Having other people every week made it easy. It was fun... I was also looking forward to working with other students."

02 Potential as a teaching and learning tool

A second theme was that student teachers realised the potential of Scratch as a teaching and learning tool. One student teacher said:

"Scratch is capable of creating projects that can serve as powerful learning tools. For example, in Mathematics, you can create projects on quadrilaterals. The project could be used to engage learners. It has shown me that I can go beyond what I am given. Sometimes, teachers like limiting themselves with using only resources they have. Scratch has given me an opportunity to create more teacher and learner support material."

Other student teachers noted that they realised Scratch could be used to create formative assessment tasks:

"Scratch could be used when you want to engage learners in activities ... you can create a game and include learners to answer questions, create a project to introduce the lesson, and elicit learners' prior knowledge. This can be used in different subjects like life skills. I have created a story about animals ... stories about comprehension where learners watch the story and answer questions around that."

Another student teacher said in his native language, isiZulu:

"umuntu uzofunda aze afe (translated - a person will learn until they die). "I did not know that I would be able to create Scratch projects that learners would enjoy. I run a tutoring company and around September, I used the same projects to teach my Grade 7 learners. It was fun and interesting... I learned how to code and even use it in class. I also learned that in teaching there are lots of tools that you can use to work for you."

The Scratch Coding Club and the associated research will continue in 2021.

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Preparing pre-service teachers to teach with robotics in a fast-changing world

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Technology is changing the way we engage with the world in helping us work, learn, and have fun as we build our future together. As the next wave of technological innovations emerge, robotics is becoming more prominent. It is therefore not surprising that the Department of Basic Education (DBE) is introducing coding and robotics in primary schools. For this to happen, primary school teachers will need appropriate in-service professional development and, by default, so will pre-service teachers. By the time they graduate, new teachers must have the knowhow of how science, engineering, maths, and technology work together and interact in the field of robotics and they should be able to plan engaging lessons and activities for their learners.

With this imperative in mind, we conceptualised a research and development project for final year pre-service teachers in 2020. This project will be implemented in 2021 and aims to guide student teachers through workshops in how to use robotics in teaching. Together with the student teachers, we will learn what works and does not work in the classroom. The study seeks to derive learning design principles about how to teach with robotics from applicable literature and then to refine these principles in practice, using a design-based research approach. These principles will be grouped for form four clusters: robotics knowledge; pedagogical knowledge; content and competency knowledge; and external factors that can impact the integration of these three knowledges.

01 Robotics and STEM

The first cluster of principles positions robotics as a part of the science, technology, engineering, and mathematics (STEM) field. Teachers not only need knowledge of STEM areas, but should also have thorough knowledge of various robotics kits and the purposes for which such kits were designed.

This will ensure that a teacher can select the best robotics kits that fit the specific grade of their learners. For example, learners in the foundation phase would prefer 'floor robots' rather than 'build bots'. Floor robots usually have buttons that learners can press to control the movements of the robots. Build bots comprise electronic components that learners in the intermediate phase can connect in various ways and then control to perform specific tasks. Therefore, pre-service teachers should be able to determine the age appropriateness of the kits for their learners. To further acquire this knowledge, pre-service teachers must be given opportunities to playfully experience the robotics kits themselves. In addition to these questions, our research will also consider the affordances of robotics as a tool to help learners develop competencies for a changing world like critical thinking, collaboration, and resilience, among others.

02 Pedagogies to develop competencies for a changing world in learners

The second cluster of principles centres around teachers developing the pedagogical knowledge to design activities that enable learning through tinkering and making mistakes. The teachers' lessons should have evidence of learning activities that lead to collaboration, creativity, critical thinking, communication, and computational thinking. For example, learners can be encouraged to work on projects and solve problems in groups. As they solve problems, learners can make mistakes. When they correct their mistakes, they would be involved in a process of debugging – a cognitive activity. As learners then playfully engage with various robotics kits in solving problems, they will think about their own thinking processes and, in this way, develop competencies for a changing world like metacognitive thinking. Teachers and pre-service teachers must therefore be intentional about their teaching approaches.

03 Development of knowledge and competencies in teachers

The third cluster of principles relates to pre-service teachers knowing the content and the competencies they intend to teach and develop. In other words, teachers should be content specialists who possess the competencies they seek to develop in the learners. For example, the teaching of electric circuits means that the teacher must know more about electrical circuits beyond the grade they are teaching. They must also know how competencies for a changing world can be developed in the learners. For example, to teach computational thinking, a teacher must first be a computational thinker. As with the development of knowledges above, pre-service teachers must have opportunities to develop content and competency knowledge by experiencing them in action. Having developed these competencies and content knowledge, pre-service teachers must be intentional about planning for learning outcomes that lead to competency development in learners.

04 Building a supportive environment

The last cluster of principles considers external factors that can influence the acquisition and integration of knowledge mentioned in the earlier clusters. External factors can range from preservice teachers' prior experience with different forms of technologies during initial teacher education programmes, collaboration and interaction during workshops, and pre-service teachers' experiences with robotics kits as they solve complex problems.

Robotics training workshops that are planned for 2021 are designed to ensure that the external factors enhance, rather than impede, the knowledge pre-service teachers need to plan their lessons. Importantly, during the workshops, a thorough knowledge of robotics will be developed first before any of the initial design principles can be refined. Workshop activities will focus on addressing perceived barriers to the integration of robotics in STEM areas. Participants will work in groups so that communities of practice are formed.

Intentions for the study

Our hope is that the study will shed light on why and how pre-service teachers can integrate robotics into the teaching of curriculum content and competencies for a changing world. The initial learning design principles will be refined at each iterative stage, in collaboration with participating pre-service teachers. Thus, the data analysis will be an iterative, formative process of learning design principle refinement and will result in the redesign and improvement of subsequent workshops.

The findings from this study may inform ITE institutions, researchers, and practicing teachers about what they can do to develop the desired knowledge of how to teach robotics in primary schools. The learning design principles derived and refined from this study can inform future research and continue to improve the training of teachers and pre-service teachers as they introduce robotics in their classrooms. Ultimately, our hope is that research and ideas about emerging educational technology such as robotics will be translated into action in classrooms across the country.

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