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Research Paper

# Bridging Learning Gaps in Urban Communities: Insights from a University-Led Tutoring Program

Widyoretno Adiani[1]*

[1]Parahyangan Catholic University, Indonesia

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**Abstract**

University-led tutoring programs can bridge academic knowledge and local needs in densely populated urban areas where children may have limited access to structured academic support outside school hours and may experience anxiety toward mathematics and English. This paper reports a service-learning-based community education initiative implemented in Bandung Wetan, Bandung City, Indonesia, and highlights program insights relevant to replication. The program delivered free weekly tutoring in mathematics and speaking-focused English for three months (3 February–29 April 2017) at a community hall, using differentiated grouping (elementary grades 1–3, grades 4–6, and junior secondary) and weekly informal mentor reflection meetings. Materials were aligned with Indonesia's Revised 2013 Curriculum and emphasized interactive practice, short quizzes with low-cost rewards, and supportive feedback. Average attendance was approximately 21 children per session, expanding through peer-driven participation and family-based spillover. Results suggest that low-anxiety, interactive activities can strengthen willingness to attempt answers and communicate learning difficulties, enabling more actionable weekly adaptation of materials. Participation patterns indicate that sustainability depends not only on instructional quality but also on environmental and social factors: rainfall and peer-dependent attendance influenced elementary participation, whereas junior secondary engagement was more stable and need-driven. An unplanned pre-elementary subgroup was accommodated when mentor capacity allowed, though outcomes were inconclusive due to inconsistent attendance. Overall, findings support a feasible, adaptable model for university-led tutoring in similar urban community contexts.

**Keywords** *Service-Learning, Community-based Education, Mathematics Anxiety, Foreign Language Anxiety, Urban Community Engagement, Play-based learning*

## INTRODUCTION

In many densely populated urban communities, children's formal access to schooling does not necessarily translate into equitable access to meaningful learning support beyond the classroom. University-led community service can serve as a bridge between academic knowledge and local community needs, particularly in densely populated urban areas where children may have limited access to structured academic support outside school hours. Research consistently shows that socioeconomic disparities influence access to enrichment opportunities, learning resources, and parental academic support, which in turn affect academic achievement (Sirin, 2005; OECD, 2012). This pattern is consistent with broader evidence showing that children from lower socioeconomic backgrounds may experience substantial learning gaps; for example, students from the poorest households have been found to experience learning losses equivalent to approximately two years of schooling (Hata et al., 2024). Such disparities highlight the importance of providing accessible learning support beyond formal schooling, particularly in foundational subjects such as mathematics and English, which are often perceived as difficult.

From Ashcraft and Krause (2007) to Barroso et al. (2018), research highlights how mathematics is often associated with math anxiety, defined as feelings of tension and apprehension that interfere with number manipulation and problem solving. Similarly, English as a foreign


Corresponding author's email: adianiwidyoretno@gmail.com

language can trigger foreign language anxiety, characterized by fear of negative evaluation and communication apprehension (Horwitz et al., 1986). Negative early learning experiences in these subjects may reduce learners' motivation and willingness to participate actively.

At the same time, competence in mathematics and English is widely recognized as critical for long-term educational and socioeconomic mobility. Mathematical literacy is strongly associated with problem-solving ability, employability, and national economic growth (Hanushek & Woessmann, 2008; Maloney & Beilock, 2012; OECD, 2016). English proficiency, as a global lingua franca, enhances access to higher education, international knowledge networks, and labor market opportunities (Crystal, 2003; Graddol, 2006). Therefore, providing supportive, low-anxiety learning environments in community settings may contribute not only to short-term academic confidence but also to longer-term human capital development.

To address these challenges, the Student Association of the Mathematics Study Program at Parahyangan Catholic University, Indonesia, initiated MATHCARES 2017, implemented in a high-density neighborhood in Bandung Wetan, Bandung City. The program adopted the theme "CLOSER", which framed community service as a process of bringing academic knowledge into closer alignment with everyday community needs. In this sense, "CLOSER" referred not only to physical proximity, through the placement of learning activities in a community space, but also to relational and motivational proximity, by creating a welcoming learning atmosphere that reduced fear of failure and encouraged children to engage more confidently with mathematics and English. The theme further emphasized the idea of knowledge circulation, namely that disciplinary expertise developed in higher education should not remain on the campus but should be translated into socially meaningful support, especially for communities with limited access to learning resources beyond school.

The initiative also aligned with the institutional ethos of Parahyangan Catholic University, reflected in its motto "*Bakuning Hyang Mrih Guna Santyaya Bhakti*" ("Based on divinity, pursuing knowledge to be devoted to society"). In the context of MATHCARES, this ethos was interpreted as an obligation to pursue knowledge with wisdom and compassion, and to apply one's expertise through concrete service consistent with one's field of study (Parahyangan Catholic University, 2017). Accordingly, MATHCARES positioned mathematics and English mentoring not merely as academic tutoring but as empowerment-oriented engagement to expand children's learning opportunities and support their long-term aspirations.

Building on this ethos, MATHCARES 2017 addressed two persistent learning challenges in community settings: limited access to academic support outside school and the perception of mathematics and English as intimidating subjects. The program combined school-aligned mathematics mentoring with play-based English learning activities, supported by differentiated grouping and child-friendly facilitation. Beyond content mastery, MATHCARES emphasized participation, creativity, and confidence in learning as immediate foundations for building longer-term aspirations. This paper presents the program design, implementation process, and immediate outcomes of MATHCARES 2017, and draws practical lessons for university-led, community-based education initiatives. It further highlights key enabling elements that support replication, adaptation, and scaling in other urban community settings.

## METHOD

### Methodological Approach

This community service activity employed a service-learning model, implemented as a community-based education program. Service-learning is commonly described as experiential education that addresses community needs while integrating learning and reflection to generate both service outcomes and learning outcomes (Furco, 1996). Reflection serves as a key mechanism

that connects service experiences to learning and continuous improvement (Bringle & Hatcher, 1999). In MATHCARES 2017, the service component was implemented as free weekly tutoring and mentoring in mathematics and English, while the learning component for mentors was facilitated through session preparation, facilitation practice, and weekly informal reflection meetings to review progress and refine subsequent sessions.

**Setting and Schedule**

MATHCARES 2017 was conducted in a densely populated neighborhood in Bandung Wetan, Bandung City, Indonesia, using the community hall to maximize accessibility and reduce participation barriers. Sessions were held once per week on Saturdays (midday–afternoon) over three months (3 February–29 April 2017), with the closing ceremony held on the last day of activity.

**Participants, Recruitment, and Participation Dynamics**

The target participants were children aged 6–15 years (elementary to junior secondary level). Initially, information about the program was disseminated through the local neighborhood leader (RT), who communicated it to parents in the area with children within the targeted age range. Over the three-month implementation period, the program recorded an average weekly attendance of approximately 21 children across all groups combined. Attendance, however, was not equally stable across groups, with elementary-level participants showing greater fluctuation than older learners. Over time, the number of participants also increased through peer-driven participation, as some children joined after observing friends of a similar age attending in previous weeks or were encouraged by their parents after noticing neighboring children taking part in the activity.

**Grouping and Mentor Allocation**

Participants were grouped by school level to ensure age-appropriate instruction: Elementary grades 1–3, elementary grades 4–6, and junior secondary. Mentors were assigned separately for each group, with differing instructional emphases: younger groups received more play-based learning and interactive activities, while junior secondary group sessions emphasized more structured tutoring and academic consultation. During implementation, mentor allocation was adjusted in response to group size. For the elementary groups, which tended to have the largest number of participants, additional mentors were assigned to provide more responsive support. A lead mentor remained responsible for explaining the topic at the start of sessions, while additional mentors circulated to address questions immediately and prevent learning delays.

**Curriculum and Instructional Procedures**

***Mathematics (school-aligned, by level)***

The mathematics curriculum was aligned with commonly taught school topics and adapted at the group level. Examples included:

a. Elementary grades 1–3: multiplication and division; introductory geometry.
b. Elementary grades 4–6: multiplication/division operations with increased complexity; more advanced geometry.
c. Junior secondary level: algebra, geometry, statistics, and problem-solving tasks.

Sessions generally followed a sequence of concept explanation, guided practice, and short quizzes. Quizzes were accompanied by light snack rewards as a low-cost motivational strategy to encourage active participation. The instructional materials, including explanations, practice exercises, and quizzes, were developed in alignment with Indonesia's Revised 2013 Curriculum (*Kurikulum 2013 Revisi/K13*), which is widely implemented in Indonesian schools, to ensure

relevance to participants' formal learning content.

***English***

English instruction was designed to prioritize speaking practice within a low-anxiety learning environment. Because the program prioritized creating an enjoyable learning environment, English mentoring did not emphasize passive learning (e.g., extended writing/reading exercises) or explicit grammar instruction. Instead, English learning emphasized speaking through short quizzes, daily conversation practice, and interactive prompts. Mentors provided spelling corrections when needed, but delivered them in a relaxed, supportive manner to maintain learners' willingness to speak, even when answers remained inaccurate.

***Responsive tutoring for older learners***

In addition to planned materials, junior secondary-level participants sometimes requested support with school homework and tasks, indicating that the program also functioned as a flexible academic support space.

**Reflection and Iterative Program Adjustment**

Reflection was conducted weekly in an informal format through brief meetings with the mentor. The reflection focused on reviewing quiz results and mentors' observations of participants' enthusiasm and engagement. Outputs from reflection informed iterative adjustments during the three-month implementation. Examples included (1) modifying the delivery of explanations to improve participant understanding and (2) increasing mentor capacity in groups with higher attendance by adding supporting mentors to handle questions during the session more effectively.

**Data Collection and Outcome Reporting**

Data collected included (1) quiz results and (2) mentors' observational notes from the groups they facilitated, focusing on participation and learning engagement. For recognition at the closing ceremony on the final day of activities, "active participation" was defined as children who frequently responded to quizzes and consistently engaged in explanations and discussions. As MATHCARES 2017 was designed as a community service program rather than a controlled study, outputs and immediate outcomes are reported descriptively, including attendance patterns, differentiated delivery, engagement indicators, and end-of-program recognition.

**Ethics and Community Permission**

Prior to implementation, the MATHCARES team met with the local neighborhood leader (RT) to request permission to conduct the activities in the community hall, which was selected because it was familiar and easily accessible to participating children and their parents, while also providing a sufficiently conducive setting for the planned learning activities, including the use of teaching materials, a whiteboard, quizzes, and games. Following community approval, the local neighborhood leader informed residents about the program. Consent for children's participation was obtained verbally through community communication, and some parents were present as observers during sessions. No personal identifiers of participating children were collected or reported in this manuscript.

**RESULT**

**Program Participation and Attendance**

During the three-month implementation period, MATHCARES engaged children aged 6–15 years, with an average of approximately 21 participants per session across all study groups. At the

initial stage, program information was communicated through the local neighborhood leader, and the team anticipated that participation would increase over time through word-of-mouth, particularly as children saw their peers, siblings, or other neighborhood children taking part. This pattern was indeed observed during implementation. However, an additional factor that had not been fully anticipated was the role of repeated indirect exposure through the choice of venue. Because the activities were conducted in a familiar community space that residents regularly passed by, parents and children were able to observe the program on an ongoing basis. This repeated visibility appeared to contribute meaningfully to the gradual expansion of participation over time.

Notably, beyond the planned participant range, an unanticipated pre-elementary subgroup (Group 0) emerged during implementation. This group included children of varied ages, although most were already enrolled in early childhood education (PAUD). Their attendance was typically prompted by family proximity; for example, younger children accompanied older siblings who participated or joined after their mothers observed the sessions. While the number of pre-elementary participants was small and did not appear consistently each week, their inclusion was accommodated when mentor capacity allowed, with learning activities adapted to early literacy and numeracy readiness. Overall, the program maintained multi-age engagement in an open community setting, indicating accessibility, family-based spillover participation, and social attractiveness as key enabling conditions.

**Participation Challenges and Attendance Variability**

Despite the program's accessibility, attendance was influenced by external and social factors. Weather conditions (e.g., rainfall) affected weekly attendance, reducing the number of participants who were able or willing to attend outdoor community-based sessions. In addition, participation among elementary-age children showed peer-dependent variability: attendance increased sharply during certain mid-period weeks when peer groups attended together, but participation also decreased in particular weeks when key peers were absent, as children were less motivated to attend without friends. Notably, this pattern persisted even though all participants, both the elementary-age and junior secondary group, received small snacks at the end of sessions in addition to quiz-related rewards, suggesting that peer companionship outweighed material incentives as a driver of attendance for this age group.

**Figure 1**. Play-based learning activities (participants' faces have been blurred to protect privacy)

By contrast, attendance in the junior secondary group was relatively more stable across weeks, as participation appeared to be driven less by peer presence and more by academic need.

This was reflected in learning behaviors during practice activities: junior secondary participants tended to work independently on exercises without requiring repeated prompts, with mentors primarily facilitating clarification and supporting problem-solving when questions emerged. Overall, these patterns suggest that sustained engagement in voluntary community learning programs is shaped not only by program quality but also by environmental constraints and age-related differences in motivation and peer-group dynamics.

**Outputs Delivered**

The program delivered regular learning support through mathematics and English activities across groups. Mathematics support reinforced school-related topics through short practice and quiz tasks, while English activities emphasized communicative practice through interactive prompts and games. Furthermore, although the pre-elementary group (Group 0) emerged unexpectedly during the program, the MATHCARES team promptly recognized its presence, even though the program had initially been designed only for elementary- and junior secondary-level participants and instructional materials were prepared accordingly, as described in the previous section. Therefore, following the observation and reflection meetings, the team made the necessary adjustments to accommodate the needs of this additional group and include them in the activities.

Learning activities for Group 0 were therefore differentiated according to the children's developmental readiness. For those who were able to read and write, mathematics practice focused on foundational numeracy, such as basic addition and subtraction. However, for children who had not yet developed basic literacy and numeracy skills (i.e., were not yet able to read, write, or perform simple arithmetic), activities emphasized early writing practice (e.g., guided letter formation, tracing, and copying simple words) and were integrated into playful tasks to maintain engagement. For junior secondary participants, sessions also served as an academic consultation space, where learners brought school assignments for guidance beyond the planned lesson.

**Immediate Outcomes from Quiz Results and Mentor Observations**

Immediate outcomes were documented using session-level quiz results and mentors' observational notes. Across sessions, mentors consistently observed high engagement during quiz- and game-based components, as evidenced by frequent attempts to answer questions and greater willingness to respond even when participants were uncertain. Over the three-month period, mentors also observed that increasing mentor–participant rapport supported more open communication, particularly among elementary-level learners. As children became more comfortable with their mentors, they showed greater willingness to express their opinions and to articulate specific points of confusion in both mathematics and English. This marked an important shift, particularly among elementary-level participants, who had previously tended to disengage when they did not understand the material or quiz items, as reflected in behaviors such as refusing to respond, sulking, or distracting their peers. The openness made the weekly evaluation more actionable and facilitated adaptive refinement of learning materials based on learners' expressed difficulties.

For the elementary-level participants, the rapport developed with mentors appeared to make them more expressive and confident in communicating their learning progress. Some children, for instance, proudly stated that they were able to answer mathematics questions at school because they had already encountered similar material during the sessions. In the English component, the materials were designed to be practical and delivered in an enjoyable manner through activities such as the game Hangman. Although participants initially demonstrated varying levels of English proficiency, observations over the three-month period indicated overall

improvement among the elementary group, particularly in basic English communicative skills, including the use of everyday vocabulary and the ability to convey simple information such as stating the day and introducing oneself. By the end of the program, the gap in ability appeared less pronounced, particularly among children who attended the sessions consistently from week to week.

**Figure 2**. Mentoring activity with the elementary group (participants' faces have been blurred to protect privacy)

Mentors further observed that a supportive facilitation style helped maintain learners' confidence during correction, particularly in English-speaking practice. For junior secondary participants, repeated homework-related inquiries suggested perceived usefulness of the mentoring relationship and increased comfort in asking academic questions in a non-formal environment. Notably, week-to-week changes were particularly evident in the junior secondary group's English component: participants gradually demonstrated greater confidence in initiating everyday English conversations with mentors and in delivering responses more accurately.

**Figure 3.** Mentoring activity with the junior secondary group (participants' faces have been blurred to protect privacy)

However, the interpretation of outcomes for the pre-elementary group (Group 0) was limited. Attendance in this group was highly fluctuating, and the number of participants was the smallest among all groups, resulting in the shortest and least consistent exposure to the program. Instruction for Group 0 primarily focused on foundational early literacy and numeracy activities: children who were ready practiced basic skills such as simple addition, while those who had not yet developed basic reading and writing skills were supported through early writing practice (e.g.,

writing numbers and letters). Although mentors observed progress (e.g., some children demonstrating the ability to perform simple addition), these observations were insufficient to draw firm conclusions due to limited contact time and inconsistent participation compared with the other groups.

**Program Closure and Recognition**

On 29 April 2017, participants received certificates of participation, and additional recognition was given to children who were categorized as active and consistent. Recognition functioned as a symbolic reinforcement for sustained engagement and participation during learning activities.

## DISCUSSION

### Positioning the Findings Within Urban Learning Inequality and Access Gaps

This community-based tutoring initiative was designed in response to a common challenge in densely populated urban areas: children may have limited access to structured academic support outside school hours, and learning opportunities are often unevenly distributed across socioeconomic contexts. Contemporary international evidence continues to show that educational outcomes are patterned by socioeconomic background, and that equity remains a persistent concern in many systems. OECD (2018) reports that equity and learning outcomes consistently indicate that performance is related to students' socioeconomic circumstances, and that disadvantaged learners often face compounded barriers to achievement and engagement. In this context, a free, neighborhood-based program can be understood as a practical access intervention that reduces barriers to cost, distance, and formality, while attempting to reshape how children experience "difficult" subjects such as mathematics and English.

The findings indicate that the program sustained multi-age engagement, with an average attendance of 21 participants per session, and created a learning environment that was both accessible and socially appealing to neighborhood children. More importantly, the three-month program highlighted and confirmed that learning gaps in densely populated urban communities should not be understood simply as a reflection of children's individual ability (Sirin et al., 2005). Rather, the observed disparities point to unequal access to learning reinforcement beyond formal schooling, including limited access to private tutoring, books, supportive home learning environments, and other educational resources that are more readily available in better-resourced settings.

In this sense, the program brought into view a critical educational reality: some children in densely populated urban areas have formally entered the school system, yet their learning needs remain insufficiently supported, particularly in relation to academic foundations, self-confidence, and personalized guidance. Formal schools may not always provide intensive individual mentoring, families may face constraints in offering sustained academic support, private tutoring is often unaffordable, and communities do not necessarily have accessible learning facilitators. The relevance of the program, therefore, lies not only in delivering supplementary instruction but also in helping to bridge this gap in learning support.

At the same time, attendance patterns remained dynamic, shaped by contextual factors such as weather conditions and peer-group influence (Kindermann, 2007). These findings underscore an important consideration for university-led community education: program quality alone is not sufficient to ensure stable participation. Environmental constraints and social dynamics can significantly affect attendance patterns and, consequently, the reach of the intervention. Evaluating the effectiveness of such community service initiatives, therefore, requires an ecological perspective, one that understands participation as the outcome of both program design and the

broader social and environmental conditions in which the program is implemented.

**Reducing "Intimidating" Subjects Through Low-Anxiety Design**

A central theoretical problem raised in the introduction is that mathematics and English are often perceived as intimidating, with negative early learning experiences reducing motivation and willingness to participate actively. The program's observation-based outcomes align with a substantial body of evidence showing that anxiety is strongly associated with lower achievement and avoidance behaviors. Meta-analytic work on mathematics anxiety confirms a robust negative association between math anxiety and mathematics performance among school-aged learners, and highlights that this relation can vary with grade level and task characteristics (Namkung et al., 2019). Likewise, foreign language anxiety is often associated with lower self-efficacy and reduced willingness to communicate, which can hinder participation in speaking activities.

From a psychological and relational perspective, the three-month program highlighted the extent to which fear and embarrassment can shape children's engagement with learning. In densely populated urban settings, children often learn in environments that are crowded, socially competitive, and constrained in terms of individual attention. In such contexts, difficulties in mathematics and English may stem not only from the cognitive demands of the subjects themselves, but also from fear of making mistakes, reluctance to ask questions, and the perception that these subjects are beyond one's ability.

Within this setting, university students appeared to occupy a valuable position as near-peer mentors. Because they were less formal than school teachers and less socially distant than lecturers, they were able to build rapport with children more easily. Their contribution, therefore, extended beyond the delivery of academic content. A central value of the program lay in its capacity to create a learning environment that felt safer, more interactive, and more supportive of repeated attempts, thereby helping to transform learning from a potentially stressful experience into a more approachable one.

This was reflected in mentors' repeated observations of high engagement during quiz- and game-based activities, in which children frequently attempted to answer questions and showed a greater willingness to respond even when uncertain. Such a pattern is consistent with the principle of low-stakes participation: when learning activities are brief, interactive, and socially supportive, the psychological cost of trying and of being wrong is reduced. For learners experiencing anxiety, this is especially important, as fear of failure can lead to withdrawal, silence, and passivity, particularly in mathematics problem-solving and foreign-language speaking. In this regard, the program's emphasis on friendly facilitation and supportive correction appears to have functioned as an anxiety buffer, enabling children to participate more openly without anticipating negative judgment.

**Formative Processes and Why Weekly Quizzes Helped Adaptation**

Beyond motivation, the weekly use of practice and quizzes created a practical formative feedback loop. Modern formative assessment research emphasizes that the power of assessment lies in its pedagogical use, eliciting evidence of learning, interpreting it, and acting on it to adjust teaching in ways that move learners forward. Black and Wiliam's (2018) later work explicitly situates formative assessment within a broader theory of pedagogy and highlights the importance of how feedback information is used instructionally. In MATHCARES, the weekly informal reflection meetings used quiz outcomes and mentor observations as actionable signals, supporting changes in delivery and mentor allocation. This is a meaningful "continuous improvement" mechanism, especially in informal learning environments where participant readiness varies widely and attendance is not guaranteed.

An important result from mentor observation was that increasing mentor–participant rapport made weekly evaluation more actionable: elementary learners became more able and willing to articulate what they did not understand, including identifying where confusion occurred. This matters for adaptation. A common obstacle in tutoring is not simply that children "do not understand," but that they cannot diagnose their misunderstanding, and may be reluctant to admit confusion. When rapport and psychological safety grow, children are more likely to communicate their learning gaps, enabling mentors to refine explanations and tasks more precisely. In practical terms, this makes the program's reflection cycle more accurate: the "data" are not only quiz results but also clearer learner feedback.

**English Speaking Confidence as a Visible Week-to-Week Change**

The junior secondary group showed a particularly visible week-to-week change in English-speaking confidence: learners gradually demonstrated greater willingness to initiate everyday English conversations with mentors and to deliver responses more accurately. This is theoretically consistent with the idea that speaking development depends on repeated opportunities to produce language in meaningful interaction, and that learners need supportive conditions to take communicative risks. In EFL contexts, anxiety often suppresses speaking attempts, which limits practice and slows improvement (Chen & Zhang, 2022). The program's approach, by prioritizing communicative speaking through interactive prompts rather than grammar-heavy instruction, likely increased the volume of speaking attempts, which is a plausible pathway to confidence growth. While the evidence here is descriptive (mentor observation rather than standardized speaking assessment), the consistency of week-to-week changes makes this a noteworthy program insight: the relational climate of community tutoring can be especially consequential for oral language confidence, where fear of negative evaluation is a common barrier.

**Understanding Participation Variability: Peer Effects and Environmental Constraints**

One of the most practically important findings is the variability in participation, especially among elementary-age children. Elementary attendance was strongly peer-dependent: when friends attended, participation increased; when key peers were absent, children were less motivated to attend, even with snack incentives. This aligns with research showing that naturally existing peer groups can shape academic engagement over time, reinforcing patterns of participation and motivation within social networks. In other words, attendance was not only an individual decision; it was socially coordinated (Kindermann, 2007).

This has direct design implications. For elementary-age children, social belonging may be a stronger driver of attendance than material rewards. Snack rewards can support momentary engagement during activities, but they may not override the perceived social cost of attending alone. This finding is also consistent with motivational frameworks that emphasize relatedness as a basic psychological need. Recent synthesis work by Wang et al. (2024) on self-determination theory (SDT)-based interventions in education suggests that interventions that support autonomy, competence, and relatedness can improve motivational outcomes, underscoring the importance of relational design rather than relying primarily on external incentives. In MATHCARES, peer companionship appears to function as a "relatedness anchor" for attendance. Programs seeking replication should therefore treat peer-group dynamics as a design parameter rather than a background noise variable.

Another issue was that weather-related disruptions also affected turnout. This is a structural issue in open community settings and has implications for scaling: if sessions occur in locations sensitive to rainfall, attendance instability will remain a predictable challenge. A replication model should include a weather contingency plan (e.g., indoor alternative space, flexible

scheduling, or shorter sessions during rainy weeks) to protect continuity.

**Age-Related Differences in Motivation and Learning Behavior**

The contrast between elementary and junior secondary groups is one of the clearest interpretive insights. Junior secondary attendance was more stable and appeared driven more by academic need than by peer presence. During practice activities, junior secondary participants tended to work independently without repeated prompting; mentors primarily facilitated clarification and supported problem-solving when questions emerged. This suggests stronger task orientation and clearer perceived utility of the program. Such age-related differences are important when deciding what to scale. A "one-size-fits-all" retention strategy is unlikely to work. Elementary groups may benefit most from structured peer-team approaches (buddy systems, stable small groups, collaborative goals), while junior secondary groups may benefit from stronger academic consultation features (homework clinics, problem-solving sessions, exam preparation aligned to school curriculum).

**Interpreting Group 0: Why Evidence Must Remain Cautious**

Although the program was initially designed for two elementary-level groups (segmented by grade level) and one junior secondary group, an unplanned pre-elementary subgroup emerged during implementation. In response, the organizing team adjusted the program by assigning mentors who could facilitate this younger group and by preparing age-appropriate learning activities. As a result, while sessions for the youngest participants emphasized play to sustain attention and engagement, the program's core mission remained consistent: to introduce mathematics and English through enjoyable, child-friendly learning experiences.

Following program completion, it is important to note that findings for Group 0 (pre-elementary) were treated as inconclusive. This caution was warranted given the group's highly fluctuating attendance, small number of participants, and the shortest and least consistent exposure to the intervention compared with the other groups. Instruction for Group 0 was necessarily foundational and heterogeneous: some children practiced basic numeracy (simple addition/subtraction) if they were already ready, while children who had not developed basic early literacy and numeracy skills focused on writing numbers/letters. Although mentors observed progress in specific instances (e.g., some children demonstrating simple addition), these observations cannot be generalized as program effects. This limitation is not merely methodological; it reveals a practical constraint in early childhood community tutoring. Younger children often require stronger caregiver coordination and consistent routines for stable program exposure. As such, scaling for pre-elementary learners may require a different model: parent/caregiver engagement, shorter-but-more-frequent sessions, or integration with existing PAUD structures.

**Service-Learning Value and Program Insights for Universities**

The program was framed as a service-learning initiative, and the findings suggest that the reflective cycle was not merely symbolic but operational. Weekly informal reflection meetings led to tangible adjustments in implementation, such as modifying delivery strategies and reallocating mentors in response to group size and engagement patterns. This reflects a core service-learning principle: reflection as a mechanism linking service experience to learning and continuous improvement. Consistent with existing literature, such structured reflection enables both pedagogical adaptation and deeper student learning through real-world engagement.

Importantly, the value of this model extends beyond the delivery of community service. First, it provides direct benefits to the community by increasing access to supportive and low-

anxiety learning environments in contexts where such support is limited. Second, it contributes to the development of students' practical pedagogical competencies, particularly in managing diverse learner needs, responding to fluctuating participation, and facilitating learning in non-formal settings. These competencies are often difficult to cultivate within classroom-based university instruction alone.

It is important to note that the outcomes reported in this study are primarily based on observational data rather than controlled measurements. Participation was not limited to a fixed group of children attending each week, and therefore changes in learning outcomes were assessed from a broader "helicopter view" of recurring patterns across sessions rather than through individual-level tracking. While this limits the ability to make precise causal claims, the consistency of observed patterns, such as increased willingness to participate, improved basic communicative ability, and more active engagement, provides indicative evidence of program impact at the community level.

From a university perspective, this suggests that service-learning programs in similar contexts should be evaluated not only by rigid outcome metrics but also by their ability to create adaptive, responsive, and socially embedded learning environments. The "CLOSER" framing and institutional ethos further reinforce this perspective by positioning the program as an act of knowledge circulation, bringing disciplinary expertise into community spaces in ways that are accessible and contextually meaningful. In this sense, the program offers a replicable model in which community service is not treated as a one-off activity, but as an iterative process of engagement, reflection, and adaptation that benefits both students and the communities they serve.

**Replication, Adaptation, and Scaling: Key Enablers and Design Recommendations**

Based on the results and the mechanisms suggested above, several key elements appear central for replication:

1. Accessibility and legitimacy through local leadership
   Coordinating with neighborhood leadership supports trust and communication and helps normalize attendance as a community-endorsed activity.
2. Differentiated grouping with flexible staffing
   Grouping by level and adding supporting mentors when attendance is high reduces bottlenecks and makes help more immediate, especially for elementary groups where attention spans are shorter
3. Low-anxiety learning design
   Interactive tasks, supportive correction, and frequent low-stakes practice reduce avoidance and invite participation, aligning with evidence on anxiety and performance in math and language learning
4. Formative feedback loops
   Weekly quizzes and observation notes are useful only when they inform real instructional changes; grounding reflection in concrete indicators supports iterative improvement, consistent with formative assessment theory
5. Social design for elementary retention
   Given peer-dependent attendance, elementary programming should intentionally leverage peer dynamics (buddy attendance commitments, small-group identity, team-based games) rather than treating them as incidental. Evidence on peer-group effects supports the importance of this approach
6. Weather contingency planning
   Especially in dense urban neighborhoods where outdoor access is common, indoor backup venues or flexible protocols are necessary to stabilize engagement

7. Scaling should also consider evaluation feasibility
   Because this was not a controlled study, claims are appropriately limited to observed patterns and descriptive indicators. However, scaling efforts can strengthen evidence without sacrificing the community-friendly atmosphere by adopting lightweight monitoring: attendance logs by group, simple quiz score tracking across weeks, and brief learner confidence check-ins (one-item Likert scale) for math and English speaking.

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