LEAP Final Deliverables

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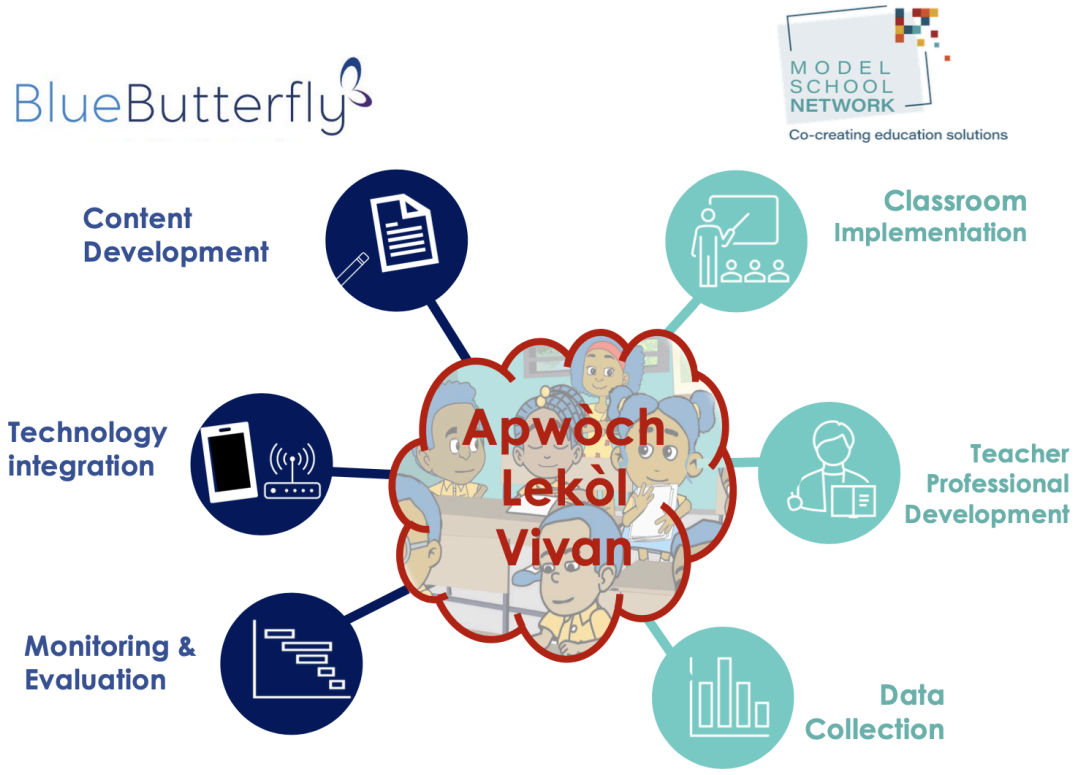
Introduction

Student engagement, or the level of energy students invest in learning, can be fostered via the culture, family, peer, academic, and school context students inhabit. Interventions targeting these factors, including improving teaching quality within the school context, can improve student learning outcomes. Fortunately, strong continuing professional development (CPD), including through technology, can improve teaching quality when accompanied by peer and coaching relationships. Interventions that aim to improve student learning outcomes through strengthening student engagement, including providing teacher CPD to improve teaching quality, present a promising avenue for impact in Haiti, where schooling has historically reflected a teacher-centric pedagogical orientation emphasizing student compliance over engagement. In particular, in Haiti, instruction is typically in French (which most students do not speak) and is characterized by lecture, repetition, and memorization (Baron et al., 2016; Prou, 2009). While limited in number, several studies of Haitian education interventions suggest that pedagogical and curricular reforms can engage students actively in their learning, leading further to improved student learning outcomes.

This literature review examines the theory of change behind Eksploratoryòm, an educational intervention promoting student engagement in Haiti. Developed by Blue Butterfly, Eksploratoryòm is a comprehensive science learning program that seeks to improve Haitian primary-school student learning outcomes through equipping teachers to adopt a learner-centered approach to teaching, using strategies like connection to student real-world experience and interactive questioning. Specifically, by providing teachers with joyful story-based audio lessons in Haitian Creole, accompanying learning

materials, and continuing professional development that incorporates teacher behavioral change mechanisms, Eksploratoryòm is built on the principles of Apwòch Lekòl Vivan (ALV), a student-centered pedagogical method developed and used by the Model School Network, a consortium of laboratory schools in the Central Plateau of Haiti (the relationship between these parties is depicted in Figure 1). Eksploratoryòm provides the tools and support for teachers to implement ALV, which creates high levels of student engagement and ultimately improves student learning.

Figure 1. Relationship between Blue Butterfly, Eksploratoryòm, Apwòch Lekòl Vivan (ALV) and the Model School Network



Measuring student engagement is an important component of evaluating whether the program is having its intended effect on student learning. Researchers and social entrepreneurs have developed several tools for measuring student engagement by collecting data on a combination of teacher practice and student behavior. These tools include The Playful Learning Across The Years Toolkit, LENA, TeachFX, and the Stallings Classroom Snapshot. Different tools may be more suitable for measuring student engagement depending on the scenario. When selecting a tool, researchers and practitioners should consider training, administration and cost requirements, as well as adaptability to the Haitian context.

Student Engagement and Learning Outcomes

Student engagement is the level of behavioral, cognitive, and emotional-affective energy a student invests in the learning process in a given context and with a given set of supports. Wang et al. (2019) define student engagement as the level of energy invested in order to achieve a goal. This energy is multidimensional, including a behavioral dimension (the level of participation, effort and persistence the child puts into the process), cognitive dimension (the level of mental energy the child puts into the process, which includes attention allocation), and emotional-affective dimension (the level of both positive and negative emotions involved during the learning process). Further, student engagement varies across contexts, as well as across time. Student engagement is also malleable in response to supportive factors, including strategies and coping mechanisms students employ and features of the student's learning environment (Wang et al., 2019).

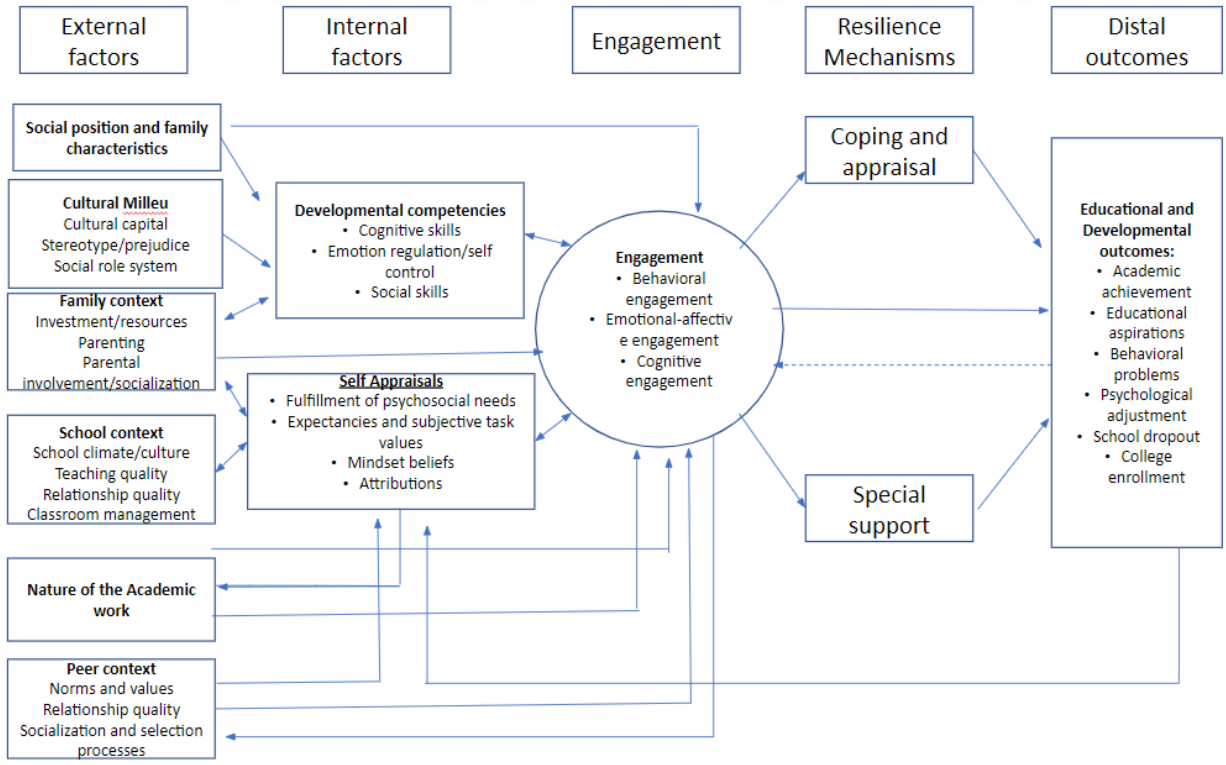
In Wang, Henri, and Degol's theoretical model of student engagement (2019), two groups of factors contribute to student engagement 1) e<u>xternal factors</u> and 2) i<u>nternal factors</u>. External factors include a) social position and family characteristics, which affect the level of access to resources, the level of external stressors, and the available tools for responding to stressors; b) Cultural milieu, including stereotypes, prejudice, and social role, including environmental stressors in the family, school, and neighborhood; c) family context, including resources, parenting and parental involvement; d) school context, which includes school climate, teaching quality, classroom management, relationship quality within the classroom, and school activities; e) the nature of academic work and whether it provides a sufficient challenge; and f) peer context, or the quality of the relationship between peers. With respect to academic work, Blumenfeld et al. (2005) found that authentic connections from the material to students' experiences increase student motivation and engagement. These connections motivate the students to know more, as they recognise the knowledge will help them with real-life situations, which in turn increase the students' engagement. They also found that peer collaboration enhances engagement, as students are encouraged to ask questions and explain their ideas (Blumenfeld et al., 2005). With respect to school climate, joy has also been found to enhance engagement because joy is associated with increased dopamine levels in the brain's reward system linked to memory, attention, mental shifting, creativity, and motivation (Zosh et al., 2017).

The internal factors include individual personal factors such as the developmental competencies of the individual student (e.g. cognitive skills, emotion regulation, self-control and social skills). These developmental competencies lead to

self-appraisals, which will affect a student's future behavior to seek or avoid challenges and involve the fulfillment of psychological needs, subjective task values, and attributions.

Per Wang et al.'s (2019) model, student engagement impacts student resilience, social support, educational, and developmental outcomes. Student resilience includes mechanisms such as coping and appraisal, enhancing children's abilities to cope with everyday challenges and adapt their behavior when needed. Student engagement impacts the support students receive because highly-engaged children tend to elicit higher levels of teacher support. Distal (long term) outcomes of high levels of student engagement include high academic achievement, positive behavioral and psychological approach to learning, reduced school dropout and increased college enrollment. A representation of the dimensions of student engagement, and how student engagement is influenced by internal and external factors to produce student outcomes, is depicted in Figure 2.

Figure 2. The components of engagement (image taken from Wang et al., 2019)



The claim that student engagement impacts learning outcomes is well evidenced. Engaged students, at every stage of development, both enjoy the learning process and demonstrate better learning outcomes (Ferrer, et al., 2022; Carini et al., 2006; Kahu, 2013; Ryan & Deci, 2020), which is in large agreement in the scientific community (Wang, Henri and Degol, 2019; Ferrer et al., 2022). For example, studies of active learning pedagogy, in which teachers facilitate discussion and exploration of topics grounded in students' real-world experiences, have found that engaging students through active learning pedagogy can strengthen student achievement, growth mindset, and social-emotional skills (Parker & Stjerne Thomsen, 2019). Zhu et al. (2023) reviewed the literature on student engagement and reading outcomes specifically,

finding that cognitive and behavioral engagement are consistent predictors of reading achievement. With respect to student engagement and math outcomes, Fung et al. (2018) found that students with higher levels of engagement, particularly cognitive engagement, had higher math scores. The proposed mechanism for these outcomes is explained by Wang et al. (2019), highlighting the role of children's engagement in influencing distal children's outcomes both in the short-term and long term, including academic achievements, school dropouts, college enrollment, psychological adjustment, and more positive behavioral attitudes towards learning.

Teaching Quality and Student Engagement

Quality teaching is an important factor influencing student engagement. Teacher pedagogy and lesson activities that are hands-on, interactive, and tied to students' real-world experiences tend to engage students in the instructional material (Wang et al., 2019).

Strong continuing teacher professional development (CPD) can improve teaching quality and student learning outcomes. Sims et al. (2021) conducted a systematic review and meta-analysis of 104 experimental studies, which evaluated the impact of teacher CPD on children's attainment. Although most of the research was conducted in the USA or the UK, around 12% focused on science, similar to Eksploratoryòm. Sims et al. (2021) identified 14 mechanisms, which are aligned with established behavior change techniques (Michie et al., 2013), and were found to underpin the success of the evaluated CPD programmes. These mechanisms centered around four themes: i) instill insight, ii) motivate goals, iii) teach techniques, and iv) embed practice. Sims et al. (2021) found that programmes that had all 14 mechanisms

had an impact on children's attainment, with a pooled effect size of .17. Programmes with none of the 14 mechanisms had an expected effect size of 0.

Strong CPD can be effectively delivered via technology when accompanied by peer and coaching relationships. Hennessey et al. (2022) recently conducted a systematic review of 170 studies evaluating the impacts of technology-based CPD on teacher knowledge and practice in low- and middle-income countries. The review found that successful CPD programmes had some of the following features: i) lesson plans and other resources on tablets; ii) regular, in-person (or virtual) coaching with lesson observations and opportunities for feedback on difficult content, and regular lines of follow-up communications; iii) strong relationships between teachers and coaches, and iv) supportive peer-to-peer learning in strong communities of practice. They also found that video-based, self-reflective CPD was common in many of the included studies that demonstrated improvements in teacher knowledge and practice. Specifically, technology was used to enable teachers to observe effective teaching and pedagogy practices. These modeling features were found to be particularly beneficial for less experienced teachers, especially those in contexts where quality teaching may be more scarce (Osmanoglu, 2016). The positive impacts were also enhanced when these modeling techniques were combined with structured opportunities for reflections about the observed practices, such as prompts or probing questions from a trainer and lesson plans that build on the observed content.

Student Engagement in Haiti

Haiti's education system reflects the inequities and power structure of its colonial past, which valued control and compliance over engagement. French

colonists established the first formal primary schools, and schools established after Haiti's independence were modeled on schools in Europe (Clement, 1979). While these schools were largely closed after Haiti's reunification, subsequent school design, curricula, and pedagogy reinforced the elitist colonial social structure (Prou, 2009). When the US occupied Haiti from 1915 to 1934, it introduced a two-tier educational system with European-styled education in cities and an agricultural, vocational system in rural areas. Haitian people largely rejected this reform, viewing the vocational system as a means for a new colonial power to extract wealth from the nation and desiring equitable access to "elite" education (Prou, 2009). Yet the elite education of the time had no cultural relevance to Haiti and was taught in French, rendering it both inaccessible to most people and detrimental to building pride in Haitian identity and culture (Prou, 2009). Despite the introduction of major education reform in 1982 (la Réforme Bernard), which mandated instruction in Haitian Creole and reformed both curricula and pedagogy, education practice has largely remained rooted in Haiti's colonial past (Baron et al., 2016; Prou, 2009).

Mainstream education practice in Haiti does not engage most students, as instruction is delivered in a language foreign to most students and characterized by lecture, repetition, and memorization. Observers from The World Bank found that instruction was three times more likely to be delivered in French than in Haitian Creolel. Further, while teachers elicited responses from the class, they tended not to correct incorrect responses or engage students who do not respond at all (Baron et al., 2016). Therefore, despite finding that teachers spend 76% of class time on instruction,

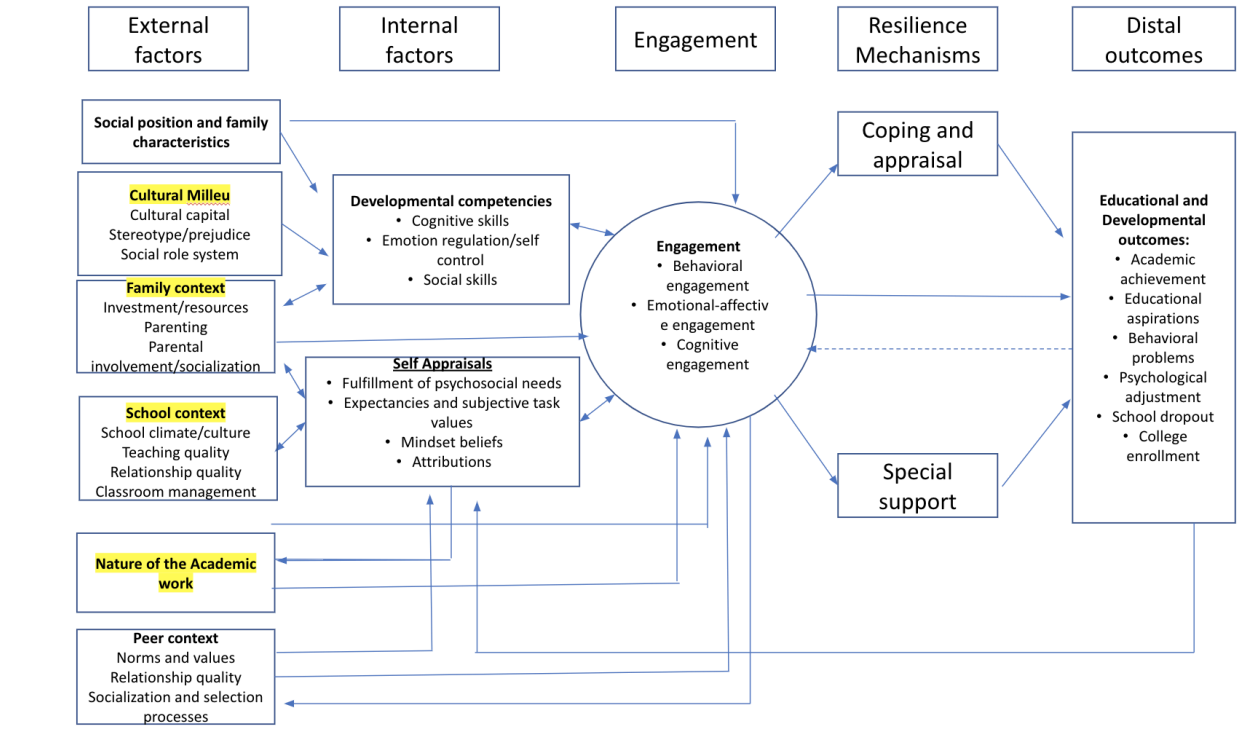
students were paying attention in only 35% of this time. The rest of the time, students played, slept, or stared off into space (Baron et al., 2016).

However, education intervention research in Haiti suggests that pedagogical and curricular reforms can engage students actively in their learning, leading further to improved student learning outcomes. Baron, Adelman, and Evans (2016) found that students with teachers who engaged all students for more of the instructional time had higher reading skills than students with teachers who did not engage all students. In a study of the *Read to Learn* program, which provided teachers training in clear and engaging instruction, increased class reading time and Haitian Creole language material, provided students with targeted feedback, and provided instruction in Haitian Creole, first- and second-grade students demonstrated stronger oral reading fluency and emergent reading skills as a result of the intervention (Kowalski et al., 2022). In addition to showing improvements in literacy learning, engaging instruction and materials in Haitian Creole may improve student social emotional learning. D'Agostino et al. (2020) found in a pilot study that a social emotional learning intervention including morning meetings with a scripted teacher guide and consistent, fun, interactive, format, as well as a teacher guide, lessons, and books in Haitian Creole for discussion of social emotional learning themes led to statistically significant student gains in self-management, self-awareness, relationships, and social awareness.

Eksploratoryòm and Apwòch Lekòl Vivan: Curricular Material and CPD for Engaged Learning

Blue Butterfly's Eksploratoryòm draws on the principles of Apwòch Lekòl Vivan (ALV) to engage students in learning. Eksploratoryòm addresses multiple external factors identified by Wang et al. (2019) that influence student engagement (Figure 3). With respect to the nature of the academic work, the program utilizes story-based audio lessons that feature interactive questioning and communication about key topics in the Haitian science curriculum. By using familiar wildlife and plantlife to demonstrate scientific concepts, and using storylines familiar to students' every-day experiences in audio lessons, Eksploratoryòm enables students to make real-world connections with the science content. Further, the lesson content is in Haitian Creole, challenges social and gender stereotypes, and connects to students' real-world experience, making Eksploratoryòm culturally relevant to students. Participating schools commit to parent outreach, a key principle of ALV. Parents are encouraged to actively participate in school activities. School climate and classroom management are enhanced through tips on classroom climate and positive behavior management in the Eksploratoryòm teacher materials. Joy is also a significant element of Eksploratoryòm, fostering a healthy school climate through songs children love and entertaining audio lesson storylines. Eksploratoryòm promotes ALV's focus on teaching quality: characters in the lesson content model and reinforce effective teaching techniques that foster student interaction, such as questioning as a means of critical thinking. Program coaches also support teachers to interact with every student during each lesson.

Figure 3. The components of engagement in Blue Butterfly's Eksploratoryòm and Apwòch Lekòl Vivan (image taken from Wang et al., 2019)



As part of implementing Eksploratoryòm, the Model School Network provides continuing professional development to participating teachers that improves teaching quality and enables teachers to effectively engage students. Through the Model School Network, teachers attend three preparatory training courses. First, teachers receive foundational training focused on child-centered pedagogy and learning, which underpins the ALV method. Teachers are then introduced to subject-specific training, which aims to develop their confidence with the Eksploratoryòm science content, and upskill their subject-specific knowledge. Finally, teachers are supported with how to use the program technology, which aims to ensure that Eksploratoryòm is effectively implemented in their individual school contexts.

Building on these preparatory courses, teachers continue to receive support and professional development opportunities through their engagement with the Eksploratoryòm program. This is achieved in three ways. First, there is a coaching element to the program, whereby a coach is embedded onsite in each community. These coaches build relationships with the teachers through regular in-person support sessions. Teachers receive feedback from their coach and have opportunities for constructive reflection. Second, teachers can attend booster training sessions, which take place when the children are not in school. Through these sessions, teachers have an established community of practice with each other, and have opportunities to further develop their subject-specific content and general pedagogical knowledge and training. Third, the Eksploratoryòm lessons themselves model effective science teaching and pedagogy practices. In this manner, Eksploratoryòm and ALV include some of the components of effective CPD that Hennessey et al. (2022) describe.

Eksploratoryòm and ALV's professional development opportunities are aligned with some of the behavior change mechanisms shown to underpin the success of teacher CPD programmes on children's learning outcomes (Sims et al., 2021). These include managing cognitive load, revisiting prior learning, credible source, instruction, practical social support, modeling, feedback, rehearsal, action planning, and context-specific repetition (see Table 2). When considering these mechanisms, it is important to highlight that they should not be considered necessarily in isolation, but rather that they combine together to achieve success.

Table 2. Mapping of the professional development opportunities within the Eksploratoryòm, ALV, and Model School Network approach to evidence-based behavior change mechanisms.

Theme	Mechanism	Example
Instill insight	Manage cognitive load	Training focuses on the most essential and practical strategies for implementation and lesson plans focus teacher attention.
Instill insight	Revisit prior learning	The ALV programme includes opportunities to revisit previous topics and techniques through booster training sessions, and spiral introduction of concepts.
Motivate goals	Credible source	Blue Butterfly and their partners are well respected in the local Haitian community. Building trust with individual teachers is also a key part of the initial professional development training.
Teach techniques	Instruction	The professional development opportunities within Eksploratoryòm, ALV, and the Model School Network provide teachers with multiple training courses focused on child-centered pedagogy and subject-specific knowledge, as well as improving their skills for using technology.
Teach techniques	Practical social support	Teachers also receive practical support for their performance from their peer-to-peer support network. Further support is also provided via WhatsApp reminders.
Teach techniques	Modeling	The Eksploratoryòm and ALV materials provide many opportunities for modeling, whereby teachers can observe how the science content materials can be taught to their pupils.
Teach techniques	Feedback	Teachers receive feedback on their performance from their professional development coach.
Teach techniques	Rehearsal	Training includes practice of engagement strategies, as well as practice of actual lessons.
Embed practice	Action planning	The Eksploratoryòm and ALV materials include lesson plans, which incorporate teaching techniques

		that teachers are encouraged to use with their pupils.
Embed practice	Context-specific repetition	Training teaching simulations are in realistic settings and involve repeated practice of isolated skills. Teachers receive specific feedback as part of the simulations.

Measuring Engagement

Students demonstrate engagement through measurable behaviors. While level of engagement is hard to quantify, several studies have attempted to assess it despite the challenge. Stepehn and colleagues (2008) suggested measuring several signs that may suggest a high level of child engagement in a given activity. This includes body language, eye contact, being on task, asking pertinent questions, and group talk (see Table 3).

Table 3. Signs for child's engagement (based on teacher's reports). Taken from Stephen et al. (2008)

Signs of engagement	Examples
Body language	Facing the front, eyes open, hands are put straight up
Eye contact	Disengagement is associated with a lack of eye contact with the teacher who speaks
Being on task	Having ideas, plenty to write, participants
Asking pertinent questions	Engaged students will ask questions if needed
Task related group talk	Engaged children are talking in a group about what they are doing during the process

There are several measurement tools, which can be used to assess student engagement, which are based on these signs of engagement, as well as others. Here, the following measurement tools are summarized the Playful Learning Across the Years (PLAY) Toolkit from the LEGO Foundation, the Language ENvironment Analysis (LENA) System, TeachFX, Stallings Classroom Snapshot (Adelman et al., 2015), and Teacher Engagement Measure Questionnaire (Klassen et al., 2013).

PLAY Toolkit

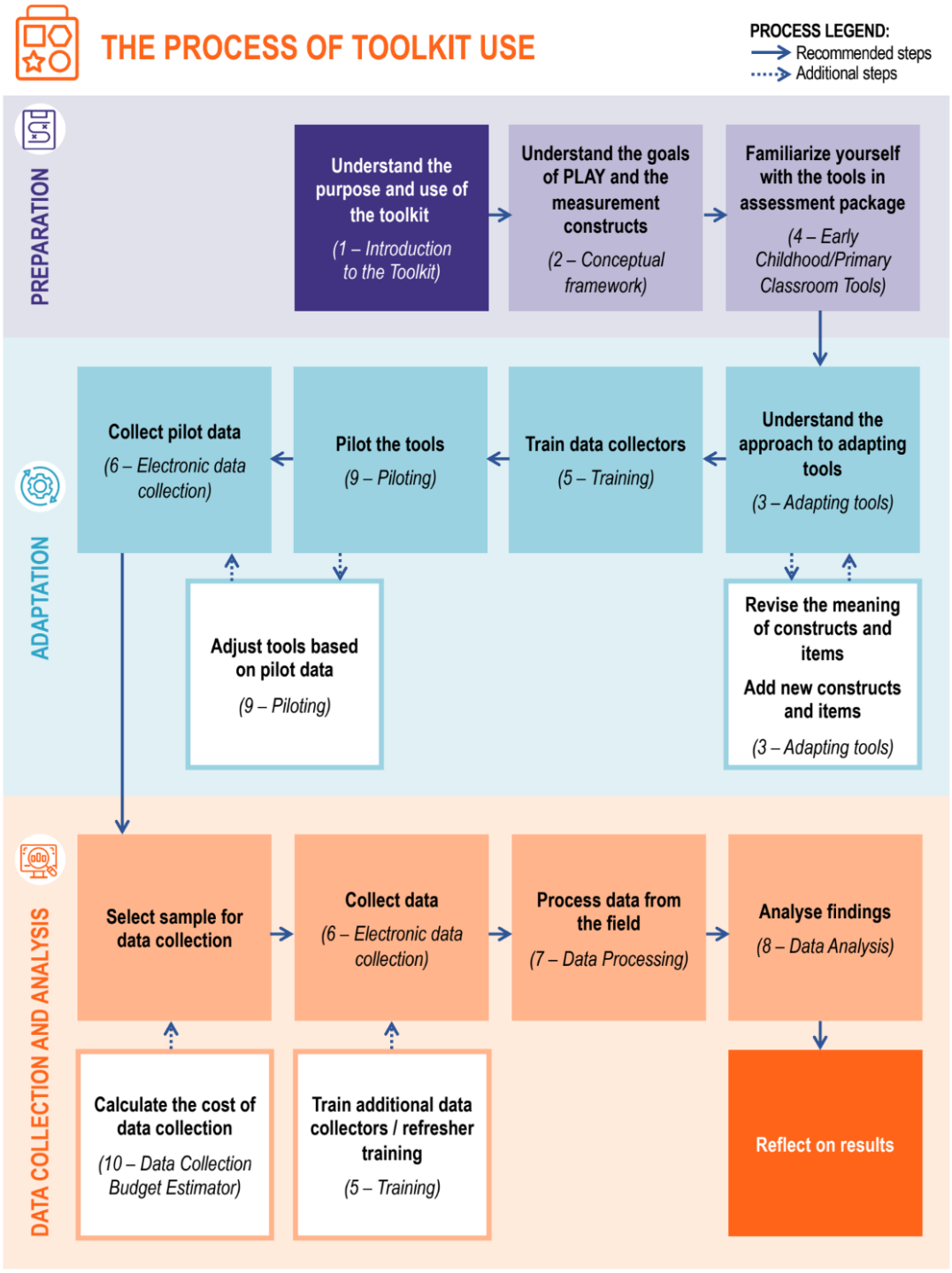
The Playful Learning Across the Years (PLAY) Toolkit measures "the quality of adult-child interactions that promote children's self-sustaining engagement in learning, leading to a broad range of learning outcomes." Designed to measure student engagement at the classroom level, the PLAY toolkit includes materials for classes of children ages 6-12 and measures four constructs: support for exploration, support for agency, support for social connection, and emotional climate. For the primary school age group, the toolkit includes a classroom observation, an adult interview, and a student interview. It is designed to evaluate interventions that intend to support children's engagement in learning. The PLAY Toolkit provides full instructions for administering the observations and interview protocols.

Although the PLAY Toolkit is free to use, there is likely a range of time costs to fully consider. First, the appropriateness of the PLAY Toolkit measure(s) for a new specific context should be considered, as well as the time to familiarize new users with the toolkit materials and procedures. Overall, the LEGO Foundation, who are the developers of the PLAY Toolkit, summarize the process of the toolkit use with 12 recommended and 4 additional steps, including preparation (3 recommended steps),

adaptation (4 recommended steps and 2 additional steps with feedback loops), and data collection and analysis (5 recommended steps and 2 additional steps) (see Figure 4).

The PLAY Toolkit is designed for use in low- and middle-income countries and has clear advice and guidance for adapting the measures to educational contexts in other countries. It has also been piloted in at least four countries, including Colombia, Ghana, Jordan, and Kenya. The psychometric properties (i.e., reliability and validity) of the PLAY Toolkit in these countries is well established (LEGO Foundation, 2022). Importantly, the PLAY Toolkit materials also include detailed advice and guidance for how to make adaptations to the observations and interview protocols, so that the measures are suitable for use in other countries, including potentially the Haitian context. Alongside the time cost to fully consider the appropriateness of the measure(s), it is also important to incorporate sufficient time to implement any adaptations. Adaptations are likely to be focused on language translations as the PLAY Toolkit is available in English, and is not currently available in French or Haitian Creole.

Figure 4. The process of the PLAY Toolkit use, as outlined by the LEGO Foundation.



Finally, there are also time costs associated with data collection and analysis. Specifically, the classroom observations and interviews with adults and/or students will all require time resources to implement and analyze. Best practices in

qualitative research highlight the value of researcher reflexivity when collecting and analyzing observational and/or interview data. Reflexivity involves researchers reflecting on their assumptions, beliefs, values, and biases, which may influence the data collection and analysis (Brantlinger et al., 2005). It is also recommended that a sub-sample of the qualitative data is double coded (typically 20% of the sample) to ensure the consistency in the data collected and/or analyzed. For example, two researchers could complete the same observation to ensure consistency in the information recorded. In addition (or alternatively, in light of resource constraints), a second researcher could re-analyze a sub-sample of the data to ensure consistency in the study findings. In both situations, there should be a correlation of ≥. 70 between the findings from the two researchers. This will indicate suitable inter-rater reliability. Overall, these best practices are also likely to contribute to additional required time and resources. Time savings could be made by using either the observations or the interview tools only; this would also reduce time commitments associated with data collection and analysis, as well as the triangulation of data and findings from different sources. However, this decision should be considered alongside the purpose and goals of the specific evaluation study, and should be balanced against the level of detail that is desired within these project goals.

Language ENvironment Analysis (LENA) System

LENA (Understanding LENA Technology) is an audio-based classroom speech recording tool that measures student and teacher talk, a component of student engagement. LENA characterizes the speech features of a recording (high vs low, etc.), the background noise, and the linguistic characteristics of verbal recordings. This includes the number of generated words, the length, and the frequency of a given word. While some analysis requires that the recordings are in English or Spanish, LENA can measure change over time in word count, volume of talk, and talk turn-taking between students and teachers in any language (see Figure 5).

Figure 5. The LENA recording and analysis scheme (from Understanding LENA Technology)

LENA does not require explicit training to be implemented as part of a research project. However, some familiarization with the hardware devices and the software functioning may still be expected. This has the potential to reduce the required time and resource costs, should this measure be chosen. This is because children wear the LENA device for a defined period of time (e.g., up to one day) in their naturalistic setting(s); in this case the Haitian classroom (Phase 1 in Figure 5). The data recorded is

then transferred to a cloud processing system (Phase 2 in Figure 5). This is the likely point at which there may be time costs to the research team, as this process will require familiarization with the system for successfully uploading the data. However, the developers of LENA can provide initial support. Next, the uploaded data is analyzed by the LENA algorithm, which can differentiate between adult and child voices, as well as background noise (Phase 3 in Figure 5). A report is then produced, which summarizes the key patterns in the data recorded (Phase 4 in Figure 5). As Phases 3 and 4 are automatically generated by the LENA programme, there are minimal researcher training costs, as well as reduced time costs associated with data collection and initial analysis, which are present in other tools, such as the PLAY Toolkit. However, there will remain a time cost associated with triangulating findings across multiple recordings. But, this should be facilitated through the summary reports produced in Phase 4.

Overall, these reduced time and researcher resource costs should be balanced against the financial costs for the LENA devices and software system. Furthermore, it is currently only available in English and Spanish, and so may not be suitable for use in the Haitian context, in which Haitian Creole is most commonly spoken within the naturalistic classroom environment.

TeachFX

TeachFX (TeachFX) measures student engagement, equity of voice, and the discourse patterns in a teacher's classroom using artificial intelligence technology. Priced for K-12 school districts in the United States, TeachFX analyzes audio recordings of an individual classroom to provide insights to teachers on how talk

was distributed between the teacher and students, and how student talk was distributed among individuals and groups. TeachFX also provides data on the questions teachers asked to engage students in talk. Although TeachFX can immediately generate some insights about the classroom setting, the voice recognition software improves over time, and will generally be able to produce meaningful and accurate insights from the individual teacher's tenth recording.

The TeachFX programme requires classroom recordings to be made via internet-connected devices, such as a smartphone, tablet, laptop or desktop computer. The programme also requires some initial training for the new teachers, schools, and organizations to become familiar with how to use the software and the insights it produces. TeachFX has a dedicated team to deliver this training via four live, online professional learning sessions. As such, TeachFX is likely to have time and resource costs associated with use in the Haitian classroom. The financial cost of TeachFX includes these live online training sessions and unlimited use of the software for one year. The pricing for TeachFX is structured based on the school or organization size. At the time of writing, and in consultation with TeachFX, the following pricing details were provided: "for a small school or organization, TeachFX costs $10,000 for up to 20 teachers. For a mid-sized school or organization, TeachFX costs $20,000 for up to 50 teachers. For a large school or organization, TeachFX costs $30,000 for up to 120 teachers".

Unfortunately, the TeachFX programme is not currently available in Haitian Creole. Users can adjust the transcription language in their TeachFX profile and transcriptions are available in French. However, the current artificial intelligence

programme was developed using English language data, and as such may not work as effectively in other languages, despite their availability. This may limit the accuracy and usefulness of the data produced using this approach in a Haitian school context.

Stallings Classroom Snapshot

The Stallings Classroom Snapshot evaluates the efficiency and quality of teaching, a key factor impacting student engagement (Adelman et al., 2015). The tool provides a method of evaluating a class activity, with several criteria and scoring options, including the level of quality of the activity, the classroom management and the interaction with the students. An example for this scoring sheet is provided in Figure 6.

Although this measurement tool is free to access, it has significant time and resource costs. Consistent with other observational checklists (e.g., the PLAY Toolkit), and unlike the automated system in LENA, this measure requires significant time and resource considerations for training the researchers on how to use the tool. All details are provided in the Stallings Classroom Snapshot manual (see Mundial, 2015). The implementation of this measurement tool is also likely to have high resource costs. This is because researchers need to observe the classroom environment in cycles of 15 seconds. Although this may provide rich data insights, particularly as it will ensure researchers are focused throughout the observation session, it will require opportunities for training and piloting for researchers to familiarize themselves with the accurate data collection procedures. The implementation demands may also be challenging in the Haitian classroom context, particularly if there are a large number of children or education may become distributed. Furthermore, although the data collection materials

are accessible, translations to French and/or Haitian Creole will also be required, if used by local researchers. Consistent with other qualitative-based measurement tools, it is also recommended that inter-rater reliability is established (see above), if this engagement measure is selected.

Figure 6. The Stallings Classroom Snapshot instrument (taken directly from Adelman et al. 2015).

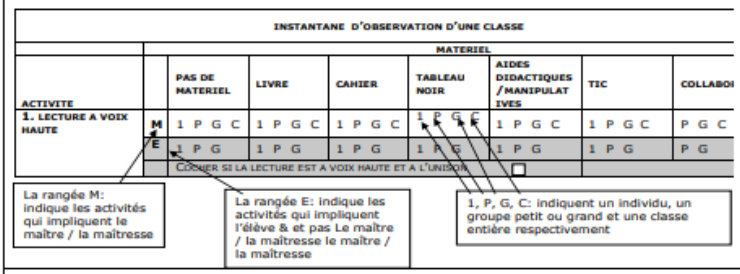
Box 1: The Stallings Classroom Snapshot instrument (from Bruns and Luque 2015)

The Stallings method uses a standardized coding grid to register the activities and materials being used by a teacher and students over the course of a single class. Ten separate observations or "snapshots" are made at regular intervals over the course of each class period. For example, if a class is 50 minutes long, observations are made every 5 minutes.

Each observation takes 15 seconds. During those 15 seconds, the observer scans the room in a 360 degree circle, starting with the teacher, and codes for key aspects of classroom dynamics in detail: (1) how the teacher is using the class time within three broad categories (instruction, classroom management, or other activities considered off-task); (2) if the time is being used for instruction, which pedagogical practices are being used; (3) if the time is being used for instruction, which learning materials are being used; and (4) what share of students are visibly engaged in the activity being led by the teacher and/or engaged in off-task behaviors (such as social interaction or obviously not paying attention to the activity at hand). The categorization of activities is listed below:

Use of time	Specific practice
Academic activities	Lecture/demonstration
	Reading aloud
	Discussion/debate/question & answer
	Practice and drill
	Individual seat work
	Copying
Classroom management	Verbal instruction
	Discipline
	Classroom organization
	Classroom organization alone
Teacher off-task	Teacher absent from classroom
	Teacher in social interaction with students
	Teacher uninvolved or in social interaction w/ others

The coding grid has a matrix format in which different activities are listed along the vertical axis and materials used along the horizontal axis. Within each activity, there are two lines: the top line captures who in the classroom the teacher is engaging with – whether it is the entire class, a large group of students (6+), a small group of students, or only one student. The bottom line registers what different students are doing, in the event that the entire class is not engaged in the same activity as the teacher.



Teacher Engagement Measure Questionnaire

All of the engagement measures so far draw on observation and/or interview methods. An alternative approach would be to use a teacher engagement measure questionnaire. Klassen and colleagues (2013) created a scale to assess teachers' engagement, which covers the following domains: 1) cognitive engagement, 2) emotional engagement, and 3) social engagement (which includes both the student's engagement and the teachers/colleagues engagement). Figure 7 outlines the questions included in this measure. Each item is rated on a 7-point Likert scale, from never (scored 1) to always (scored 7). Research shows that the scores of this questionnaire were positively correlated with measures assessing work engagement and measures assessing teachers' self-efficacy (see reliability table in Figure 8). This evidence suggests this teacher engagement measure has established psychometric properties.

Using teacher engagement measures may be beneficial due to the close relationship between student engagement and teachers' engagement in their work (Thang & Mahmud, 2017). Although such measures will not fully capture the nuances and richness of student engagement, as would be achieved with the other tools, it will, nevertheless, provide a helpful insight into the initial impact of the ALV method in Haiti. In particular, this questionnaire is freely accessible and has significantly less time and resource costs that are associated with data collection and analysis in the other measurement tools. However, as this measure is currently available in English, a translation into Haitian Creole would be required.

Figure 7. Teacher Engagement Measure Questions (taken directly from Klassen et al, 2013)

Item	Content	Factor			
		EE	SEC	CE	SE
10	I love teaching	.95 (.89)			
2	I am excited about teaching	.80 (.81)			
5	I feel happy while teaching	.72 (.83)			
13	I find teaching fun	.70 (.76)			
9	At school, I value the relationships I build with my colleagues		.88 (.83)		
7	At school, I am committed to helping my colleagues		.83 (.83)		
12	At school, I care about the problems of my colleagues		.79 (.82)		
1	At school, I connect well with my colleagues		.57(.58)		
11	While teaching I pay a lot of attention to my work			.82 (.82)	
8	While teaching, I really "throw" myself into my work			.77 (.80)	
15	While teaching, I work with intensity			.76 (.76)	
4	I try my hardest to perform well while teaching			.65 (.71)	
14	In class, I care about the problems of my students				.87 (.82)
16	In class, I am empathetic towards my students				.79 (.83)
6	In class, I am aware of my students' feelings				.75 (.73)
3	In class, I show warmth to my students				.53 (.65)

Note. Factor structure coefficients were included in the parenthesis. EE = emotional engagement, SEC = social engagement: colleagues, CE = cognitive engagement, SES = social engagement: students.

Figure 8. Evidence of established reliability for the Teacher Engagement Measure Questionnaire (Taken directly from Klassen et al, 2013)

Means, Standard Deviations, and Reliability Coefficients for Factors of ETS

Factors	Mean	SD	α
TE (composite)	5.07	.56	.91
CE	5.16	.65	.84
EE	5.05	.73	.87
SES	5.26	.60	.83
SEC	4.80	.80	.79

Note. TE = teacher engagement, CE = cognitive engagement, EE = emotional engagement, SES= social engagement: students, SEC = social engagement: colleagues.

Comparisons Between Engagement Measures

As discussed throughout this section, there are important trade-offs to consider relating to the costs of the different measurement tools, when deciding which one(s) to use in the context of the specific goals and purpose of a specific research study. Costs may be associated with the financial implications of the measurement tools, as well as the costs in terms of time and resources. To aid this decision making process, comparisons between the engagement measures outlined in the current report are summarized in Table 4. Based on the professional judgment of the LEAP team, perceptions of the relative costs (i.e., low, medium, and high) are also provided for each measurement tool for each of the cost areas. Judgements on the perceived richness (i.e., nuance) of the data insights potentially collected via each measurement tool (i.e., very rich, somewhat rich, less rich) is also provided to aid cost-benefit considerations.

Table 4. Comparison of measurement tools in relation to training, administration and cost requirements, as well as availability in different countries.

Measure (Potential for Rich Data Insights)	Comparisons of Costs				
	Financial	**Training**	**Time to Administer**	**Requirements to Administer**	**Translation**
PLAY Toolkit **(Very rich)**	**Low-** Free	**High-** PLAY Toolkit provides full instructions for administration, advice for adaptations, piloting, and data collection.	**Medium-** Variable; observation for full length of lesson.	**High-** Paper-based observations with the whole class; interviews with students and teachers are one-to-one.	**Medium-** Designed for LMICs, but adaptations to Haitian context required.
LENA **(Very rich)**	**High-** $329 per device. Available here.	**Low-** Minimal training required. Data collections and analysis provided by the LENA system.	**Medium-** Up to 1 day.	**Medium-** Children wear a LENA device, which captures audio. Audio then uploaded to the cloud processing system. LENA runs on low power processors.	**High-** This tool is not available in Haitian Creole; only available in English and Spanish only.
TeachFX **(Very rich)**	**High-** Annual fee charged by TeachFX based on size of school/ organization	**Low-** Four initial training sessions required.	**Medium-** Variable to meet needs of the project.	**Medium-** Data collected in naturalistic classroom setting from recordings via internet connected devices.	**High-** This tool is not available in Haitian Creole. Translations available in French, but the system works best with English.

Stallings Classroom Snapshot **(Somewhat rich)**	**Low-** Free	**High-** Stallings Classroom Snapshot manual (see Mundial, 2015).	**High-** 1 lesson. Observations every 15 seconds.	**High-** Paper-based observations with whole class.	**Medium-** Initially developed in the USA. Available in English and French and has been used in Haiti.
Teacher Engagement Measure Questionnaire **(Less rich)**	**Low-** Free	**Low-** Minimal training required- some data analysis skills required.	Not reported.	**Low-** Paper-based survey with teachers. Does not require internet connection.	**Medium-** Initially developed in Canada. Available in English.Translation required.

Recommendations for Further Research

1. Examining the effects of Eksploratoryòm on gender beliefs (Cultural Milieu) - A recent study by Dina L. G. Borzekowski, Tanesha Mondestin, and Sacha St-Onge Ahmad (2023) found that Blue Butterfly's Lakou Kajou television program, featuring the same characters as those in Eksploratoryòm, caused children who viewed the show and recalled more characters to hold less stereotypical gender beliefs. Investigating whether Eksploratoryòm has similar effects may further illuminate Eksploratoryòm's impacts on students and demonstrate Eksploratoryòm's influence on student engagement via cultural factors.
2. Determining the effect of Eksploratoryòm on motivation among the students and the educational team and relating it to students' outcomes. A large body of

literature relates to the effect of motivation on learning and focuses on motivation as driving students' engagement (for example, see Froiland and Worrell, 2016) as well as on teachers' motivation and engagement (Wal et al., 2014). The students' intrinsic motivation was assessed using the following questions: (a) "When I'm in class, I feel good"; (b) "When we work on something in class, I feel interested"; (c) "Class is fun"; and (d) "I enjoy learning new things in class." Responses to all items were on a 1 to 7 Likert-type scale (e.g., 1 = not at all true; 4 = somewhat true; 7 = very true). The strong connection between the intrinsic motivation of the students and their academic outcomes was tested in more than 1000 students. Focusing on the effect of the program on motivation - both in the students and the teachers - can help strengthen the theoretical foundations of the program's focus on student engagement. Some relevant literature can be found in the "motivation recommended literature" folder.

3. Determining the effect of Eksploratoryòm on brain plasticity. If funding allows, the effect of motivation on neurobiological changes associated with motivation and learning can be even explored by determining brain plasticity in neural circuits supporting motivation and learning (see Schumann & Wood, 2014). These days, neuroimaging tools are more accessible and can be used ecologically, even in the classroom (see Ko et al., 2017). Potentially, using fNIRS (functional near-infrared spectroscopy), which is a noninvasive detector for the brain's hemoglobin oxygen saturation, reflects brain activation, can be used in the classroom and is less affected by motion. This tool can be used to evaluate the

involvement and frontal brain regions pre/post and during educational programs. The results can potentially be associated with student outcomes.

4. Assessing the effect of the program on teacher engagement and its relation to students ’outcomes. Teacher engagement contributes to the student engagement process (as can be seen in Wang et al., 2019; as well as in Frioland and Worrell 2016). In these studies, engagement was evaluated using several statements rated on the same 1 to 7 Likert-type scale: (a) “I try hard to do well in school”; (b) “In class, I work as hard as I can”; (c) “When I'm in class, I participate in class discussions”; (d) “I pay attention in class”; and (e) “When I'm in class, I listen very carefully.” Teacher engagement can potentially be assessed at the beginning of the school year (pre-Eksploratoryòm) and at the end of the school year and the difference between the scores can be related to students’ academic outcomes. We, therefore, suggest assessing the effect of the program on teacher’s engagement and examining its relations to children’s outcomes.

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