

| 2022 LEAP CHALLENGE

LEAP Final Deliverable(s)

Project Host:

Pangea Educational Development



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TABLE OF CONTENTS

Executive Summary	3
Introduction	3
Organization’s role and strength	3
Summary solution	3
Deliverables	4
Deliverable 1: Data Structuring Tool	5
Introduction	5
Rationale for use of R	5
Data merger methods and considerations	6
Takeaway	7
Deliverable 2: Learning in a Semi-Autonomous Context: Insights from Prior Research	8
Summary	8
Learning independently	9
Learning in the family setting	13
References	19
Deliverable 3: Data Analysis Plan	21
Introduction	21
R script	21
Preliminary analyses	21
Preliminary analyses summary	26
Future suggested analyses	26
Considerations for data collection in the future	28
Data collection, storage, and structuring best practices	31
Deliverable 4: Scale-up Considerations	36
Introduction	36
Pangea’s current scale-up state	38
Simplified Scale-Up Framework	39
Using VVOB Scalability checklist and running Pangea’s workshop	43
Workshop results	44
Takeaways and Action Recommendations	47
Annexes	52
References	54

Executive Summary

Introduction

Pangea's Project Backpack addresses basic literacy education needs in vulnerable refugee communities using tablet-based semi-autonomous learning. The LEAP project focuses on improving data management, understanding learning effectiveness, and scaling the program. These are all relevant topics to organizations and individuals interested in enhancing education access and quality for underserved populations.

Organization's role and strength

Project Backpack provides basic literacy education for out-of-school students and students in overcrowded schools. By providing families with tablets, including preloaded educational apps, the project aims to deliver educational content to families in a cost-effective and scalable way. An important aspect of the program is that it empowers parents and peers to participate in their children's learning, regardless of their prior education.

Summary solution

This project addressed Pangea's following concerns:

1. **How to leverage existing data:** As an evidence-driven initiative, Project Backpack has integrated data collection into its implementation. However, the team required assistance making this data more accessible and organized to continue making informed decisions.
2. **How to enhance learning effectiveness:** Pangea sought a framework to better understand the primary drivers behind semi-autonomous learning in family contexts, aiming to improve their interventions and inform data collection in the future.
3. **How to scale up the program:** Pangea employs an agile implementation approach for Project Backpack, continuously building on past iterations. They needed guidance on incorporating scaling-up considerations into their current and future implementation plans to expand the program's reach and impact.

Deliverables

1. **DATA STRUCTURING TOOL**

A scalable and customizable R script streamlines Pangea's demographic and literacy assessment data management. Addressing common data merging challenges (data quality, data structure, data size, data redundancy, and data privacy) empowers the organization to make informed decisions about interventions and scaling strategies.

2. **A LITERATURE REVIEW ON LEARNING IN A SEMI-AUTONOMOUS CONTEXT**

This literature review explores semi-autonomous learning, parental involvement, and peer interaction to enhance learning effectiveness. These concise findings can guide Pangea's next evaluation and inform similar interventions.

3. **DATA ANALYSIS PLAN**

The plan includes an R script for initial analysis, guidelines for analyzing existing data and future data collection, and a document on best data practices. This plan aims to assess Project Backpack's efficacy, identify factors influencing its effectiveness based on the previous literature review, and offer recommendations for enhancing evidence-based interventions.

4. **SCALE-UP CONSIDERATIONS**

Based on a literature review on scaling up educational interventions, we devised a simplified scale-up framework for Pangea's team, focusing on core scaling elements: effective intervention, implementation, and enabling environment. We adapted VVOB's Education Scalability Checklist (ESC) to evaluate Project Backpack and develop concrete actions. We also provided three recommendations based on workshop results. To support Pangea and similar teams, we created accessible, user-friendly tools for future use, including workshop guidelines, instructional videos, an action prioritization tool, and a scale-up template.

Deliverable 1: Data Structuring Tool

Introduction

Pangea provides evidence-based literacy interventions to use technology to help refugee learners, and as part of that mission, they have collected data from field sites in Uganda about the demographics and literacy progress of their intervention recipients and their families.

However, the data they have collected is scattered across multiple files and formats, which has made it difficult to access and utilize for testing their interventions' efficacy and informing decisions. To address this issue, we have created an R script that cleans and combines Pangea's existing demographic and literacy assessment data. This script will provide Pangea with better access to their data, enabling them to make informed decisions about their interventions and scaling.

Our R script uses various data cleaning techniques to ensure that Pangea's data is organized in an accessible and reliable manner. It combines the demographic information about participants with their assessment data by-participant, so that each participants' combined data appears in a single line in a new, cleaned CSV file. We employ standard data-cleaning methods to concatenate existing data, which handle some basic issues such as redundant information by-participant, small misspellings, and missing data. This combined dataset will make it easier for Pangea to analyze and draw insights from their data, reducing the time and effort required to utilize their existing and future evidence.

The R script is annotated to allow it to be highly customizable, allowing Pangea to adapt it to their specific data needs. Additionally, our R script is scalable, meaning that as Pangea's data grows, the R script will handle the increased volume of data with ease. Overall, the R script will provide Pangea with a streamlined and efficient way to access and use their data.

Rationale for use of R

R (<https://www.r-project.org/>) is a free software environment for statistical computing and graphics. We chose it because it is freely available, runs consistently across platforms, and allows a simple method by which we can provide notes about the data merger process alongside the script that implements it. It's also very popular for data analysis worldwide, which means that there is ample documentation and support for how to use it.

A key advantage of R is that it is an open-source tool. This means that the source code is freely available, and users are free to modify and distribute it. As a result, R has a large and active community of developers who continuously improve and enhance its capabilities, fix bugs, and add new features. R's is likely to remain popular as a tool for data analysis and statistics precisely because of its open-source nature. The popularity also made it a good choice for Pangea because there will be ample support for future elaborations of the R script we have composed as part of our work.

R has a vast range of statistical and graphical tools built into the language. These tools can be accessed through packages, which are libraries of functions that can be used to extend the functionality of the language. The R package repository, CRAN (Comprehensive R Archive Network), hosts over 18,000 packages, covering a wide range of statistical and graphical techniques, data manipulation, machine learning, and more. R's versatility for data visualization is well suited for Pangea's needs. The R package repository gives it an expanding capability to create charts, graphs, and other visualizations that help to communicate their complex data clearly and concisely.

Data merger methods and considerations

Concatenating data is the process of combining data from multiple sources into a single table. Data concatenation is a necessary first-step to make the data accessible for Pangea. We chose to employ R for this process because it is a free, widely available

The R script is written to manage common data merging issues including:

1. **Data quality:** Concatenating data works best when there are few inconsistencies, missing values, and errors in the data—which is a major challenge for any non-profit collecting data in the field. Composing the R-script revealed common data issues in Pangea's issues, some of which can be addressed and corrected automatically by the script, and some of which require systemic changes to the tools and procedures used for collecting data from the field.
2. **Data structure:** Concatenating data works best when the merged data files share a consistent structure. For Pangea, inconsistencies in participants' names and demographic information posed a challenge for this process, along with common structural data issues such as mismatched column names and data types. The R script addresses some of these issues, and we have additionally composed a best data practices document to highlight issues in Pangea's data and provide guidance for future data collection.

3. **Data size:** Today, Pangea has a relatively small quantity of data to process as part of its efforts to monitor the efficacy of literacy interventions. As it scales up, datasets will be expected to become larger, which could lead to performance issues in the R script and make the analysis process slower. We have written the R script to import and merge the data as efficiently as possible with this expectation in mind, to ensure future data concatenation and analysis runs as smoothly as possible even as datasets increase.
4. **Data redundancy:** Concatenating data can sometimes result in data redundancy—such as repeated demographic information in the merged data file after concatenating all of participants’ assessment data. The redundancy stems from when the same information is present in multiple datasets. Redundant data creates problems such as data inconsistencies and slower analysis processes. Our R-script is written to deal with some of the basic data redundancy issues, and our future practices document makes recommendations for how to reduce data redundancy by, for example, having a central location and consistent procedural method for participants’ demographic information.
5. **Data privacy:** Concatenating data from different sources can raise privacy concerns, especially if the data contains sensitive information. Our data practices document makes recommendations for how the privacy of the participants’ data could be better protected by separating participants’ demographic information from their assessment data and linking the two via use of a participant ID.

Takeaway

The R script will help give Pangea better access to their data and provide them with a foundation for creating future systems to merge and structure their data for effective analysis and monitoring of their interventions.

Deliverable 2: Learning in a Semi-Autonomous Context: Insights from Prior Research

Summary

Due to large student-to-teacher ratios and a growing number of children who are out of school entirely, literacy rates in refugee camps such as Impevi are still relatively low. To address this issue, Project Backpack offers supplementary, tablet-based literacy education in the family context, which allows students to learn relatively autonomously, with help from parents or peers if needed.

How do students learn in a semi-autonomous learning context?

The main objective of this literature review is to gain a deeper understanding of how learning takes place in a ‘semi-autonomous’ learning context, and to identify factors that could enhance or hinder learning effectiveness. We bring together a number of key insights from reviews and meta-analyses related to independent learning and learning from parents or peers. First, we describe challenges and opportunities of autonomous, self-directed learning. We argue that the autonomy provided in Project Backpack may have positive effects on students’ motivation and foster the development of agency, but that it is important to balance this with sufficient structure and support. Too much freedom can hinder learning, as students often do not know how to effectively manage their own learning. This applies particularly to younger students, whose cognitive abilities are still developing. Furthermore, it is important for students’ motivation that they feel socially connected and cared for by others, which suggests that students should not be left to themselves completely. Next, we describe a number of ways in which parents and peers can play a role in students’ learning. A key hypothesis underlying Project Backpack is that the social context of children’s families may facilitate learning. The literature indicates that involvement of parents and peers may indeed enhance learning, but that there is considerable variation in the effectiveness of different types of interaction. When it comes to parental involvement, indirect factors such as parental attitudes and encouragement may have greater influence than direct involvement with the schoolwork itself. As for peer interaction, it appears that students learn most effectively when they are working on a common goal and are provided with support and guidance.

How can we leverage these insights for more effective learning?

The literature review provides valuable insights regarding the way students’ autonomy and self-regulation can be supported during learning, as well as how to effectively learn with peers

and parents. These insights can inform further development and scaling of Project Backpack. However, it is crucial that the review is accompanied by field research in the local context. Considering that the literature review relied mostly on research from Europe and the United States, it is of utmost importance to establish whether the recommendations are relevant to the students in Imvepi and feasible to implement with Pangea's resources.

Learning independently

In Project Backpack, students learn with a degree of autonomy, i.e., they have a say in what, how, and when to learn. Having a sense of autonomy is considered a fundamental psychological need, required for effective learning and overall well-being¹, and key to advancing students' agency². Yet, independent learning also comes with some challenges, as it requires students to regulate their own learning and to stay engaged despite potential temptations or distractions^{3,4}.

Autonomy as a fundamental psychological need

In the literature, autonomy is defined as a feeling of control over one's experiences and actions, and alignment of one's behavior with one's interests, goals, and values¹. According to Self-Determination Theory¹, autonomy is a fundamental psychological need and people are inherently motivated to satisfy this need. Importantly, the need for autonomy does not mean that students should be self-reliant and detached from others. As described below, many students, especially younger and inexperienced ones, lack the prior knowledge and (meta)cognitive skills to learn entirely independently². Moreover, too much independence may interfere with fulfilling two other basic needs: the need for relatedness (i.e., feeling cared by and care for others) and the need for competence (i.e., feeling capable of accomplishing a task)¹.

Autonomous vs. controlled motivation. When people are autonomously motivated, the primary reason for doing a task is either because the task is inherently rewarding (e.g., the task is fun or collaborating with peers is enjoyable), or because a learner believes that consequences of doing the task will be of personal significance (e.g., literacy is important for my future)¹. Autonomous motivation stands in contrast to controlled motivation, which is driven by control or pressure from other people, or by social comparison. As opposed to controlled motivation, autonomous motivation often leads to higher learning outcomes, stronger perseverance, and fewer behavioral problems¹.

Challenges

1. Although providing freedom and choice can improve motivation and foster the development of agency, too much freedom can hinder learning, as students often do not know how to effectively manage their own learning².
2. Because the effectiveness of autonomous learning is likely influenced by both task- and student characteristics, it may be difficult to determine the optimal level of autonomy².
3. Students are generally not very good at judging their own learning and the effectiveness of their learning strategies⁵. They need to learn cognitive and metacognitive strategies to effectively regulate their own learning (see 2.2).

Self-regulated learning

Self-regulation refers to the capacity of students to regulate their own behavior, emotions, and cognitive strategies to achieve personal and academic goals³. It comprises a range of cognitive and metacognitive skills, along with motivational factors such as self-efficacy beliefs and emotion regulation^{3,6}. Numerous studies have shown that students' ability to regulate their own behavior is positively associated with learning outcomes^{4,7}. Importantly, self-regulation strategies can (and must!) be learned³. Two types of strategies that are worth discussing in the context of Project Backpack are metacognitive strategies and self-control strategies.

Metacognitive strategies. Metacognition involves how students plan, monitor, and evaluate their own learning⁶. Metacognitive strategies are particularly important for complex, less structured tasks⁷. Because Project Backpack includes (a) digital learning tasks with direct feedback, and (b) assessments that provide insight into students' learning progress and guide them towards the tasks that are most relevant, the pressure on metacognitive strategies is expected to be relatively low. Yet, as students transition from learning to read to reading to learn, the demand for metacognitive strategies, as well as learning and comprehension strategies, is expected to increase.

Self-control strategies. Students need self-control when long-term goals conflict with momentary temptations⁴. In other words, students will need to devote effort to stick with schoolwork and resist more immediately rewarding distractions, such as playing with friends or relaxing, especially when the schoolwork is not inherently motivating. There are a number of different self-control strategies that students employ to manage their motivation to stay on task⁴. Strategies that are probably most relevant to the context of Project Backpack are situational strategies (e.g., finding a place and time to study effectively, while minimizing distraction) and appraisal strategies (e.g., boosting the perceived value of the task or reducing the perceived costs)⁴.

Development of self-regulation

Although young children already show a range of self-regulatory behaviors⁶, children, and even adolescents, are not always capable of regulating their learning most effectively². This can partly be attributed to the fact that self-regulation builds on a set of basic cognitive processes called executive functions, which are known to show a protracted development⁸. Yet, self-regulation also depends on learned strategies^{3,4,6}. Students need direct instruction or observation of others' thought processes; they generally do not develop self-regulation strategies by themselves. Learning of self-regulation strategies should ideally take place within the subject or task context. Separate instruction on 'learning to learn' appears less effective⁶.

Challenges

1. Metacognitive and self-control strategies do not necessarily develop spontaneously, so they need to be taught, either explicitly or implicitly⁶.
2. Teaching self-regulation strategies is affected by teachers' (or parents') understanding of these strategies⁶.
3. Unless strategies are fully automated, applying self-regulation strategies increases cognitive load (i.e., strain on mental effort and resources), which may interfere with learning⁶.
4. Self-regulation may be more challenging for children than for adults, due to immature executive functions and limited (metacognitive) knowledge^{2,8}.
5. Students need to be willing to apply self-control⁴. In other words, they need to be motivated to learn.

Future directions for intervention approaches

A number of suggestions and recommendations can be derived from the literature summarized above. It is important to bear in mind that these recommendations are mainly based on research conducted in the United States and Europe. Therefore, their applicability to other cultural contexts should be approached with caution. According to Self Determination Theory, the needs for autonomy, competence, and relatedness are universal, but they may manifest differently in different cultures¹. Although some scholars question the universality of -particularly- the need for autonomy, this might be attributed to their definition of autonomy, equating it with individualism and independence¹. Nonetheless, it is important to recognize that the value and expression of autonomy may vary across cultures. Therefore, it is imperative to test these recommendations in the local context.

Recommendations regarding student motivation and self-regulation

1. Learning should be structured in a way that helps students learn independently, including setting concrete short-term goals, structuring the physical and social context to stay on task while encouraging effective peer interactions (see 3), and managing time-use efficiently³. This is particularly important for younger students, who may lack the cognitive capacities and (metacognitive) knowledge to structure their own learning².
2. Providing choice and encouraging self-regulation may positively contribute to students' feeling of autonomy¹. If learners do not have the prior knowledge and cognitive capacities to effectively regulate their own learning, autonomy may be supported by allowing students to choose non-essential features of the learning context².
3. Students' need for competence can be supported by providing structure and positive, informational feedback. Moreover, the learning tasks should neither be too easy, nor too difficult^{1,6,9}, which can be accomplished by adapting difficulty to students' abilities. Project Backpack already incorporates both of these recommendations, as it provides informational feedback regarding students' progress and adaptive tasks on the tablet. Additionally, it is recommended to reward effort rather than outcomes, and to avoid social comparison¹.
4. The need for relatedness can be supported by making sure that students feel socially connected and cared for by others¹. Social support is particularly important when students are not intrinsically motivated¹.
5. Students need guidance to learn how (and why!) to self-regulate their own learning, by providing feedback and helping them to plan, monitor, and evaluate their own learning⁶ and exercise self-control⁴. Teaching of self-regulatory skills is most effective when it is embedded in the learning context^{6,9}.

Questions for future research

A better understanding of students' motivation could be leveraged to better match the content and characteristics of Project Backpack to students' interests, goals, and values. It also provides insights into whether there is a need for helping students to develop self-control and self-regulation strategies more generally. As motivation and self-regulated learning may change across development, it is important to consider the age of students when studying the following questions.

Questions regarding student motivation and self-regulation

1. Why do students take part in Project Backpack?
2. To what extent do students feel that the program is meaningful and relevant for their personal goals?
3. To what extent do students find the tasks and activities intrinsically rewarding?
4. To what extent do students experience pressure to take part in Project Backpack (or pressure to learn how to read more generally)?
5. To what extent do students feel supported in their autonomy?
6. Does motivation (specifically: enjoyment, value, and pressure) predict learning outcomes?
7. To what extent do students find it challenging to stay engaged (and why)?
8. To what extent do students find the feedback from the assessment helpful (and why)?
9. To what extent do students experience challenges in managing their learning effectively (and why)?

Learning in the family setting

In Project Backpack, learning takes place within the family setting. Families usually consist of a mix of direct siblings, cousins and other relatives. Parents may or may not be present. Each family receives a tablet to share between family members. After two weeks, the tablet rotates to another family, and the family will have the opportunity to read books from Pangea's mobile library. After one month, the tablet rotates back to the family. Although parental involvement and interactions between family members are expected to enhance learning outcomes in Project Backpack, there is considerable variation in the effectiveness of different types of interaction, as described below.

Parental involvement

The literature is inconsistent with regards to the effectiveness of parental engagement strategies for improving educational outcomes. In ‘typical’ contexts where parental involvement is provided in addition to regular education, the association between parental engagement and school performance is not as great as commonly assumed^{10,11}. Yet, some forms of involvement seem to be more beneficial than others¹⁰. Moreover, it is likely that parental involvement will have greater effects when education is of insufficient quality or when children are out of school, such as during the Covid-related lock-downs¹².

Parental expectations and encouragement vs. ‘hands-on’ assistance. Parental involvement can take on many different forms, from helping children with their schoolwork, to facilitating the schoolwork processes, and providing emotional support¹¹. Factors that seem to show the strongest relationships with academic achievement are parental expectations and aspirations, as well as academic encouragement (e.g., praising children’s effort)¹⁰. It is not necessarily important to do the schoolwork together. In fact, several studies have shown that direct involvement with schoolwork (e.g., by helping or checking children’s homework) is even negatively associated with achievement^{10,11}. An exception is when parents support children’s autonomy when they assist them with their schoolwork¹⁰.

Reading activities. Shared reading is another factor that consistently shows a positive relation with academic achievement, at least in younger children¹⁰. Evidence from family literacy programs suggests that exposing children to the rich language in books helps them to acquire vocabulary knowledge and comprehension skills¹³. Targeted programs that encourage parents to support a limited set of activities (e.g., shared reading) generally work better than programs that encourage a variety of parental behaviors and activities¹³. Although many research studies have focused on shared reading activities, it has been argued that the family’s cultural context should be taken into account, e.g., by encouraging also other than print-based activities, such as storytelling and play¹⁴. This could be particularly helpful for parents with low literacy, as is often the case in Imvepi.

Changes across development

Forms of effective parental involvement change across childhood & adolescence due to both cognitive (e.g., increased self-regulatory skills) and socio-emotional development (e.g., increased focus on peers in adolescence)^{10,11}. For example, whereas shared reading activities and games are positively associated with achievement in young children, this type of involvement is no longer beneficial for older children¹⁰.

Challenges

1. When parents lack content knowledge and/or meta-cognitive knowledge they are often not able to provide effective assistance with schoolwork, and they may even confuse children¹¹.
2. Although parental expectations and aspirations appear to be associated with school achievement, it is currently not clear if/how parents' attitudes can be changed in such a way that it will affect children's school achievement¹⁵.
3. Obviously, the implementation of parent-supported reading activities will be hindered if parents do not have sufficient reading skills or do not speak the program's language.

Learning with and from peers

Peer interaction may provide an opportunity for children to learn from and with each other, by co-constructing and reorganizing knowledge and making sense of diverging ideas^{16,17}. Yet, as with parental guidance, peer learning should not be considered one broad construct. Characteristics of peer learning differ along several dimensions, including structure (are learning tasks and participation spontaneous or structured by a teacher or program), directionality (do peers determine together how learning takes place, or is one person primarily responsible), and engagement (are all learners equally engaged)¹⁸. Peer learning in Project Backpack mainly involves spontaneous interactions, but the literature on more structured forms of learning such as collaborative learning and peer tutoring may also provide valuable insights.

Spontaneous interactions. In a meta-analysis, Tenenbaum et al.¹⁹ investigated the effects of spontaneous, bi-directional interaction on student learning. They found that working in pairs was more effective than learning individually, and in some cases as effective as learning one-on-one with adults. Yet, the effectiveness of spontaneous peer interactions varied a lot between studies. One factor that played a large role in the effectiveness of peer interaction was the instruction 'to reach consensus'¹⁹. The authors speculate that this is because the prompt triggers intersubjectivity (i.e., building of shared meaning) and sociocognitive conflict (i.e., mental conflict due to differences in beliefs or perspectives), resulting in deeper reflection¹⁹. A prerequisite for learning from sociocognitive conflict is that students really want to improve their understanding, rather than showing that they are 'right' or mindlessly comply with the others' viewpoint¹⁶. Finally, it is worth noting that the meta-analysis by Tenenbaum primarily involved complex reasoning tasks. It remains to be investigated whether this also applies to more basic tasks such as learning letters and words.

Collaborative learning. Collaborative learning involves students working together on a shared task or learning goal. Research suggests that collaborative learning may have a positive effect on learning, although the impact seems to be smaller for literacy than for other subjects such

as science²⁰. Moreover, there is large (and partly unexplained) variation between studies, suggesting that it is “important to get the detail right”²⁰. Based on the evidence gathered by the Education Endowment Foundation²⁰, collaborative learning is most successful if collaboration is structured and supported, including tasks that facilitate collaboration (e.g., by requiring a joint outcome). Furthermore, it is important to keep in mind that while collaboration may reduce cognitive load (i.e., the amount of mental effort and resources that each individual puts in to reach understanding), it may also increase cognitive load in various ways¹⁷. For basic tasks, the extra cognitive load imposed by peer interactions is often not justified¹⁷.

Peer tutoring. Peer tutoring differs from collaborative learning in that there is clear directionality, with one learner taking on the role of tutor, and other(s) taking on the role of tutee²¹. The tutor role can be consistent or alternate between different learners. In general, peer tutoring programs have a positive impact on learning²¹. One example of a peer tutoring approach that has successfully been applied to literacy instruction is a program called ‘peer assisted learning strategies’ (PALS), in which lower and higher performing children alternate between the role of tutor and tutee during reading activities^{22,23}. Peer tutoring, including PALS, has shown to be effective for both tutors and tutees, and students with different ages and abilities²¹⁻²³.

Challenges

1. To effectively implement peer tutoring, students need to be trained and be provided with support²¹.
2. For peer tutoring, the age/achievement gap should not be too wide nor too small²¹.
3. Students need support to effectively work together in collaborative learning activities²⁰.
4. If tasks are not properly designed to engage both high- and low-performing students, low-performing students may disengage from the learning activity, widening the achievement gap²⁰.
5. Peer tutoring and collaborative learning require time and resource investment from teachers¹⁹, which provides challenges for implementation in low resource settings.
6. Collaborative learning may increase cognitive load¹⁷.

Recommendations and future directions

The literature provides a number of recommendations, but again it is important to remain cautious regarding the application to the local context given that the literature review primarily included work from the United States and Europe. It is known that parenting practices and social norms differ greatly across cultures¹. Moreover, the same parenting practices may be perceived differently by children in different cultures¹. Therefore, it is important to investigate to which extent these recommendations apply to the students and caregivers involved in Project Backpack.

Recommendations for learning with caregivers and peers

1. Not all forms of caregiver involvement are equally beneficial. Caregiver attitudes and encouragement may be more important than direct involvement with the schoolwork itself¹⁰. Moreover, caregiver help should support children's autonomy, rather than be controlling or intrusive^{1,10}.
2. Although the literature suggests that shared reading may benefit literacy development^{10,13}, this obviously does not work if caregivers' reading skills are insufficient. Other (more culturally appropriate) types of engagement such as storytelling and play are worth exploring¹⁴.
3. Caregivers need support, advice, and resources to help their children¹⁵. Yet, caregivers should not be overloaded by encouraging them to engage in many different behaviors and activities. Research suggests that broad programs often ask too much of caregivers and/or draw attention away from supporting children's literacy¹³.
4. Given the positive impact of peer tutoring programs²¹⁻²³, it is worth exploring whether certain aspects of peer tutoring can be incorporated in Project Backpack. For effective implementation of peer tutoring, it is important to bear in mind that students need guidance on how to effectively tutor each other²¹.
5. Although structured forms of peer learning appear most beneficial²⁰, spontaneous interactions between learners may also support learning¹⁹. Based on prior research in different contexts, it is expected that spontaneous interactions may encourage reading comprehension, especially if students are prompted to reach consensus about the content and meaning of a text¹⁹.
6. When students learn together, keep an eye out for low performing students, as they may disengage if they are not challenged on their own level of performance²⁰.
7. To successfully learn from sociocognitive conflict, it is important to create an environment that fosters mastery goals (i.e., the desire to learn and grow) as opposed to performance goals (i.e., the desire to demonstrate competence relative to others)¹⁶.

8. Finally, the benefits of peer interaction should be weighed carefully against the extra time and effort it requires, and the cognitive load it may induce¹⁷.

Questions for future research

As parental engagement and peer interaction can take on many different forms, it is important to investigate how caregivers and peers are currently involved, and to identify which aspects of involvement are most effective for improving students' literacy skills. Additionally, it is worthwhile to explore how to further stimulate and provide guidance for effective interaction. As the interaction with caretakers and peers might change across development, age should be taken into account when studying the questions below.

Questions regarding learning with caregivers and peers

1. To which extent do students learn by themselves versus with a caregiver or peer?
2. Which person(s) contribute most to students' learning (caregiver, peers, both)?
3. When they are involved, to what extent do caregivers and peers (a) provide encouragement, (b) help with tasks, and (c) help students regulate their learning?
4. To what extent do students read together with their caregivers or peers? In what language?
5. To what extent do caregivers or peers take part in other types of activities, such as storytelling and play? In what language?
6. What type of interactions do students have when they learn together (i.e., is there directionality and equal engagement)?
7. How do students perceive their caregivers' expectations?
8. To what extent do parents feel that they can support their children?
9. What challenges do parents encounter regarding the support of their children?
10. To what extent do students perceive their caregivers' help as controlling vs. supportive?
11. Does the interaction with caregivers and peers predict learning outcomes? Which factors moderate this effect?

12. Is it possible to positively influence caregivers' attitudes about students' learning and does this improve learning outcomes?
13. Is it possible to further involve caregivers in students' learning and does this improve learning outcomes?
14. Is it possible to further leverage peer interaction by introducing more structured peer tutoring?

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Deliverable 3: Data Analysis Plan

Introduction

Pangea has a need to leverage their existing data in order to understand what factors predict greater learning through their iPad-based interventions, as well as plan for what data they would need to run analyses to examine and improve their evidence-based interventions.

We prepared the following deliverables in order to meet this need:

1. R scripts that examine basic questions of efficacy and visualize the results
2. Analysis plan for analyses using existing data
3. Outline of required data to test future literacy intervention questions based on the literature review
4. A document on best data practices for data collection, storage, and structuring in future iterations of interventions

R script

The deliverable includes two R scripts, one which combines data across files, and another which plots the resulting data to visual inspection. The utility of these files will be improved through implementation of the best data practices for future data collection, storage, and structuring.

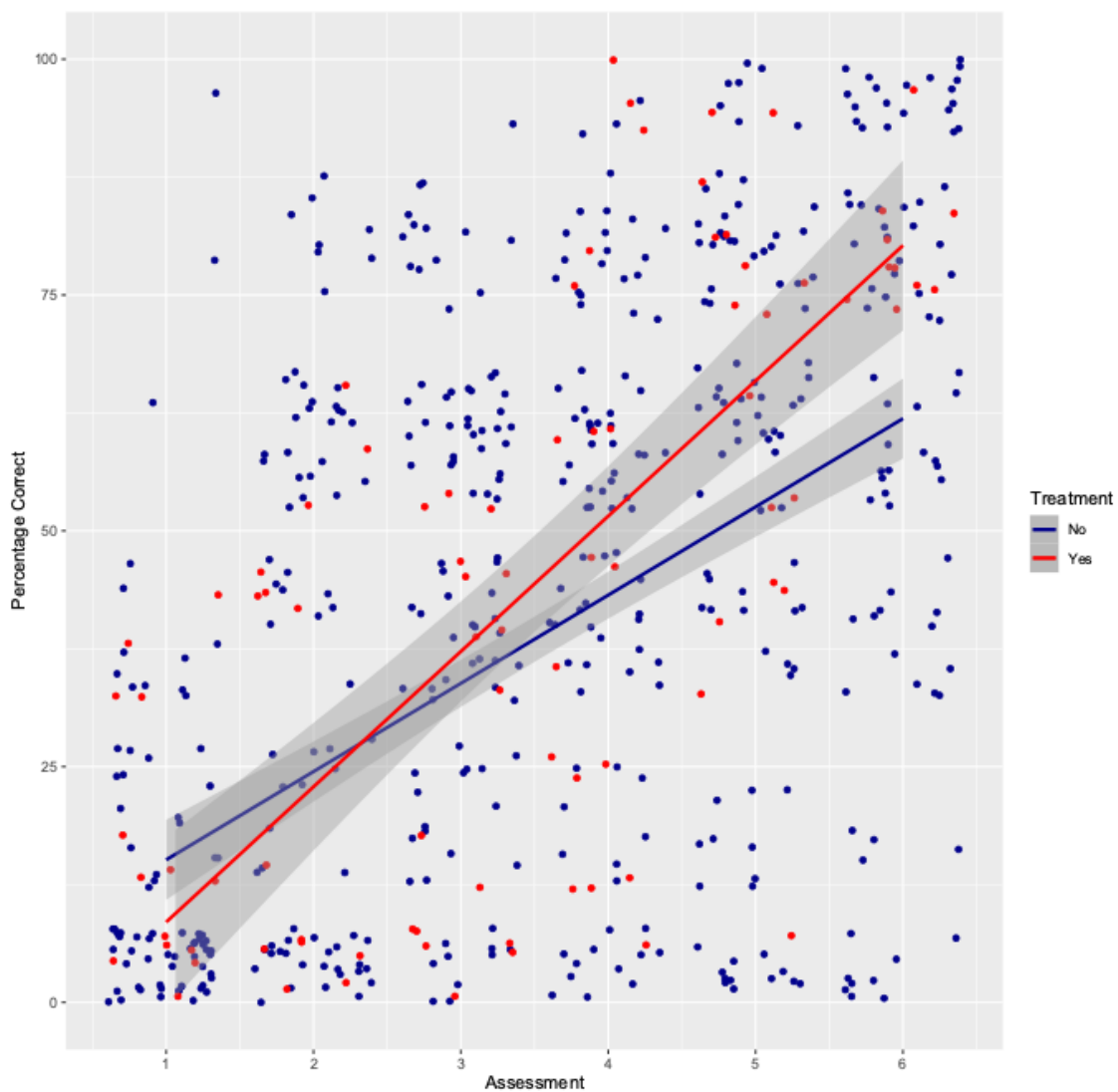
Preliminary analyses

For most stakeholders, including Pangea's partners, participants, and (potential) funding sources, the most relevant question is whether Project Backpack 'works', i.e., whether it is effective in improving literacy skills. Therefore, we provide a preliminary analysis using data from Project Backpack phase II to examine whether a) literacy skills improve, b) whether literacy skills improve more for students who received feedback regarding their progress and suggestions for practice with specific apps or books (i.e., formative assessment), relative to students who had access to the tablets and assessments, but did not receive feedback (Q1). Next, because it is conceivable that the program will be more effective for students of a certain

age than for others, we investigated to what extent learning gain was affected by age (Q2). Finally, we test whether the interventions are also effective for improving the literacy of caretakers (Q3).

Q1. Does Project Backpack improve reading skills, and is this improvement larger for children who received formative assessments?

The first step in examining the effectiveness of Project Backpack is to establish whether reading skills improve. Preliminary analyses show that both experience with the Project Backpack tablets alone (blue) and the guided Project Backpack tablets with guided suggestions (red) yield significant positive literacy outcomes across the six assessments.



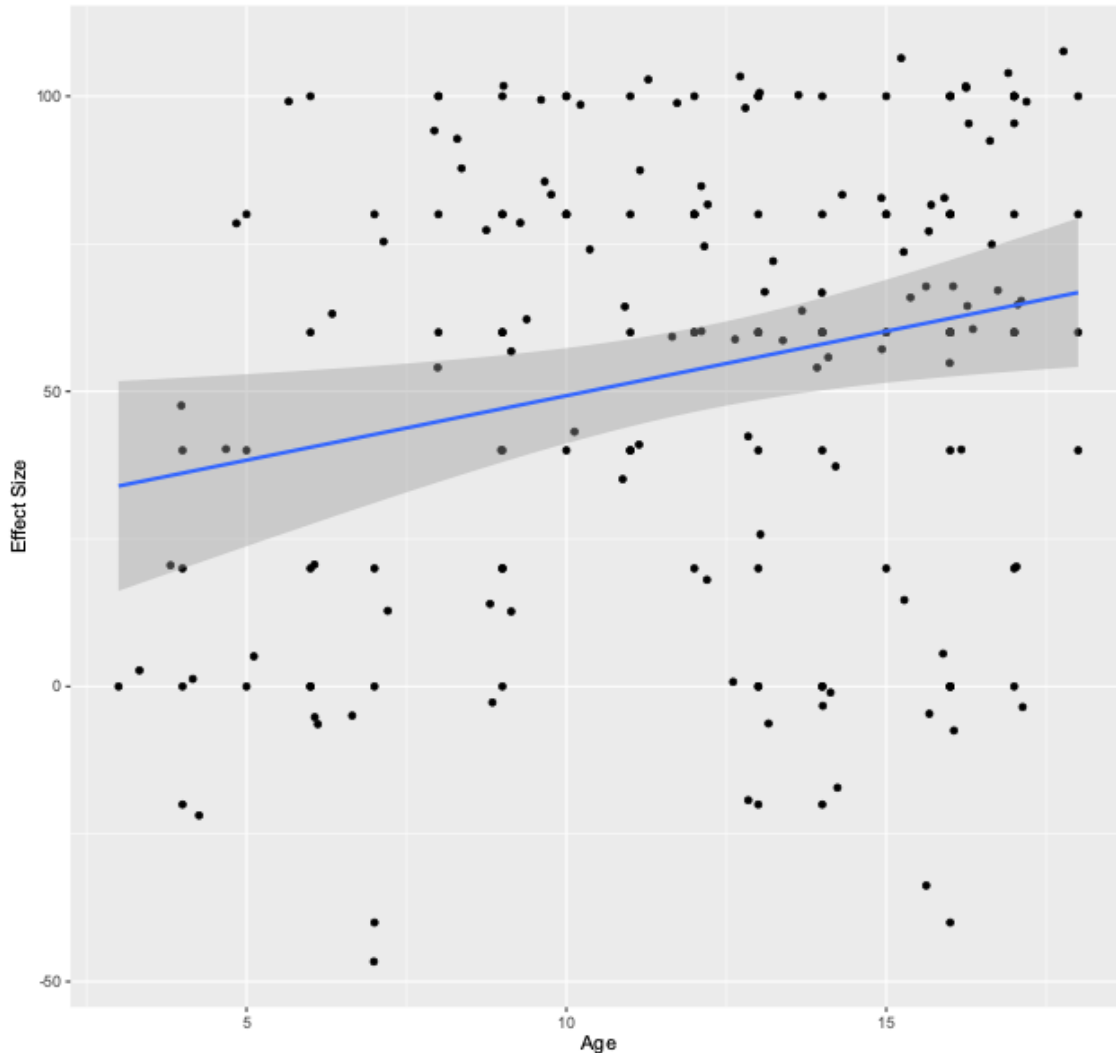
This plot depicts the literacy assessment scores at the six measured timepoints throughout the Project Backpack intervention (horizontal axis). Each dot represents a score, with higher dots indicating higher literacy assessment scores. The datapoints from the tablet-only intervention are displayed in blue and fit with a linear best-fit line, also in blue. The gray area surrounding the line represents 95% confidence intervals, meaning the most likely area in which the true mean occurs. The formative assessment plus tablet intervention is depicted in red, with the data points and the linear-best-fit both depicted here. The non-overlapping gray areas surrounding the best-fit lines at assessments 4, 5, and 6 indicate significantly higher literacy achievement for individuals given formative assessments. Additionally, the slope is higher for the group with the formative assessments, indicating the added benefit of more rapid progress for children who received the guided literacy instruction, above and beyond just access to the tablets. This plot shows data from children, as well as some caregivers.

In summary, the analysis shows improvement in literacy assessment scores for both the tablet-only and the formative assessment, and more rapid progress for children with the formative assessments

Q2. Is improvement different for students of different ages?

As it is conceivable that the program will be more effective for students of a certain age (or skill level) than for others, it is important to investigate to what extent learning gain is affected by age. Outcomes of this analysis may inform a more narrow selection of the target group and/or adjustment of the program to better suit students of all ages and abilities.

Preliminary analyses suggest the interventions are consistently effective across ages (meaning there is positive improvement in literacy), with no significant differences observed for children of all ages.



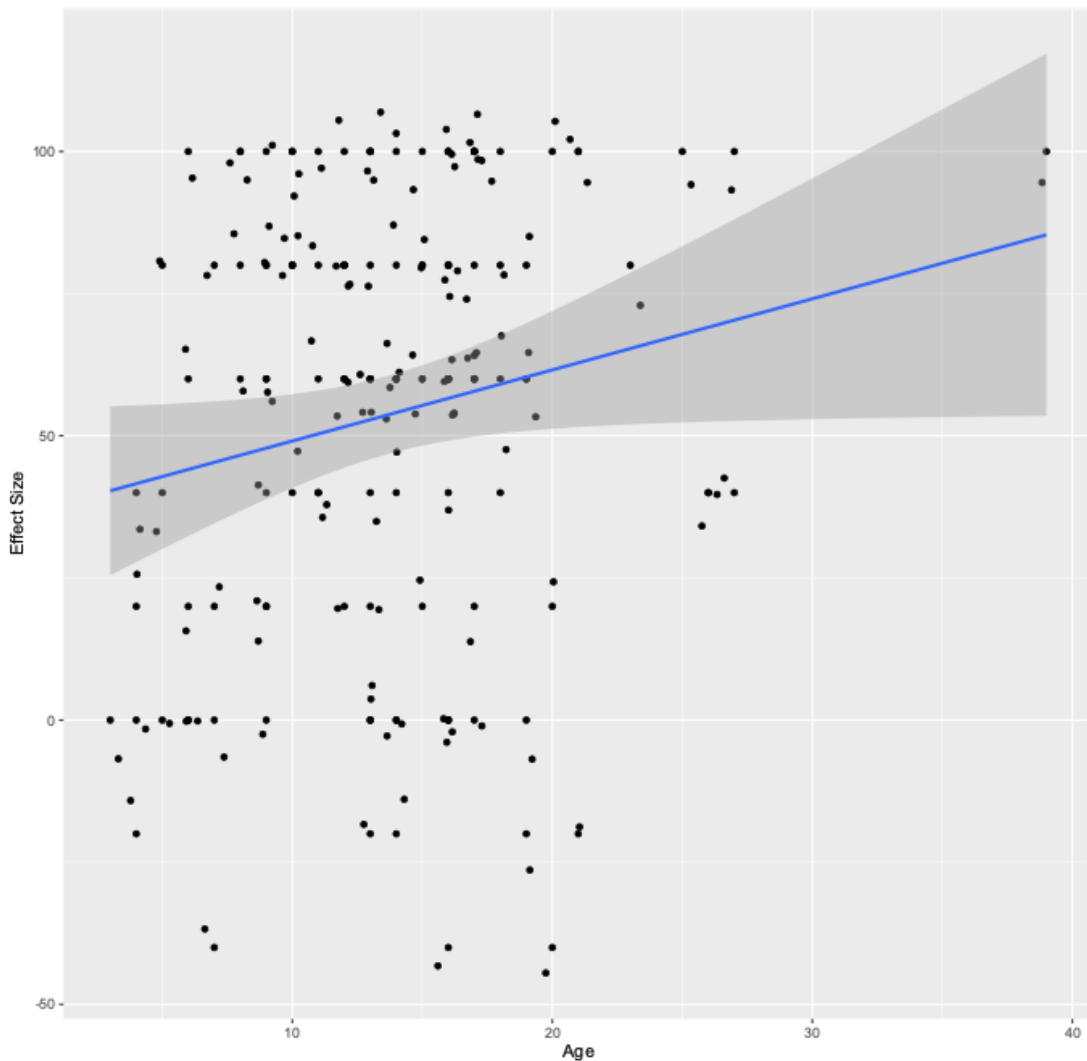
The plot above shows the effect size by age, which is computed by subtracting the score of the first assessment from the score of the sixth and final assessment. Positive values indicate improvements in literacy, and represent the vast majority of dots in the plot above. The horizontal axis reflects participants' ages in years. Each of the participants' literacy improvements is thus represented as a dot above. The blue line represents a linear best-fit to the data, and the gray area surrounding the best-fit line represents 95% confidence intervals (meaning the area in which the true mean of the data most likely resides). A perfectly straight best-fit line would indicate that the literacy intervention is equally effective at all ages. The fact that one could draw a straight-line through the gray 95% confidence interval in the plot above is consistent with this same conclusion. This plot depicts the data from intervention recipients ages 18 and younger.

In summary, this analysis shows overall improvement on literacy assessment scores for the majority of kids, and that the intervention is equally effective for children of all ages (with a mean improvement of 50% on the assessments).

Q3. To what extent do caretakers experience changes in reading skill?

To get insight into how the beneficiaries experienced the effectiveness of the program, the current data allow examination of changes in reading skills of both children and caretakers.

We again plot the literacy improvement (effect size) by age, this time including the caretakers, and demonstrate that the non-significant age trend remains the same if adult caretaker participants are also included according to the best-fit line and surrounding 95% confidence intervals.



This plot includes both child and caretaker data. Note the lack of data on the right of the plot below the 0 effect size line. This indicates that all caretakers in the sample experienced learning gains from the Project Backpack interventions.

The plot clearly shows greater learning gains for the caretakers overall (as indicated by no data below the 0 effect size line, which represents the literacy learning gains), despite no significant effect of age.

We note that it is likely inclusion of the caretaker data—if there were more of it—would create an apparent age-related learning gain effect, with older individuals appearing to learn more than younger ones. Data sparsity for individuals at older ages prevents us from reaching any strong conclusions, and we note that future analyses should take care not to assume a linear effect or utilize a linear best-fit if data from all ages of participants are analyzed together due to this possible categorical difference between child and adult literacy assessment improvement scores. We recommend child and caretaker data be analyzed separately for this reason.

In summary, every caretaker showed improved literacy assessment scores in this sample. Thus, both children and caretakers benefit from literacy improvements from the Project Backpack interventions.

Preliminary analyses summary

In conclusion, these plots show the Project Backpack interventions (1) yield overall positive improvements on literacy assessment scores, 2) are equally effective across children from 3 to 18, and 3) yield overwhelmingly positive improvements in literacy in caretakers as well as children.

Future suggested analyses

We additionally provide analysis plans to test whether students improve more than in other literacy programs and ‘business as usual’ (Q4).

Moreover, besides investigating *whether* the program works, it is also important to better understand *how* it works, and which factors could enhance or hinder its effectiveness. We propose analyses to test whether Project Backpack influences student attitudes towards reading (Q5). Furthermore, by combining assessment results with questionnaire data, it will be possible to study to what extent treatment effects are associated with certain family demographics, perceived parental engagement, and motivation for reading (Q6). A better understanding of the mechanisms that contribute to the program’s effectiveness could provide valuable insights for further development of the program.

Q4. What is the effectiveness of Project Backpack relative to other literacy programs and ‘business as usual’?

The best evidence for the project's effectiveness is when it outperforms other similar interventions in the same context. Around the same time of Project Backpack phase II, a partner in the camp provided small group literacy instruction to primary grade students. Small group literacy instruction is currently considered the most ideal approach for refugee education, but a challenge is that it requires a lot of manpower. As such, it provides a good comparison group to evaluate the effectiveness of Project Backpack, and to control for expectancy effects. In addition, this partner collected data in a no-contact control group, which provides an opportunity to compare Project Backpack against 'business as usual'.

To study this, we propose an analysis that compares the six literacy assessment scores of Project Backpack kids to those of kids receiving small-group literacy instruction and kids receiving no instruction. We also recommend an analysis to look at the impact of the different treatment conditions as a function of age, as the impact could be different depending upon the age of the child. This analysis could estimate effect size by kid by simply computing a difference score between the 6th and the 1st assessments, and then looking for a difference in change scores by age. The structure for both types of analyses are included in the R plotting script.

It is important to acknowledge that none of the kids in the treatment and comparison groups were in school due to Covid. Therefore, from these data it is not possible to draw any conclusions on the effectiveness of Project Backpack relative to 'schooling as usual'. Future data collection will make this comparison possible.

Q5. To what extent does the program affect students' attitude towards reading?

The current data also allow investigation of a change in students' attitude towards reading, once the verbal responses are converted to numeric values. Specifically, this could be examined using questions regarding students' enjoyment and the importance of reading (i.e., How do you feel when it's time to put away your book and do something else? Is reading important to you? Do you want to be a good reader?), which were included in both the entry and exit survey.

Q6. To what extent are treatment effects associated with family demographics, (perceived) parental engagement, and motivation for reading?

Available data allow investigation into a number of factors that might contribute to potential differences in learning gain, including

1. Family factors, including the number and ages of people in the household
2. (Perceived) parental engagement (i.e., Do your parents help you read in English? Do your parents encourage you to read more?)

3. Motivational factors, including reading pleasure (i.e., How do you feel when it's time to put away your book and do something else? For leisure, do you prefer reading more than other activities?) and perceived value of reading (i.e., Do you want to be a good reader? Is reading important to you?)

We propose the following analyses to address each of the above potential factors that may contribute to learning gains, once a larger set of data is available to test these hypotheses with:

1. Evaluate whether learning gains (Assessment score 6 - assessment score 1) are predicted by family household size using basic data visualization with 95% confidence intervals.
2. Whether either parental engagement measure predicts either overall final literacy assessment scores or learning gains, as tested through a simple barplot with 95% confidence intervals and one bar each for "yes" and "no" for each of the engagement measures. Non-overlap of the 95% confidence intervals will indicate significant differences between "yes" and "no" responses.
3. Whether quantitative motivational factors (questions with yes/no answers) predict significant differences in either overall final literacy assessment scores or learning gains, as tested through a simple barplot with 95% confidence intervals and one bar each for "yes" and "no" for each of the engagement measures. Non-overlap of the 95% confidence intervals will indicate significant differences between "yes" and "no" responses.

Considerations for data collection in the future

Future data collection and data analysis plans should consider both multiple comparison problems, and experimental designs best suited for detecting intervention efficacy. Specifically, future data collection should differentiate between a) providing evidence of the effectiveness of Project Backpack, and b) better understanding how it works, and which factors enhance or hinder its effectiveness.

1. Avoiding multiple comparison problems.

Future analysis plans should take care to avoid a multiple comparison problem. This is when multiple pairwise comparisons are performed simultaneously or in sequence. When multiple statistical tests are conducted on the same data set in this manner, it increases likelihood of obtaining false positive results (i.e., a Type I error). If you perform individual hypothesis tests for each pair of variables (e.g., t-tests), the probability of making at least one Type I error increases as you conduct more tests. This is because the probability of making a Type I error for a single

test is typically controlled at a specific level (e.g., 0.05 or 0.01), but when multiple tests are conducted, the cumulative probability of making a Type I error across all the tests increases.

To avoid the multiple comparison problem, we'd advise Pangea to employ one of the following methods:

- a. Limit the number of comparisons made on the same data set. Do not, for example, ask the same question multiple ways and only report positive results. Instead, pick one wording or, if the same question is asked multiple ways, combine that data and analyze it all together. Combining multiple related questions into one measure could be advantageous as it may increase sensitivity (because there are more points of discrimination) and help to average out potential measurement errors.
- b. Make the appropriate statistical correction for multiple comparisons. Examples include a Bonferroni correction, which is a method for adjusting the significance threshold for each individual test to compensate for the increased probability of false positives. The significance level (e.g., 0.05) is divided by the number of comparisons being made. For example, if you are conducting five tests, you would use a significance level of $0.05/5 = 0.01$ for each individual test. This approach is relatively conservative but guarantees control over the overall Type I error rate. Another example includes performing a Tukey's honestly significant difference (HSD) test. This is a post hoc test that can be used after performing an analysis of variance (ANOVA) to compare all possible pairwise differences between means. The test accounts for the increased probability of false positives by adjusting the critical value based on the number of comparisons being made.

2. Effectiveness of Project Backpack

To provide evidence for the effectiveness of Project Backpack, we recommend comparing learning gain (i.e., improvement on the assessment) with that of a control group, ideally in a randomized controlled trial. In addition, to get insight into how the beneficiaries experienced Project Backpack, it would also be informative to look into students' enjoyment, reading motivation, and perceived improvement.

Carefully consider the type of control group that is used:

- a. A passive control group shows how effective the intervention is relative to 'business as usual', and controls for test-retest effects (i.e., the possibility that students improve on the assessment simply because they do the same assessment multiple times). It is important to bear in mind that a passive control group does not take into account motivation and expectancy effects (i.e., the possibility that students show enhanced performance because they and/or the learning guides develop a certain expectation concerning improvement, akin to placebo effects in drug studies).

- b. An active control group shows how effective the intervention is relative to other interventions, while controlling for familiarity and expectancy effects. Ideally, the control intervention should be similar in content, but lack the characteristics that make Project Backpack unique (i.e., tablet-based education in families, including formative assessment). For example, Project Backpack could be compared with tablet-based literacy instruction in schools or in-person literacy instruction in families.
- c. Instead of using an active control group, the results of Project Backpack could also be contrasted with a very similar intervention that focuses on different skills. For example, students who train their literacy through Project Backpack could be compared with students who train their numeracy skills in a similar way.
- d. To assess the effectiveness of a particular aspect of Project Backpack, two different versions of the program can be compared, as was done in Project Backpack phase II. For example, the literature review suggests that it would be worth exploring whether certain aspects of peer tutoring can be incorporated in Project Backpack. To examine the added benefit of peer tutoring, it would be valuable to compare the effectiveness of Project Backpack with and without structured peer tutoring.

3. Insight into factors that enhance or hinder the program's effectiveness, with a specific focus on self-directed learning, parental guidance, and peer interaction

The literature review points to a number of topics regarding self-directed learning, parental guidance, and peer interaction that would benefit from additional research in the local context (refer to Deliverable 2). We recommend including questionnaires before, during, and after the program, and relate outcomes from these questionnaires to students' learning outcomes.

- a. To provide insights into whether and how students could be supported by their family members during learning, it will be valuable to investigate to what extent students engage in autonomous learning versus learning with family members, what type of interaction students have with their family members during learning, and how effective different types of interactions are for improving learning outcomes (see Deliverable 2). In addition, it will be informative to include a couple of open-ended questions asking students what they like about the interaction with their family members during learning, and what they feel is lacking. Caregivers could be asked about the challenges they perceive regarding the support of their children.
- b. To align the program more closely with students' interests, goals, and values, it will be informative to gain further insight into students' motivation to take part and to stay involved with the program (e.g., do they find the program meaningful, do they enjoy the apps and activities on the tablet, and do they experience pressure to take part in project Backpack?) and the challenges that they perceive.

It is important to bear in mind that, in data collection, sometimes ‘less is more’. Collecting excessive amounts of data may exhaust participants and consume valuable time and resources from the Pangea team. Moreover, by increasing the number of outcome measures, the probability of observing a significant effect by chance alone increases (as described above in point 1). Therefore, it is important to carefully consider what you would like to know, and why.

Data collection, storage, and structuring best practices

The R script combines existing assessment and survey data based on the listed name of the Project Backpack intervention recipients. Analyses could be streamlined through the following adjustments to data collection, storage, and structuring practices.

DATA COLLECTION

1. Test-retest considerations

- a. The number of assessments in each group should be the same across test and control groups.
- b. Assessments should contain similar, but not identical questions (which was already the case in Project Backpack phase II). Ideally, different versions of the assessment should be counterbalanced across participants (to take into account potential differences in difficulty), but this should be weighed carefully given the extra effort it takes, and the potential for errors. Our recommendation would be not to do this given the unique challenges of fieldwork and Pangea’s priorities and constraints.
- c. Use identical wording in each questionnaire (before/after the intervention) to make sure that you are testing the same construct.

2. Clarity considerations

- a. Keep questions concise and avoid asking about two or more issues within the same question. In general, the questions in the current survey are clear and brief. There are a few questions that require some attention. For example, the question “Do you or another caretaker teach or help your child to read in English?” seems to be asking several things at once. It is important to stay to-the-point and split the question into several separate questions if necessary.

- b. Beware of ambiguous questions. For example, from the question “Is knowing English important for your child?”, it is not clear whether this refers to whether the child finds it important or whether the parent finds it important.
- c. Be specific. For example, from the question “Are you a good reader?”, it is not clear what is meant by ‘a good reader’. Does the question refer to reading a book or reading letters and words? What does ‘good’ mean?
- d. Avoid biased questions.
- e. Include clear and appropriate answer options. If you are asking about a quantity (e.g., the number of children in the household), it is often more informative to ask for the exact number than in which category the number would fall.
- f. Use open-ended questions if you want to gain deeper insights into a certain topic and you are not certain about the answers that participants might give. Open-ended questions allow participants to provide more detail. Yet, beware that these questions take longer to answer, and are generally more difficult to analyze and report.

DATA STORAGE

1. Store keys with the data

Maintain a master document for each assessment or file that explains in detail what the file includes, column by column. Store this explanatory read-me in an organized way with the data.

2. Avoid employing csv columns with multiple tabs

These are harder to read in for analysis.

3. Ready-to-go philosophy

Store the data in a way that you can imagine zipping up one master folder and sending it with no additional explanation required to a data analyst to make sense of it.

4. Anonymizing participant information

Participants data should be stored in a way that their scores and demographic information are not tied directly to their name. Each participant should be assigned a unique identifier to tie their personal details and scores to their identities. This will help protect participants' privacy and also facilitate sharing the anonymized data with researchers who may be able to help and collaborate with Pangea with their analyses.

5. Data minimization

Collect less data. Only collect and store data that is necessary for testing your targeted hypothesis or directly relevant to Pangea's mission. Avoid collecting excessive or sensitive information that is unrelated to your objective, such as names of others in the household unless you intend to use this information. This will also help with data storage and data analysis efficiency.

6. Consent and transparency

Obtain documented informed consent from individuals before storing their data, and discuss with them the practices you will use to keep them safe. Clearly communicate the purpose of data collection, how it will be used, and any third parties involved.

7. Access control

Implement access controls to limit data access to authorized personnel only. Assign unique user accounts, passwords, and permissions to prevent unauthorized viewing, modification, or deletion of data, for example, by storing the data in a location where such access controls are possible, such as Google Drive.

8. Data retention and disposal

Establish clear policies on data retention periods. Avoid retaining data for longer than necessary and securely dispose of data when it is no longer needed.

9. Regular data backup

Maintain regular backups of stored data to prevent loss due to system failures, natural disasters, or other unforeseen events. Test the backup and recovery process periodically to ensure its effectiveness.

10. Staff training and awareness

Provide comprehensive training to staff members handling human data storage. Educate them about data protection laws, privacy practices, and potential risks. Encourage a culture of privacy awareness throughout the organization.

DATA STRUCTURING

1. Store participant data to enable merging and analysis

- a. Participant data to be analyzed is easiest to manage in a file where there is one line to represent all measures and demographics for a single person. To make this possible, one column value should uniquely identify a participant across different data files—for example, demographic information, assessment scores, and survey data. It is crucial that this value be (1) identical and consistent across all data files to be merged and (2) unique to the individual. If these two criteria are not met, the data cannot be merged effectively.
- b. Misspellings, typos, and nicknames in participant names can cause merger problems if this is the column value that is relied upon for merging data across participants. A better practice would be to create one csv or other database file that assigns participants a random unique identifier (some sequence of numbers and letters) to preserve their identity in the data files and also facilitate merger. Then the unique identifier should be used in place of their names across the data files. Care must be taken to ensure the correct identifier is used for each participant.

2. Likert scale data

- a. Questions that ask participants to quantify the degree to which they disagree or the frequency of events should be stored as numerical values (e.g., 1-7) to facilitate analysis rather than in the natural language format (e.g., “Always”, “Frequently”, “Sometimes”, “Never”). It is recommended to provide the verbal labels to the participants, and automatically convert these labels to numerical values during data collection. It is quite possible to convert word strings into numeric values later, but this transformation requires a relatively clunky fix and will result in inefficient data analysis, especially as Pangea scales.

- b. Repeated questions across time should take care to use the same likert scale options, both numeric values and wording, to facilitate comparison.

3. Informative-but-brief column names

- a. Rather than naming the columns numerically by question number (e.g., A2Q3b), or simply titling the column the entire string of the question (e.g., “How much do you enjoy reading?”), the best practice is to give the column a simple but informative name that needs to alteration before analysis (e.g. EnjoyReading).
- b. Column names should be chosen to avoid spaces and special characters, and be short enough to type repeatedly and easily for composing and performing analysis and plotting scripts.

4. Use redundancy strategically

- a. Avoid collecting data repeatedly that could be collected only once. For example, if you collect the birthday of a child, and you have the test date, you can compute the child’s age automatically without having to ask repeatedly and also have redundant data you have to manage in your data file.
- b. In some circumstances, you may wish to collect information more than once in order to validate this data. For example, if the age is crucially important, maybe you want to collect it multiple times to check to ensure that you have the right age of the child. However, avoid doing this for every piece of data you collect as sorting through and cleaning the data will be more difficult the more redundant data you have collected and stored. The scripts will also run less effectively the more redundant data you have in your master data file.

Deliverable 4: Scale-up Considerations

Introduction

Project Backpack began in 2019, exploring technology's potential in education. The project underwent several phases, each contributing to its growth. Phase I focused on autonomous learning, using technology and limited instruction to teach foundational literacy skills at home. Phase II responded to the COVID-19 pandemic, shifting focus to sequential phonics-based literacy for 224 children while measuring learning outcomes. Phase III aims to deepen scaling, optimize interactions with Learning Guides, and expand its reach. Throughout its journey, Pangea has learned, assessed, and adapted, seeking to harness technology for educational opportunities worldwide.

As Pangea looks to Project Backpack's future there is a core question around if and how the intervention should scale. Therefore, the LEAP fellows have sought to develop scale-up suggestions, based on literature review of similar projects. The LEAP Fellows have developed a two-part, simplified scale-up framework that builds from literature around scaling up of educational interventions in similar contexts:

1. Part 1 of the framework focuses on identifying what type of a high-level scale-up methodology the intervention may want to pursue (bigger, deeper and / or new).
2. Part 2 of the framework synthesizes the core necessary, but not sufficient elements, for scale, namely: an effective intervention, an effective implementation and an appropriate enabling environment.

The Education Scalability Checklist (ESC) was used to determine where Project Backpack currently sits within the scale-up framework and to highlight priority actions that Pangea can take to effectively scale the intervention. It should be highlighted that the ESC looks at the ease of scaling a particular education initiative, but not at the desirability or appropriateness of scaling²⁴.

The ESC is an Excel-based tool designed by VVOB, the Brookings Center for Universal Education, and others to support implementers, policymakers, and funders in scaling education initiatives. The tool identifies opportunities, constraints, and actions for scalability and encourages early usage to understand stakeholder needs better.

Pangea involved six stakeholders with diverse roles in a three-step ESC implementation process, including individual preparation with instructional videos, a group workshop discussing scale-up plans, and individual prioritization of identified actions. This approach allowed Pangea to create a prioritized list of actions for current and future plans.

The ESC tool, consisting of seven sections, facilitated agreement on Pangea's scalability status during a workshop built on prior individual assessments. Sixteen actions were developed during the workshop, which were later classified by their ease of implementation and impact.

As an output of the workshop, the LEAP fellows believe that Pangea's Project Backpack is currently well suited to scale-up using a 'bigger' scale-up approach. This approach involves Pangea leading the expansion of the intervention to more beneficiaries, either within Invepi or similar communities.

Furthermore, three recommendations are highlighted with details provided on how the Pangea team may wish to implement these recommendations:

- Recommendation 1: Develop a scale-up plan
- Recommendation 2: Develop a communications strategy
- Recommendation 3: Reduce the complexity of the intervention

Desirability and Appropriateness of Scaling

A presumptive question that was not investigated by the LEAP Fellows was, if it is appropriate and desirable for Project Backpack to be scaled. We recommend that Pangea interrogate this question before implementing scale-up recommendations.

Some questions that the team may wish to consider are:

1. **Why do we want to scale-up Project Backpack?** Key considerations in answering this question are the likelihood of increased reach to new beneficiaries, greater depth of impact for existing beneficiaries or the opportunity to leverage existing core competencies to provide new, cost-effective and highly impactful interventions to beneficiaries.
2. **What are the chances that scaling Project Backpack may lead to the deterioration of impact to either existing and / or new beneficiaries?** A key consideration in answering this question is the level to which current impact may be driven by a highly conducive enabling environment that may not be in place when scaling to new environments.

3. **What are the opportunity costs of the resources that may be invested in scale-up activities?** By this we mean, how would the resources be otherwise used if they were not being leveraged for scale-up activities. If these resources may be used more effectively for the existing intervention then scaling may not be optimal at this time.
4. **Are there risks of negative spillover effects if Project Backpack were to scale?** Some potential negative spillover effects include: increased inequalities among beneficiaries, negative effects on key political or other stakeholder relationships, inability to effectively support existing beneficiaries.

Pangea's current scale-up state

Project Backpack, initiated in 2019, aimed to explore the potential of technology in education. The project underwent several phases, each offering valuable insights and growth opportunities.

Phase I: Project Backpack - Autonomous Learning Foundation

This phase focused on using technology and limited instruction to help students learn literacy skills at home. Students engaged in project-based learning activities with group-based tablet use, continuous feedback, and adaptive software. High engagement levels were observed, with families averaging over an hour and 20 minutes on the iPad daily.

Phase II: Responding to the COVID-19 Pandemic and Measuring Learning Outcomes

The COVID-19 pandemic led to Phase II, which addressed school closures and stagnating literacy skills. This phase provided education for 224 children lacking access to learning resources, emphasizing sequential phonics-based literacy skill development. Despite the enthusiasm, concerns arose regarding learning outcomes. Consequently, Pangea initiated measurement activities to assess the effectiveness of the technologies. The continuous assessment led to 88% of students mastering letter knowledge and 55% becoming functionally literate within nine months.

Phase III: Deeper Scaling and Expanding Reach

Phase III aims to extend the project's impact by increasing device interaction time and optimizing interactions with Learning Guides. This phase intends to improve the feedback loop by offering a weekly continuous loop and introducing more tablets into homes. Success will be defined as students mastering reading skills and reading at grade level, with a vision of 100% of children achieving this standard.

The primary questions guiding this phase include:

- How else could a similar methodology be leveraged?
- How deep can the learning go?
- How can we get the intervention to more people?

Pangea's scale-up journey is characterized by continuous learning, assessment, and adaptation. Progressing through different phases, the project has addressed concerns, refined its methodology, and explored growth avenues. Pangea remains committed to harnessing technology to unlock unprecedented educational opportunities, ultimately benefiting learners worldwide.

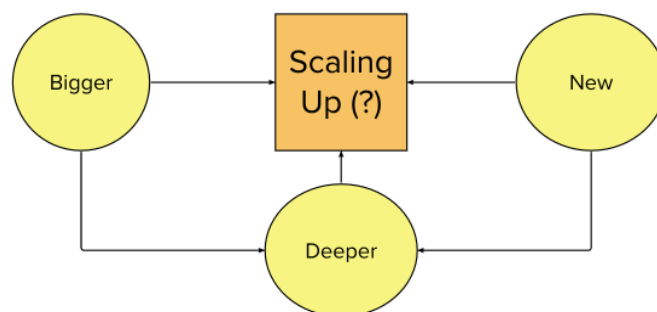
Simplified Scale-Up Framework

The LEAP Fellows have developed a two-part, simplified scale-up framework that builds from literature around scaling up of educational interventions. The purpose of this framework is to synthesize the literature around scaling and provide a structure to how Pangea can think about scaling of Project Backpack. For this reason, the framework aims to be as simple as possible, while encompassing the key elements that were identified from a range of sources on scale-up of similar education interventions in resource constrained environments. Please see **Annex D4.1: Scale Up Simplified Framework** recorded presentation.

Part 1: Type of Scale-Up

The first task when considering a scale-up plan is to clearly articulate the following:

- Why should the intervention be scaled up?
- What is the very specific intervention that Pangea wants to scale up?
- Who do you want to scale up to?



Within all of these questions there is a core assumption around what ‘scale-up’ actually means. There are various forms of scaling up that are better suited to different types of interventions, implementations and enabling environments^{25, 26}. Scaling-up can be thought of in three ways:

Type of Scale-Up	Approach	Application for Pangea’s Project Backpack
<p><u>Bigger</u> - Scale-up that leads to a bigger base of beneficiaries</p>	<p>This form of scale-up leverages economies of scale and preferably an intervention with low unit or variable costs.</p> <p><i>Example:</i> Pratham’s Teaching at the Right Level intervention has been expanded into Africa through a number of organizations including TaRL Africa.</p>	<p>If Pangea were to leverage a ‘bigger’ model of scale-up they would seek to reach more families in the existing Invepi community or other similar communities with largely the same Project Backpack intervention. The aim would be to increase the cost-effectiveness of the intervention and aim to maintain a similar level of impact to each of the beneficiaries.</p>
<p><u>Deeper</u> - Scale-up that leads to deeper impact for existing beneficiaries</p>	<p>This form of scale-up leverages a depth of understanding of the existing community and better understanding of the existing intervention (generally through data and evidence) to better serve existing beneficiaries.</p> <p><i>Example:</i> Youth Impact takes an innovative approach that is heavily evidence driven. They leverage connections with communities to experiment and innovate with new interventions.</p>	<p>If Pangea were to leverage a ‘deeper’ model of scale-up, they would continue to collect data and evidence on Project Backpack, iterate their intervention with the goal of driving deeper impact with existing beneficiaries in Invepi.</p>
<p><u>New</u> - Scale-up that leads to new interventions to either new or existing beneficiaries</p>	<p>This form of scale-up leverages economies of scope, partnerships and collaborations. The aim is to build off existing core competencies and networks to develop new interventions.</p>	<p>If Pangea were to leverage a ‘new’ mode of scale-up, they would identify partnerships that they may be able to leverage to provide new interventions to new and / or existing beneficiaries. One way Pangea could think about this is how the fixed assets (iPads in</p>

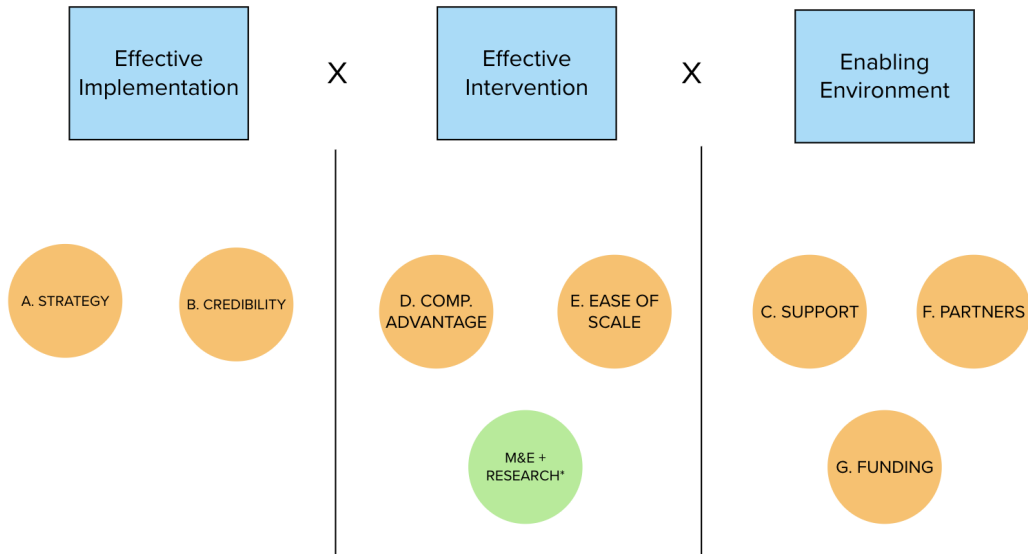
	<p><i>Example:</i> Educate Girls originally focused on a frontline worker based model targeted at encouraging out-of-school girls to re-enter the formal schooling system in India. They are leveraging their skills to implement a new intervention called Project Pragati. This is a mentor-driven intervention combining teaching, mentorship and re-entry into the formal schooling system.</p>	<p>particular) could be leveraged in other ways to drive cost-effective impact to the same or similar beneficiaries.</p>
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To be clear, these three types of scale-up are not mutually exclusive. A scale-up plan can leverage multiple types of scale-up, however the core competencies and strategy for implementing each of these approaches can be quite different.

We recommend clearly articulating what scale-up means for Pangea’s Project Backpack before developing a scale-up strategy and investing resources into scaling. Furthermore, when resources are constrained, it can be helpful to focus on a single type of scale-up.

Part 2: Characteristics Required for Effective Scaling

Once the type(s) of scale-up has been clearly articulated, the simplified scale-up framework highlights three characteristics that are each individually necessary but not independently sufficient to drive effective scale-up^{25, 26, 27, 28}. In other words, each of these elements should be in place to drive scale-up. The lack of any one of these elements is likely to severely hamper effectiveness of scale-up and strength in one characteristic cannot offset weakness in another characteristic.



Characteristic and Description	Mapping to ESC (see figure above and note that this mapping is not perfect as some elements straddle multiple characteristics)
<p><u>Effective Implementation:</u></p> <ul style="list-style-type: none"> Operational competency to implement an effective scale-up plan, Organization to create and sustain a hospitable environment for effective educational services, and Leadership to implement change management, allocate resource and resolve issues 	<ul style="list-style-type: none"> (A) Strategy: How convincing is the scaling strategy? (B) Credibility: Is the initiative credible? (<i>also relevant for Effective Intervention</i>)
<p><u>Effective Intervention:</u> The intervention in question should be evidence-backed and well-suited to scaling. Depending on the type of scale-up in questions, some interventions lend themselves more readily to scaling than others.</p>	<ul style="list-style-type: none"> (D) Comparative Advantage: Does the initiative have relative advantage over the current state of affairs and alternative solutions? (E) How easy is it for the initiative to be scaled up by Pangea and inside Invepi: <i>M&E + Research: Is the initiative built on high-quality development economics research and M&E?²⁹. (Note that this is not in the ESC Framework but has</i>

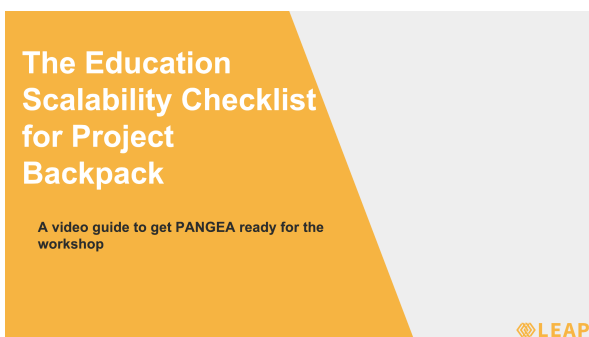
	<p><i>been considered by the LEAP Research Fellows in Deliverables 1, 2 and 3 of this document).</i></p>
<p><u>Enabling Environment:</u> The desired implementation environment should be well suited to scale-up, this includes considerations of political economy, funding availability and key partner collaboration interest³⁰.</p>	<ul style="list-style-type: none"> • (C) Support: How strong is the support for the initiative and the change it entails? • (F) Partners: How good is the fit between the initiative and the education system, particularly the adopting government institutions? (Given the limited government interactions for this intervention, data was not collected on this criteria.) • (G) Sustainability: Is there a sustainable source of funding?

Using VVOB Scalability checklist and running Pangea’s workshop

The Education Scalability Checklist (ESC) is an Excel-based tool designed by VVOB, the Brookings Center for Universal Education, and others to help implementers, policymakers, and funders assess and plan the scaling up of education initiatives. By identifying opportunities, constraints, and necessary actions, the ESC serves as a planning instrument to monitor and enhance the scalability of an initiative over time. It encourages early usage to prevent misconceptions and promote a thorough understanding of the needs of students, teachers, school leaders, and parents 24.

The ESC can be used internally by the originating organization, which develops and pilots the initiative, or in joint workshops with implementers, policymakers, and funders. To ensure commitment and success, decision-makers in scaling should participate in the assessment and planning workshops, incorporating diverse perspectives from leadership, field staff, and planning, monitoring, and evaluation staff 24.

In the case of Pangea, six stakeholders with diverse roles participated: the Board Chair, CEO, COO, Director of Mobile Libraries, a Mobile Librarian/Guide, and a researcher from a partner NGO. Please see **Annex D4.2: Scale-up Workshop Instructions** for concise instructions to implement this again. The ESC implementation was structured in three steps:



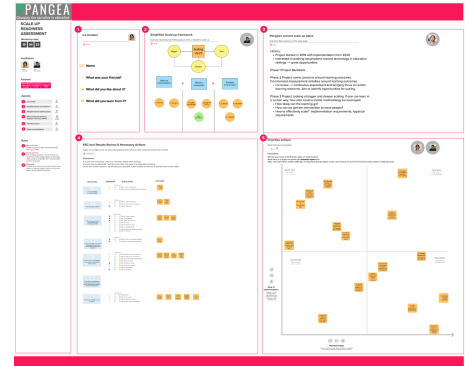
1. Individual preparation: Considering the global distribution of participants, an instructional video was prepared, and the ESC tool was adapted to Pangea's situation. The video provided an overview of Pangea's scale-up scenario and a detailed explanation of the ESC tool and its

questions to help each participant complete it. All responses were tallied before the workshop to identify areas of agreement and disagreement.

Please see **Annex D4.3: ESC-Individual Preparation Instructions** recorded video and **Annex D4.4: ESC-Individual Preparation_Full** for the Excel tool.

2. Group workshop: The workshop was held using Mural, a collaboration tool and was organized into three main parts:

- A review of the Simplified Scale-up Framework, based on scaling up literature.
- An explanation of Pangea's current scale-up plans from the CEO to ensure everyone had a shared understanding.
- A discussion on each question allowed participants to consider different perspectives, reach a consensus on Pangea's situation, and identify critical actions for improvement.



PRIORITIZATION EXERCISE:

Suggested actions to improve scale-up conditions of Project Backpack within Invepi

POTENTIAL IMPACT	EASE OF IMPLEMENTATION
If each of these tasks could get done without any difficulty or cost, which would have the most positive impact to improve PANGEA's situation to suggested methodology?	Regardless of their potential impact, which tasks are more difficult than others? (Cost, time, effort, complexity, etc.)
1. QUICK GRADE: Read each action and place a HIGH (High Impact), MEDIUM (Medium Impact), or LOW (Low Impact) next to each one. There are 16 actions so try to have an equal distribution across categories.	1. QUICK GRADE: Read each action and place an EASY (Easy to implement), MEDIUM (Hard to implement) next to each one. There are 16 actions so try to have an equal distribution across categories.
2. FINAL RANKING: Filter the actions by QUICK GRADE and rank them from 1 to 16. Number 1 will be the most impactful and 16 the least.	2. FINAL RANKING: Filter the actions by QUICK GRADE and rank them from 1 to 16. Number 1 will be the easiest to implement.

Model/Criteria	ACTION	POTENTIAL IMPACT		EASE OF IMPLEMENTATION	
		QUICK GRADE	FINAL RANKING	QUICK GRADE	FINAL RANKING
6. Is there a sustainable source of funding?	Align communication strategy with potential funders (e.g., M&D)	14	11	1b. MEDIUM	6
C. How strong is support for the initiative and the change to make?	Consider capacity to drive long-term, sustainable support	MEDIUM	14	C. HARD	15
C. How strong is support for the initiative and the change to make?	Develop a communication strategy for inside (e.g., M&D)	1b. MEDIUM	10	1b. MEDIUM	9
D. Is there a sustainable source of funding?	Develop a Prospecting List	6	6	C. HARD	12
D. How convincing is the scaling strategy?	Develop a Scale-Up Plan	1b. HIGH	1	1a. EASY	8
C. Is there a sustainable source of funding?	Develop handful of key digital assets	1b. MEDIUM	5	1a. EASY	1
D. Is the initiative credible?	Develop quantitative data "story" to showcase key outcomes	1b. HIGH	3	1a. EASY	4
D. How easy is for the initiative to be scaled up by PANGEA inside (e.g., M&D)?	Explore monitoring solutions (e.g., virtual options)	C. LOW	16	C. HARD	14
C. How strong is support for the initiative and the change to make?	Identification and nurturing of project champions and a "lead"	1b. HIGH	2	1b. MEDIUM	10
D. How easy is for the initiative to be scaled up by PANGEA inside (e.g., M&D)?	Identify operational constraints to scale up	1b. MEDIUM	8	1b. MEDIUM	7
D. How easy is for the initiative to be scaled up by PANGEA inside (e.g., M&D)?	Identify resources available for operational activities	C. LOW	15	1b. MEDIUM	5
C. Is there a sustainable source of funding?	Increase availability of resources (present and future)	1b. MEDIUM	13	1b. MEDIUM	11
D. How easy is for the initiative to be scaled up by PANGEA inside (e.g., M&D)?	Prepare business development plan (ownership and for a "lead")	4	4	1b. MEDIUM	8
D. How easy is for the initiative to be scaled up by PANGEA inside (e.g., M&D)?	Reduce the complexity of the intervention and documents	1b. MEDIUM	9	C. HARD	16
D. How the initiative have relative advantage over competitors of other and alternatives?	Research and understand the education alternatives best	1b. MEDIUM	7	1a. EASY	2
D. Is the initiative credible?	Storyboarding, adding more visibility around roadmap to lead	1b. MEDIUM	12	C. HARD	13


3. Actions planning: An Excel-based prioritization tool was developed for each participant to assess the impact and ease of implementation of the actions identified during the workshop. A quick instructional video was sent along with the tool to ensure clarity. These results were tallied to create a prioritized list of actions that Pangea could incorporate into its current and future plans.

See **Annex D4.5: ESC-Actions Prioritization Tool_Full** for the Excel tool.

Workshop results

The ESC tool consists of seven sections, and participants agreed on the project's current scalability status in the workshop but based the discussion on the prior individual assessment. This is the agreed upon status of Pangea, mapped within the Simplified Scalability Framework


Effective Implementation



A. How convincing is the scaling strategy?

- →Item 1: Is there a strategy or plan
- →Item 2: How similar or different is the scale-up setting?

While there is a basic scale-up strategy, it was concluded that a more explicit scale-up objective was necessary, especially regarding the project's expansion beyond similar settings.




B. Is the initiative credible?

- →Item 3: Is there robust evidence
- →Item 4: Independent external evaluation
- →Item 5: Visible impact

Pangea has always prioritized measuring results, and the staff agreed that the independence of each evaluation conducted was sufficient for their current purposes and budget. All evaluations demonstrated significant positive results.


Effective Intervention



D. Does the initiative have relative advantage over the current state of affairs and alternative solutions?

- →Item 14: Are the current solutions inadequate?
- →Item 15: Are we better than the alternatives?

Although there was a clear consensus on the inadequacy of the status quo, questions remained about alternative solutions being implemented. The knowledge of these alternatives seemed limited.




E. How easy is for the initiative to be scaled up by PANGEA inside Invepi?

- →Item 16: Infrastructure and human resources
- →Item 17: Departure from current practices
- →Item 18: Consistency with educational system
- →Item 19: Decision makers
- →Item 20: Initiative’s structure
- →Item 21: Initiative’s complexity
- →Item 22: Easy to monitor
- →Item 23: Easy to test

The ESC tool was modified to fit Pangea's current scale-up stage, focusing on the organization's capacity to scale up independently within Invepi. Staff agreed that scaling up would not involve additional complexity but require more resources. While monitoring results was time-consuming, it didn't pose a significant concern for most staff.

Enabling Environment



C. How strong is the support for the initiative and the change it entails?

- →Item 6: Problem’s magnitude
- →Item 7: Political agenda
- →Item 8: Potential target groups
- →Item 9: Urgency
- →Item 10: Influential supporters
- →Item 11: Leadership coalition
- →Item 12: Support from educators and key staff
- →Item 13: Opposition

While literacy and education outcomes are essential for the government, intergovernmental agencies, and participants, there was a debate about the level of support Pangea receives from these institutional actors. This was especially relevant considering the limited knowledge of government institutions about out-of-classroom education solutions.



F. How good is the fit between the initiative and the education system, particularly the adopting government institutions?

Since this one section focuses on integrating the initiative into the official government system, which is not Pangea’s current strategy, it was intentionally skipped.



G. Is there a sustainable source of funding?

- →Item 29: Costs
- →Item 30: Clear budget
- →Item 31: Easy to fund scale up
- →Item 32: Easy to integrate cost of scale up

Regarding budgeting and costs, the program relies on its partner's iPad donations. As long as this remains constant, costs aren't a primary concern for scaling up.

Takeaways and Action Recommendations

Status for Scale-Up Using Simplified Framework

Overall, Pangea’s Project Backpack appears to be well placed for scale-up. There were no major red-flags identified by either the Pangea team or the LEAP Fellow facilitators during the ESC workshop. Assuming that scale-up is appropriate and desirable for Pangea, the next question is what type of scale-up is best suited to Project Backpack.

If Pangea wishes to scale-up Project Backpack, we recommend a ‘bigger’ approach. This approach involves Pangea leading the expansion of the intervention to more beneficiaries, either within Invepi or similar communities. To come to this recommendation, the LEAP Fellows leveraged the framework developed by Management Systems International²⁶ which lists the following factors to consider when scaling:

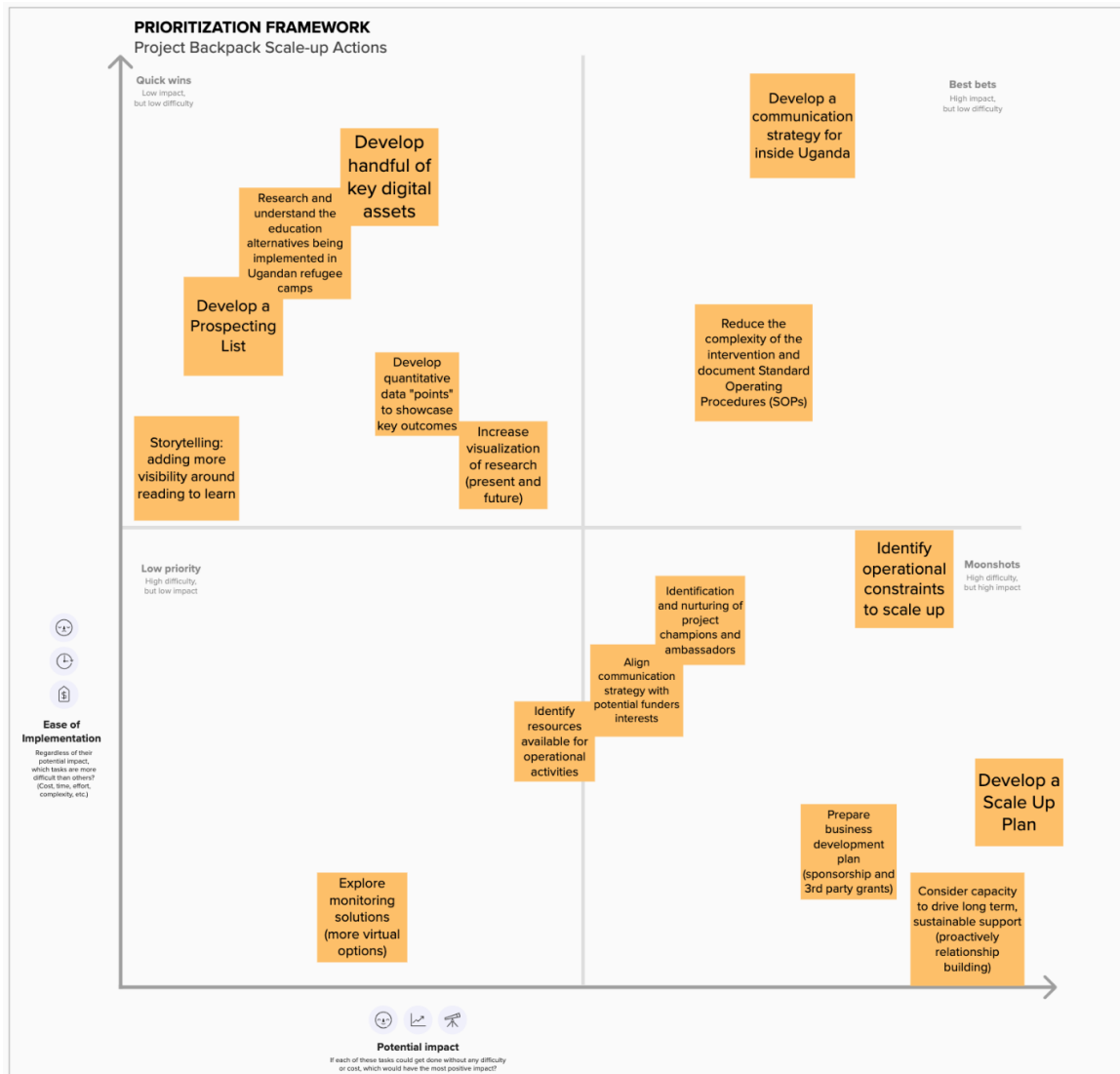
1. **Type of model:** Project Backpack is a technology intensive initiative meaning that variable costs are relatively lower. Therefore the intervention is more conducive to economies of scale - or a bigger approach to scale.

2. **Comprehensiveness of Model:** Project Backpack is relatively comprehensive meaning that it requires limited inputs from external stakeholders.
3. **Source of Financing:** Project Backpack is funded from external sources. This actually makes a bigger approach to scale more challenging.
4. **Availability of Formal Evaluation:** There is some availability for formal evaluation but due to the nature of the Imvepi environment, a large-scale RCT would be logistically difficult. Therefore expansion of the existing intervention is more attractive.
5. **Observability of Results:** It is somewhat possible to observe results from the intervention through formative and summative numeracy and literacy assessments. The long-term outcomes are more difficult to observe - such as changes in income, health and wellbeing or job opportunities. Less observable results lend an intervention to a bigger scale-up approach.
6. **Ease of Transfer to Other Organizations:** Pangea holds unique relationships with both iPad suppliers and beneficiaries which would make it difficult to transfer the Project Backpack intervention to other organizations. Therefore, scale-up is better led by Pangea as opposed to other organizations or government institutions.
7. **Quality of Governance:** The LEAP Fellows understand that the current governance structures around the intervention are quite limited. Therefore, it would make sense for Pangea to lead scale-up to other beneficiaries.
8. **Presence of NGO Networks:** It is understood that while there are other NGOs working in the community, very few if any are working in a similar area to Pangea's Project Backpack. Therefore, replication of the intervention by other NGOs would not be attractive.
9. **Social Homogeneity:** The LEAP Fellows do not have a good sense of the homogeneity of the potential beneficiaries who may be targeted if Project Backpack were to be expanded. If these new beneficiaries are demographically, socially and culturally similar to the current beneficiaries then this would lend to a bigger scale-up approach.

Please note that this recommendation should be critically reviewed by the Pangea team who have the closest understanding of the context for the current implementation of Project Backpack and future scale-up plans for the interventions.

Recommended Next Steps on Actions

During the workshop, the participants drew up sixteen actions and then later classified them according to how easy they were to implement and how impactful they were.



The LEAP Fellows have categorized the prioritized actions that the Pangea team brainstormed and identified some key themes. These themes have been mapped against the simplified, scale-up framework to highlight recommended actions that the team may wish to consider.

Effective Implementation

Recommendation 1: Develop a Scale-Up Plan

Ensuring that a solution to an educational problem can be delivered and sustained at scale requires a realistic assessment of the prospects and parameters for scaling, the changes needed to implement the initiative that addresses the problem at scale, and the challenges that stand in the way²⁴.

Scaling up is easier when there is a strategy or plan for it, that represents a consensus among actors around:

1. What is being scaled (e.g., the core components of the initiative);
2. The scope of the intended scale-up (e.g., geographies, breadth/depth of services and target groups) and expected benefits;
3. Who will have the responsibility for taking the initiative to scale, delivering it at scale (e.g., government institutions, NGOs, private sector or a combination of these);
4. What are the phases and timelines for scaling;
5. Who will have responsibility for funding the transition to scale and ongoing service delivery.

Guidance on the different tasks involved in building a full-blown scaling strategy can be found in MSI's Scaling Up – [From Vision to Large-Scale Change: A Management Framework for Practitioners](#)²⁶.

We have also developed a Scale-up Plan Template for Pangea, that follows the logic of our Simplified Scale-up Framework. See **Annex D4.6: Scale-Up Template**.

Recommendation 2: Develop a Communications Strategy

Pangea's leadership team highlighted several actions that could be synthesized within a single, holistic communications strategy for Project Backpack. There are many ways to develop a communications strategy, however here we provide details on a three-phase approach that is built on a framework developed by [Studio Subu](#) (a communications consultancy that focuses on non-profit communications):

1. **Phase 1:** Develop a Communications Toolbox - the purpose of this phase is to consolidate the key 'lego pieces' that can be combined to prepare a wide variety of communication outputs. These pieces will be either static or dynamic in nature and will be either words or visuals. The table below summarizes the key 'lego pieces' that would form the toolbox. These should be organized in a single document (guide book) so that

relevant team members can access them when they wish to prepare a communications output.

	WORDS	VISUALS
STATIC	<ul style="list-style-type: none"> Brand Narrative Program Narrative Voice/Tone/Language Vision/Mission Writing Style Culture/Philosophy About/Journey 	<ul style="list-style-type: none"> Logo Typography Colours Design Elements <ul style="list-style-type: none"> • Illustrations • Shapes/Icons • Diagrams
DYNAMIC	<ul style="list-style-type: none"> Data Points Insights Stories Testimonials 	<ul style="list-style-type: none"> Photos Mini Video-clips Long Videos

2. **Phase 2:** Develop a Communications Hygiene Kit - the purpose of this phase is to prepare a set of communications collateral that are often used by the team. It is recommended that the toolbox elements are used to prepare the elements that make up the hygiene kit.

BASIC HYGIENE KIT

<ul style="list-style-type: none"> Brand Toolbox (Guide Book) Deck (Presenting/self-read) Website Short 1 Panel Handout (Print/digital) 2-3 Panel Handout (Print/digital) Detailed Long-format Report (Print/digital) 3-4 Story Cards 15-20 Diverse Set Of Photos 2-3min Video

3. **Phase 3:** Prepare a Communications Strategy using the GAME approach - the purpose of this phase is to identify additional communication priorities for Project Backpack that go over and above the collateral elements prepared in the Hygiene Kit. An approach for identifying is using the following GAME approach:
 - a. Goal: clearly articulate the goal of communications for Project Backpack and how each of these goals will help the team pursue its mission and vision.
 - b. Actional Ideas: brainstorm tangible ideas for how to pursue the various goals.

- c. Metric to Prioritize: prioritize the ideas using 2 x 2 framework, with criteria one focused on how relatively hard or easy it would be to implement the idea and criteria two focused on how high or low potential impact would be if the idea were implemented successfully. After prioritizing, identify 3 to 5 ideas and break them into big (would take more than a month to implement) and small (less than a month to implement) ideas.
- d. Execution Plan: prepare a gantt chart to implement the ideas, identify project champions, key outcomes etc.

Effective Intervention

Recommendation 3: Reduce the complexity of the intervention

The Pangea leadership team identified that reducing the complexity of the intervention and better documenting the standard operating procedure (SOPs) could support scale-up. Additionally, it was noted that it would be helpful to identify internal and external resources that could be available to support operational activities.

One approach to systematically think about simplifying the intervention would be to prepare a [Theory of Change or logframe](#) of the current intervention. Once the team is happy with this model, each of the links of the model can be interrogated to determine how necessary it is to drive the final desired impact of the intervention. Through this process, high and low priority elements of the intervention can be identified. Focus can be placed on the low-priority elements of the model and interrogated to see if they may be necessary or not. Pilot tests can be run where certain elements of the intervention are removed.

Annexes

Annex D4.1: Scale Up Simplified Framework. This recorded PPT plays like a video and is intended to be seen by Pangea's team. It covers the Simplified Scale-up Framework, the ESC tool workshop, Pangea's results, and our recommendations for future actions.

Annex D4.2: Scale-up Workshop Instructions. This document provides concise instructions to implement the three moments around the ESC tool.

Annex D4.3: ESC-Individual Preparation Instructions. This recorded PPT plays like a video and guides Pangea's team while doing individual evaluations in the ESC Excel tool.

Annex D4.4: ESC-Individual Preparation_Full. This is an Excel tool adapted from VVOBs ESC. It has a Tab to aid in tallying future implementation results. It currently contains Pangea's team results.

Annex D4.5: ESC-Actions Prioritization Tool_Full. This Excel tool allows the team to prioritize the resulting actions from the workshop according to their impact and ease of implementation. It currently contains Pangea's team results.

Annex D4.6: Scale-Up Template. This concise Scale-up template follows the logic of our Simplified Scale-up Framework.

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