

WHITE PAPER

Towards Greater Equity Among Young Learners in Singapore



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Background

The primary school completion rate in Singapore is close to 100%, and Singaporean students routinely achieve high outcomes in international benchmarking exercises. Yet, while Singapore’s system continues to perform well overall in absolute terms, its strong emphasis on meritocracy inherently raises concerns about educational disparities that may affect certain groups or individuals.

This research project aimed to identify potential interventions to address the socioeconomic status-related (SES) disadvantage gap in education among primary-school-aged children in Singapore, so as to inform Octava Foundation’s future work in the sector as well as its current and potential partners, such as:

Public education system stakeholders – the Ministry of Education (MOE), National Institute of Education (NIE), school leaders and teachers;

Service organizations working to support schools and/or children in community settings with a special interest in disparities in educational achievement (e.g., self-help groups, family service centers, non-profit organizations, and social enterprises);

Funders targeting children and youth in Singapore, including philanthropic funders (e.g., private foundations, corporate givers, high-net-worth individual givers) and other statutory funders such as Tote Board, National Council of Social Service (NCSS), Ministry of Social and Family Development (MSF), and People’s Association (PA).



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Scope and Objectives

There are various reasons why individual children may be considered to be at risk of educational disparities. While household income or wealth is a key factor, it is just one of multiple determinants of SES. Others include parental characteristics, family structure, as well as norms and beliefs.

Outside Singapore, SES has been assessed pragmatically using measurable proxies. For instance, according to the Organization for Economic Co-operation and Development (OECD)'s Program for International Student Assessment (PISA), students from "disadvantaged" home backgrounds are defined as those whose value on an index of economic, social, and cultural status (ESCS) is among the bottom 25% within their country. The ESCS is based on the rationale that socioeconomic status is usually considered to be dependent on education, occupational status, and income. It is constructed from parents' highest level of education, parents' highest occupational status, and a home possessions index. This index serves as a proxy measure for family wealth, which includes the availability of country-specific household items and other educational resources (such as a computer) in the home.

In Singapore, across the social sector, while potential target households for social programs are defined by the criteria of being "low income or vulnerable", the concept of "vulnerable" SES is in practice context- and agency-specific. To define a practical scope for this project, we have adopted a wide and inclusive definition of SES factors.

In this report, we focus on:



Identifying whether the SES disadvantage gap in education in Singapore appears as early as primary school or before it, and potential determinants of this gap



Describing the global evidence base for interventions at the primary school stage



Understanding the context and support for likely approaches in Singapore

Understanding the Landscape

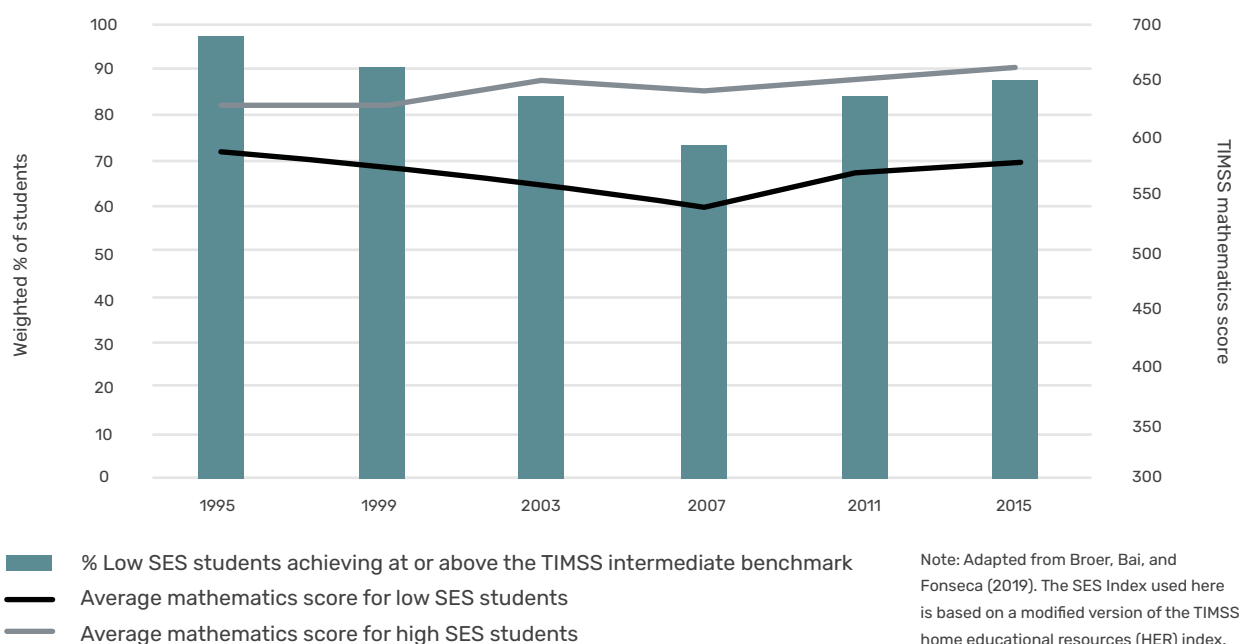
To assess the existing qualitative/quantitative local evidence on disparities in education due to socioeconomic status, we conducted a local landscape scan based on a search of the academic and grey literature over the last 15 years as well as public datasets and speeches.

What evidence is there for a disadvantage gap in primary-level educational outcomes in Singapore?

Published local sources with detailed SES analysis on primary-age children are few and diverse, but overall, we find that disparities do exist.

The Trends in International Mathematics and Science Study (TIMSS) is an international effort to examine trends in student achievement in mathematics and science. This global assessment has been conducted regularly in 4-year cycles by the International Association for the Evaluation of Educational Achievement (IEA) since 1994, involving students aged 9-10 from over 60 countries. In a published analysis of twenty years of TIMSS data up to 2015, Broer et al. (2019) noted that Singapore has remained among the top performers in the TIMSS mathematics and science assessments since its inception in 1995. When the assessment scores are segmented by SES (Figure 1), the data show that a remarkably high percentage of Singaporean students in the bottom SES quartile achieved scores at or above the TIMSS intermediate benchmark in both mathematics and science (as indicated by the bar chart in Figure 1). However, the gap between the average mathematics achievement for high and low SES students is large and persistent (as indicated by the line chart in Figure 1).

Figure 1: Achievement Gaps in Singapore, TIMSS 1995-2015



In an NIE Research Brief, Chan and Tan (2018) reported the results of a large-scale representative study of teaching, learning, and cognitive assessment practices and student outcomes. Using a multilevel analytical approach, they examined the proportion and shifts in the variation of student achievement and background characteristics in a cohort that graduated from primary school in 2007. They found that students' individual SES has a moderate effect on aggregate Primary School Leaving Examination (PSLE) scores, although other individual factors such as gender and language spoken at home had larger effects. Separately, there are strong positive associations between class-PSLE scores and class-SES, suggesting that the SES of peers also matters and influences individual achievement indirectly.

In a survey conducted as part of a 2016 research monograph for the Singapore Children's Society, Ong and Cheung (2016) found a higher proportion of affluent parents in primary schools that offer integrated programs or the Gifted Education program as well as in more competitive secondary schools (i.e., an indirect measure of primary school performance).

In June 2021, in response to a Parliamentary Question on the PSLE, MOE indicated that it "does not collect data on the household income of students, except for Singapore citizen students who apply for the MOE Financial Assistance Scheme (FAS), where the income criterion is set at about the bottom quintile of the national household income. These students on the MOE Financial Assistance Scheme (FAS) score a wide range of PSLE T-scores. Over the past decade, including for 2020, their median PSLE T-score has been stable at around 164. Likewise, the median PSLE T-score of the entire PSLE cohort has remained stable at around 207 over the past decade." Therefore, the median PSLE T-score of FAS recipients have been consistently lower than that of the entire cohort.

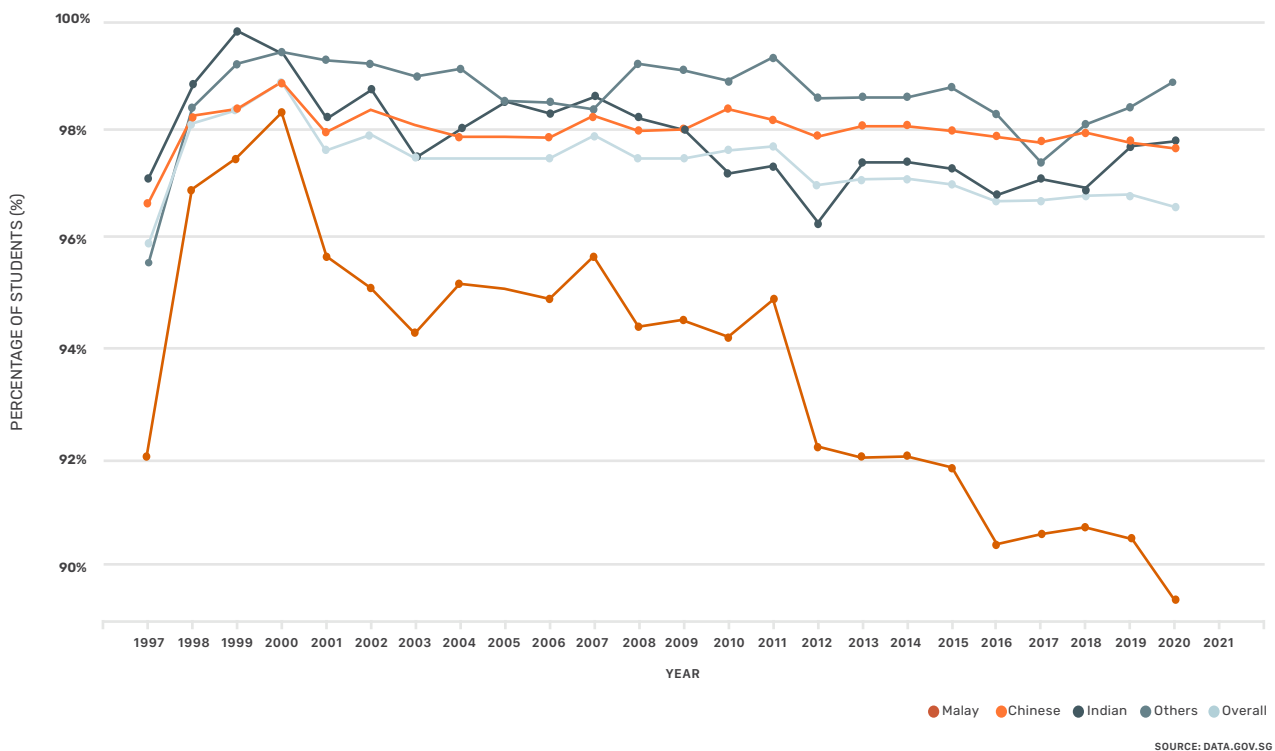
Trends in disparities are mixed and contingent on the outcome

The TIMSS data suggests that gaps in educational achievement have increased since 1995 (Broer, Bai, and Fonseca, 2019). Indeed, Broer et al. (2019) identify Singapore as one of a few countries in which SES disparities have increased rather than decreased over this period. Figure 1 shows that this gap widened significantly in the early 2000s due to a fall in absolute levels of achievement in the lowest SES quartile over time, while the performance of the highest SES quartile continued to increase linearly over time. While this achievement gap can certainly be said to have narrowed in recent years relative to the maximum gap observed in 2007, it is notable that in 1995, almost all students in the lowest SES quartile achieved at or above the TIMSS intermediate benchmark for mathematics whereas only 85% did so in 2011 and 2015. Therefore, there has been an increase in educational inequality relative to 1996, which is associated with a period of growing income inequality.

While the MOE response to Parliament described above suggests that the achievement gap has remained unchanged over the past ten years, in a 2018 speech, then-Education Minister Ong Ye Kung addressed issues of inequality in educational attainment, acknowledging that SES disparities at the primary school level exist but have, in fact, decreased over time. He noted that 9 in 10 students from the bottom 20% by socioeconomic background progress to post-secondary education today, whereas only 5 in 10 students from the same SES did so 15 years ago.¹ The Minister further emphasized that the proportion of students in the bottom socioeconomic quintile moving on to a publicly funded degree or diploma program had increased from 40% to 50%.

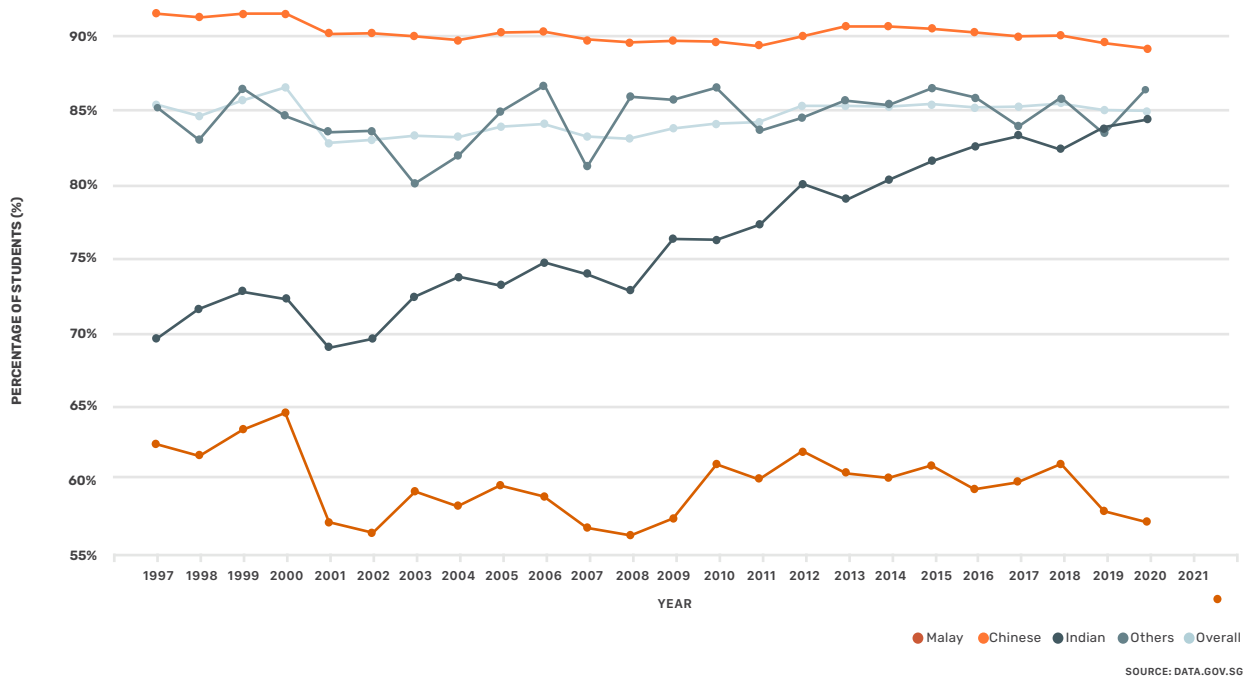
On the other hand, publicly available data on PSLE results (Figure 2) illustrate how these dynamics may be more complex and may vary depending on the outcomes and groups being examined. As shown in Figure 2, the data for PSLE English scores show increasing disparities for Malay students compared to the overall population due to a persistent downward trend in the percentage of students in that group who achieve a pass score. At the same time, the achievement gap in Mathematics among Malay students has remained wide but relatively stable, whereas there is a narrowing of the gap in Mathematics among Indian students, due to a strong upward trend in the percentage of those students who achieve a passing score.

Figure 2a: Percentage of Students Scoring PSLE A*-C (pass) for English, By Race



¹ Speech by Min. Ong Ye Kung, <https://www.moe.gov.sg/news/speeches/20181024-speech-by-mr-ong-ye-kung-minister-for-education-at-the-equal-ark-gala-dinner>

Figure 2b: Percentage of Students Scoring PSLE A*-C (pass) for Standard Mathematics, By Race



Is there evidence for a disadvantage gap at the pre-primary stage? What are the implications of a primary-level gap on future, post-primary outcomes?

While data on primary school children is relatively sparse, there is increasing data on the pre-primary years in Singapore, thanks to significant new research efforts focused on early childhood. They suggest that **disparities can begin even before formal education begins at age 7.**

The Singapore Longitudinal Early Development (SG LEADS) Study, led by the NUS Centre for Family and Population Research, conducted a study of 5,000 children (below 7 years old) and their primary caregivers, who were selected randomly from a population list to represent Singapore resident households with children under 7 years old. While not all the results have been formally published yet, the study investigators found that both achievement and socioemotional skills are associated with socioeconomic status at young ages, even before primary school.

In particular, among kindergarten-age children (4 to 6-year-olds), Yeung and Chen (2021) show achievement gaps associated with family SES indicators. Children in the lowest income quartile (Q1) scored lower than their highest quartile (Q4) peers in numeracy and verbal tests by 0.85 SD and 0.65 Standard Deviation (SD), respectively. Children whose parents are least educated had lower scores for numeracy and verbal tests (0.76 and 0.70 SD lower, respectively) than their peers whose parents had a university degree. The SG LEADS study has also shown a significant correlation between the delay of gratification scores and parental education and housing, starting in kindergarten and eventually leading into primary school (Yeung, 2021).

According to the Growing Up in Singapore Towards Healthier Outcomes (GUSTO) study, where a birth cohort of 1200 Singaporean women were studied throughout their pregnancies and after they gave birth in 2009 and 2010, preschool-aged children in the lowest income group performed 0.8 to 1.2 SD more poorly than children in the highest income group on measures of pre-academic achievement in general knowledge and vocabulary (Law et al. 2021).

What does a primary-level gap mean for future outcomes?

Our understanding of the broader ramifications of this gap is limited.

In the Singapore context, future pathways are significantly determined by achievement and assessment at the primary level, i.e., determination of streaming and enrolment in schools that offer special programs such as the Integrated Program, International Baccalaureate or Special Assistance Program. However, formal studies that quantitatively assess the long-term or cumulative impact of SES-related educational disparities in primary school are limited. In particular, it is difficult to disentangle causality from correlation in a precise manner, e.g., to attribute secondary school outcomes to the presence of SES-related disparities in primary school rather than to the same underlying SES-related factors that are likely to persist in secondary school.

In their multi-level analysis of student outcomes data, Chan and Tan (2018) concluded that over the time of their study (2004 to 2010), the contributions of SES to student outcomes decreased in importance relative to variables pertaining to individual traits, such as a track record of achievement, gender, and learning disposition such as self-efficacy. Chan and Tan (2018) noted that by 2010, the data suggest that learning disposition not only affects student outcomes, but also acts as a mediator for instructional practice. However, their study did not explore the extent to which traits related to learning disposition are formed by the experience of disparities in primary school.

What do we know about the determinants of disparities in outcomes in the local context?

The determinants of educational disparities by SES at the primary school level have, to the best of our knowledge, not been extensively documented with local data. However, data from the SG LEADS and GUSTO studies clearly articulate key contributing factors to achievement or well-being, albeit at younger ages.

Yeung and Chen (2021) used SG LEADS data to examine factors contributing to numeracy in early childhood. They identified **financial stressors, values, and in particular the strength of the relationship of the child to the father** as key contributors to **the physical home environment, development activities** and **socioemotional qualities (notably delay of gratification)**, which in turn lead to early educational achievement (Yeung and Chen, 2021). In addition, the GUSTO study has shown that a strong mediator of differences in development outcomes between low and high SES families is **maternal mental health** (Law et al, 2021).

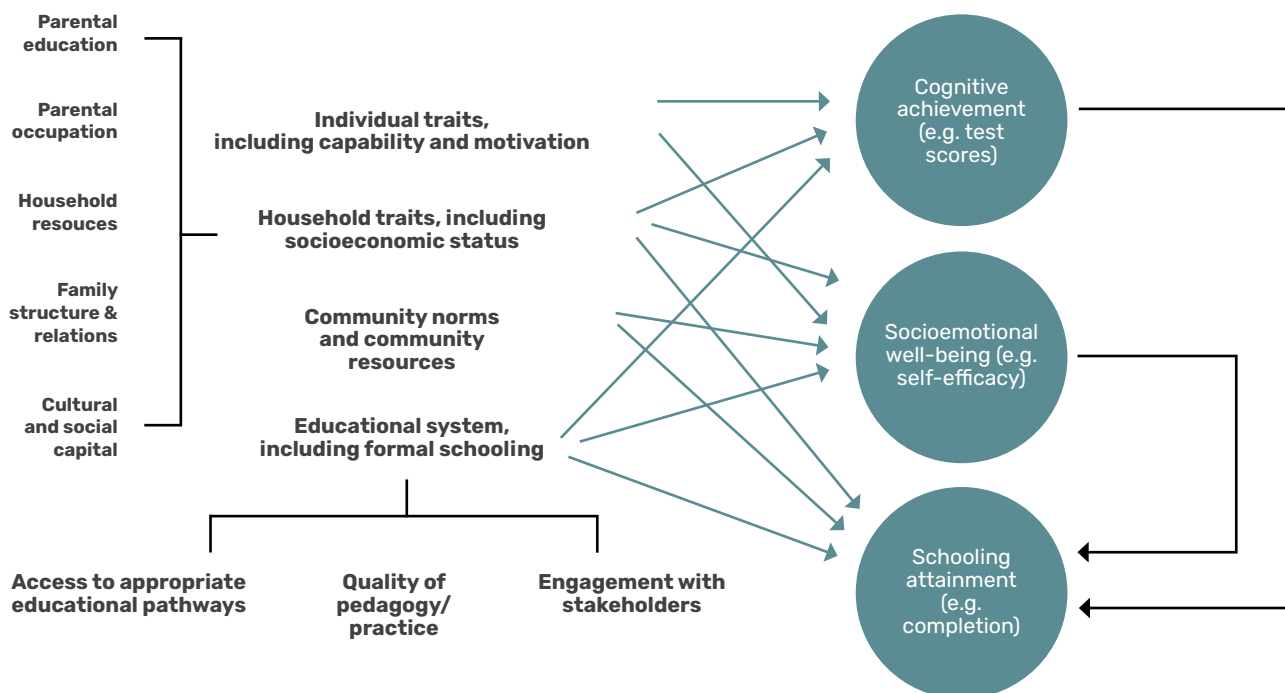
Conceptualizing the Intervention Space

Based on these findings, we developed a conceptual framework to describe the landscape in Singapore and define categories for intervention. We identified outcomes as falling into three broad categories: academic or cognitive achievement, socioemotional well-being, and educational attainment (e.g., completion and progression to secondary education).

At the micro level, we find evidence that outcomes are driven by both individual traits (including cognitive capability and motivation as well as other traits such as gender and ethnicity) and household-level traits (including SES as well as other traits such as size, citizenship, language, and the provision of a home environment and practices supportive of learning). Household SES itself is a broad construct that encompasses parental education and occupation, household financial and physical assets, family relationships as well as cultural and social capital.

At the meso and macro level, these outcomes are affected by community-level environmental factors (such as norms, resources, and programs as well as informal educational resources) and by the education system (via access to appropriate, high-quality educational resources as well as engagement with communities). Notably, the education system includes both formal instruction as well as other activities conducted by schools, including outreach and counselling activities.

These contributory factors influence one another – for instance, household SES affects the trajectory of individual development; community norms may mediate the effect of traits such as gender and ethnicity, or community attitudes or perceptions related to formal education may moderate the impact of access to education.



Within this framework, interventions to improve student outcomes fall into three categories based on their goals:

1. Interventions that enhance or expand the formal education system

- System-level interventions aimed at changing access (e.g., Financial Assistance Scheme from MOE, pedagogies or teaching strategies)
- Programmatic, school-based approaches that target engagement of or support for students and families, such as learning support

2. Interventions outside the education system that target household socioeconomic status directly, including:

- Workfare
- Housing support
- Social safety nets including Comcare

3. Interventions outside the education system that address the capacity, beliefs or resources of students, households or the community related to learning, such as:

- Awareness building
- Broad-based subsidies and targeted assistance for all educational levels
- Training or supplementary education
- Mentoring programs

In this report, we focus on the third category of interventions, i.e., interventions that improve future outcomes for students, excluding interventions carried out within the education system or those aimed at addressing the root causes of socioeconomic disadvantage.

Learning from International Practice

To identify interventions from the most relevant education systems from the OECD member countries, we conducted a rapid evidence review of the academic and peer-reviewed literature based on the project scope.

The key questions that the rapid evidence review sought to address were:

What types of interventions have been employed to enable academic attainment for children from low SES families in similar country settings?

What provisions have been put in place which have worked, and which have not, and why?

Our work focused on identifying systematic and high-quality studies conducted within the past 20 years that examine the effectiveness of various interventions in enhancing the academic performance of low SES students. The emphasis on the highest quality evidence is guided not only by constraint of time for this study, but also by the diversity and variety of studies that examine educational interventions. The Campbell Collaboration was used as a primary source of systematic review and meta-analysis as it serves as the most authoritative repository of international social science research that produces policy-relevant synthesis. A similar search was conducted using the academic journal of *Review of Educational Research*, where systematic reviews and meta-analyses are subjected to a rigorous academic peer-review process. Observational studies were identified through a search of the database hosted by the Institute of Education Sciences' *Education Resource Information Center* (ERIC).

We conducted a search that was widely defined to ensure broad coverage of initial studies. Our inclusion criteria admitted any systematic review, meta-analysis or observational study that evaluates the effectiveness of interventions specifically identifying low SES primary-aged students in high-income country settings. The search was conducted regardless of whether the term "low SES" or "at-risk" was defined by the study. A further search was conducted based on the taxonomy identified by Dietrichson et al. (2017)'s systematic review of interventions for low SES students, combining the names of specific intervention types with the key terms "low socioeconomic status" and "academic achievement". Three systematic reviews and meta-analyses were used as primary sources for the review of effectiveness while hand searching yielded another nine relevant observational studies from ERIC, which were screened from 347 search results.

Ex-post, after concluding the original search, to provide further context on specific areas of interest to Octava, we extended the review to cover computer-assisted programs in greater detail as well as approaches that target parental engagement and the home environment.

Directly supplementing gaps in classroom instruction

Tutoring refers to a one-on-one structured supplementary pedagogical intervention that seeks to reinforce classroom instruction (Bray 2006), often delivered after hours and distinguished from small group instruction. Tutoring can be both remedial (to allow the student to catch up) or enrichment (to teach advanced topics). While often delivered by trained professionals, tutoring can also be done by nonprofessional volunteers, senior students, or the student's parents.

In Dietrichson et al. (2017), **tutoring was found to have the highest positive and statistically significant effects on the academic achievement of low SES students**. However, these effects are context-dependent. When examining the impact of tutoring on self-regulated learning among low SES students, a quasi-experimental study revealed only short-term effectiveness, with the programs unable to sustain the gains after the intervention (Vandevelde et al. 2017). In an after-school tutoring program, Nicholson and Tiru (2019) identified a positive impact on the reading skills of low SES students, although these effects were not enough to reduce the learning gap that arises in summer between low and high SES students.

Cooperative learning pertains to structured activities that allow students to work together and mutually work towards their learning (Jolliffe 2007). It is also known as peer tutoring, peer learning, and collaborative learning. Small groups of students are formed (deliberately or informally) either inside the classroom or outside the class hours (e.g., remedial courses). There is focus on group dynamics that allow students to form relationships over time as well as on the diversity of intellectual abilities, interests and learning styles (Cloud 2014).

Wexler et al. (2013) found systematic evidence to support this assertion, showing at least small size effects of peer-mediated interventions on some reading outcomes such as comprehension and content acquisition. Peer-assisted learning was also found to have positive and significant effect sizes on elementary students' academic achievement (Rohrbeck 2003). While there is limited recent evidence of the singular use of peer or cooperative learning as an intervention to boost academic performance among low SES students, one study in Taiwan examined the impact of a remedial, after-school, cooperative learning intervention and showed a positive impact on low SES students' mathematical interest, confidence and competence (Yang et al. 2014).

Small group instruction can be differentiated from cooperative learning by the absence of interactive activities between the students. Small group instruction tends to include as many as five members in a group, whereas peer-assisted learning should ideally involve 2-3 students. The primary motivation for a small group over a typical medium-size class (between 6-20 students) is to efficiently deliver adult-instructed learning without sacrificing the intensity and responsiveness of instruction that benefits at-risk students (Foorman and Torgensen 2001).

Small groups generally fare equally well with one-to-one instruction in improving reading fluency (Begeny 2017). Among low SES students, small group instruction was found to have positive and statistically significant effects on educational attainment, but these effects are not robust (Dietrichson et al. 2017).

Enhancing learning effectiveness

Feedback is a quintessential component of a teacher's toolkit to enhance student performance. Feedback is information provided to the student or teacher based on monitoring of the student's progress. It is meant to be formative so that the student can alter his/her behavior or thinking. Feedback can come in the form of explaining the correct solutions, sample answers, and hints, which can be delivered immediately after a task (Shute 2008).

In Dietrichson et al.'s (2017) meta-analysis, **feedback and progress monitoring had one of the highest effect sizes in enhancing low SES achievement rates**. Providing effective feedback is contingent on the ability to ascertain the gap between the current and desired understanding of a learning domain, which could be observed at the levels of tasks, learning process, self-regulation, and the self/affect (Hattie and Timperley 2007).



Computer-assisted instruction (CAI) or digitally enhanced instruction refers to programs that deploy software platforms to enhance students' learning and achievement. Such software platforms include games, simulation, drill-and-practice or tutorials. They can vary considerably in terms of their relationship with the teacher and student. Some require the supervision

and assistance of the teacher while others foster self-directed learning with minimal involvement of the teacher or another trained professional.

Early work on CAI showed a largely positive impact of interventions to provide access to computers through their use at home or inside the classroom as part of new pedagogical approaches. Osin, Neshet, and Ram's (1994) earlier study showed that access to computer systems explains the difference between the achievement levels of students in low and high SES schools in Israel. In their evaluation of a UK government initiative for low-income households, Jewitt and Parashar (2011) found that providing a laptop and internet access increased student time engaged in homework and independent learning as well as parental engagement with their child's learning. In addition, Rosen and Wolf (2011) describe the successful use of an individualized learning program to address learning outcomes in language and mathematics for children in low-SES Israeli households.

However, later evidence on the use of in-class CAI for disadvantaged groups has been less convincing. Seo and Bryant's (2009) reviewed 11 studies that used digital tools to teach mathematics to learners with learning disabilities and found no conclusive evidence. More recently, Dietrichson et al. (2017) found no significant effects of these programs on the academic achievement of low SES students.

Due to the COVID-19 pandemic, the importance of digital platforms particularly for remote learning has expanded, although there have been few rigorous studies published to date on how best to do so. Supporting capacity for digital learning has become a new priority in an environment where CAI is no longer complementary but a substitute to traditional teaching methods. The move to online-only remote education platforms has generated significant concern about the negative impact on low SES households who lack access and are less able to engage with these modes of instruction (Bacher Hicks et al. 2021). In a recent summary review, UNICEF (2021) noted that new education technology (ed-tech) solutions have increased, providing more positive opportunities to enable adaptive learning. At the same time, evidence on how best to achieve "meaningful connectivity" and to integrate into existing teachers' pedagogy and workflow remains limited, especially in low-income settings.

Incentives refer to an "inducement or supplemental reward that serves as a motivational device for intended learning" (Grove and Hadsell 2012). Both financial and non-financial rewards can be given to motivate and support learning either in terms of educational input, (such as merit scholarships) or output (such as payments for completion and academic excellence).

There is no systematic evidence to support the use of incentives as a performance-enhancing tool for low SES students (Dietrichson et al. 2017). In general, the evidence indicate that financial incentives have little to no effect on academic achievement, particularly since the incentives do not seem to have any motivational effect (Fryer 2011). The effects, whenever observable, appear to only minimally affect mathematics test scores, and there is no convincing evidence that the effect can be sustained when the incentive is removed (Le 2015). However, recent field experiments point to the possibility of group-based incentives to improve academic performance (Dulleck et al. 2019).

Taking more holistic, nonpedagogical approaches to provide support

Out-of-school-time (OST) programs are top-up schemes to formal class time given to students. These programs are primarily characterized by the timing of their delivery, e.g., after-school programs held before or after class hours as well as programs held during summer breaks. They may be hosted by schools or by community-based organizations and tend to combine various program components, including both academic and nonacademic support.



Prior to their being considered a potential intervention to improve student achievement, the evaluation of after-school programs initially focused on their value as a means to guarantee the safety and care of children living in unsafe neighborhoods, particularly in the USA (De Kanter 2004). Delivered during regular school days, after-school programs often take the form of activities complementary to formal education. They serve various purposes, combining both academic (e.g., tutoring and mentoring) and non-academic activities (e.g., healthy snacks and physical education).

Based on early studies of after-school programs, the National Institute for Out-of-School Time (2009) identified key benefits of such programs to be: increased academic achievement, better engagement in learning, and higher school attendance among program participants, particularly the at-risk students. In another meta-analysis of 79 studies, Crawford (2011) similarly found significant positive effects of after-school programs on test scores on mathematics and reading.

Another form of OST programs, summer school, seeks to address the learning loss among low SES students during breaks between school years (Cooper et al. 1996). These programs are typically meant to enrich learning or compensate for learning losses through the provision of learning materials (such as books) and structured activities (such as tutoring, athletics, reading clubs).

A meta-analysis of studies between 1998 to 2011 demonstrated higher gains from summer reading programs for low-income students compared to high-income students (Kim and Quinn 2013). The same is true for mathematics (Little et al. 2017), although similar programs waned in the following year (Augustine et al. 2016). Bowers and Schwarz's (2018) observational study show a difference between pre-and post-program literacy (in terms of oral and written skills) among summer school participants, while Hodges, McIntosh, and Gentry (2017) show that among low SES students, summer camp attendance was associated with better performance in standardized test scores in mathematics and language.

However, more recent systematic evidence indicates that there are limitations to after-school programs' ability to specifically cater to the needs of at-risk or low SES students. A review of interventions directed at at-risk students showed that after-school programs have only a small and statistically insignificant impact on school attendance and externalizing behaviour such as delinquency (Kremer et al. 2015). Overall, summer enrichment classes have not been shown to have a consistently positive, statistically significant effect on the academic achievements of low SES students (Dietrichson et al. 2017).

The diverse nature of OST programs may contribute to these mixed findings, as the degree and nature of holistic support provided by different programs may vary. Significantly, when a meta-analysis was performed with focus on OST programs that targeted social-cognitive competencies such as stress management, problem-solving, empathy, and decision-making (Durlak, Weissberg, and Pachan 2010), there was robust evidence that after-school programs were effective in enhancing students' self-perception, fostering positive behavioral adjustments, and improving school performance (excluding school attendance).

Student coaching or mentoring does not involve pedagogical interventions. It mostly assigns adults such as in-school staff to provide counselling, active monitoring, and case management of students. It is geared towards providing avenues for a non-parental adult to provide practical, behavioral, social, and emotional support to a struggling student.

Some reviews suggest a small positive but statistically insignificant effect of mentoring on academic outcomes for low SES students (Dietrichson et al. 2017). Some studies have shown its ability to reduce absenteeism and in turn, enhance academic performance among at-risk students (May et al. 2021). Other studies have not found mentoring to have significant effects and point to the mediating role of school characteristics in allowing mentors to have a demonstrable effect on student outcomes (Mac Iver et al. 2017).

Parental engagement refers to a range of interventional approaches that seek to increase the quantity and quality of parental involvement with a student's education or school environment.

In a meta-synthesis of nine meta-analyses, Wilder (2013) found robust evidence that in low SES households, there is a positive relationship between parental engagement and a student's academic achievement. Parental expectations about the child's future educational attainment are found to have the strongest effect while counterintuitively, homework assistance tends to have no effect or even negative effects, as parents tend to lack the training needed to provide effective instruction at home.

While it is clear that home environments and parental involvement matter, evidence on how best to intervene in this area is mixed. Part of this gap is methodological. In a systematic review for the Nuffield Foundation, Gorard and See (2014) identified 68 studies of interventions regarding parental involvement, but none were of sufficiently high quality to enable meta-analysis. Of these 68 studies, nine were studies with primary age children, but all were of poor quality or small size and showed unclear or even negative outcomes for children.

See and Gorard (2015) further conducted a detailed review of 127 studies linking parental involvement in education to attainment at or before primary school and found similarly mixed and inconclusive results due to poor study quality. Positive outcomes were found only in interventions in which parental involvement was part of a package of measures. The most effective results were associated not with changing parental behavior at home, but with having parents and other adults (including teachers) meeting regularly outside the home with on-going support and cooperation.

Lastly, in a recent systematic review, See et al. (2020) examine international evidence from 29 studies on whether technology-mediated parental engagement can improve student outcomes. While parent-teacher communication platforms were found to be of some potential use, the authors found no evidence that online technological devices and digital media improve school outcomes.

Summary

Table 1 presents a summary of our evidence review of school and community-based interventions that contribute to addressing the achievement gap between low SES and high SES students.

Table 1. Summary of Evidence Review

Type of intervention	Component	Definition	Effects reported in the literature		Other potential indirect/noncognitive benefits
Supplementary in-school or other academic support	Tutoring	Structured one-on-one or small group pedagogical support	+++	Large positive and significant effects seen in systematic reviews	Increase interaction with role models and provide positive encouragement
	Cooperative learning	Students work in small groups to facilitate mutual learning	++	Moderate positive and significant effects seen in systematic reviews	Enhance affective skills through relationship formation with peers
	Small group instruction	Intensive adult-delivered instructions to 2-5 students	++	Moderate positive and significant effects seen in systematic reviews	Increase access to positive support and encouragement
Enhancements to academic learning	Feedback/progress monitoring	Timely information about student performance	++	Moderate positive and significant effects seen in systematic reviews	Improve self-regulative behavior
	Computer-assisted instruction (CAI)	Use of computer systems or computer software inside the classroom with or without trained supervision	++/-	No significant effects seen in systematic reviews; wide range of positive to negative effect sizes seen in individual studies	Increase time engaged in homework and independent learning
	Incentives	Reward and/or condition performance-enhancing behaviors	+	Limited/no significant effects seen in systematic reviews; time-limited effects seen in individual studies	Create group motivation effects to improve school performance
Non-academic or holistic support	Out of school-time (OST) program	Academic combined with non-academic support (healthy snacks, physical education) after official class hours/over vacation	+	Small positive but insignificant effects seen in systematic reviews; some positive individual studies	Improve student's self-perception and socioemotional learning, enhance access to nutritious food and foster positive behavioral adjustments
	Coaching/mentoring	Delivery of non-pedagogical support such as counselling, advice	+	Small positive but insignificant effects seen in systematic reviews; some positive individual studies	Improve student's self-perception and socioemotional learning
	Parental engagement	Support or outreach to parents to raise involvement with education and/or school environment	+/-	Low to negative insignificant effects seen in systematic reviews; some positive individual studies in combination with other interventions	Increase support at home

Note: +/- indicates effect sizes

Our review shows that, unsurprisingly, approaches that directly focus on redressing academic attainment have been most effective. Intensive supplementary academic instruction to address the general learning needs of the low SES students can have the greatest effect in improving the academic performance of these students. It has been recommended that such interventions should target areas where low SES students are weak or disadvantaged (Dietrichson et al. 2017).

Enhancing existing formal education, especially during early childhood (such as full-day kindergarten), has been shown to have effects that last till adulthood, compared to other non-pedagogical interventions such as parental training (Reynolds, Magnuson, and Ou, 2010).

Our review shows that holistic interventions that provide non-pedagogical support yield mixed results in terms of educational achievement. However, although such interventions in general have less robust effects on academic results, this is consistent with such programs being more diverse. Also, they are designed to address longer-term, broader needs, which has implications for program evaluation. There is potential for positive effects that may well be realized with a broader or longer-term lens on student outcomes.

Importantly, from the perspective of cognitive development, compared to their high SES peers, low SES students may lack individual experiences and social interactions at home or at school that stimulate productive behavior through modelling and positive/negative reinforcement (Piaget 2001, Sternberg 2009, Bandura 1986). Therefore, strategies for success could include: developing cognitive skills and prosocial behavior, augmenting family, motivational and pedagogical support, and increasing performance expectations and self-efficacy among the students. These affective competencies have been shown to play a greater role than intellectual abilities in explaining the effect of low SES background on immediate academic achievement (Józsa and Barrett 2018). However, significant time may be needed for these competencies to change and to subsequently impact learning and performance, whereas the outcomes of intensive academic tutoring may be observed more quickly. Moreover, these skills may have strong impact on longer-term life choices and well-being that lie beyond the scope of this review.



Based on this evidence review, we highlight the following insights for consideration during program design:

The optimal design of interventions involves understanding not only the differential access to learning resources between low SES and high SES students (Dietrichson et al. 2020), but also the needs of individual students. Therefore, the greatest effect may be achieved through intensive one-on-one instruction combined with the generation and provision of information about the student's performance, as it allows the specific learning gaps of the student to be addressed.

In general, we find that interventions to enhance learning that successfully bridge the achievement gap focus on key background factors leading to low SES students being inherently disadvantaged in their respective country settings. For instance, Sortkær (2019) found that low SES students in five PISA countries are given less facilitative feedback compared to their high SES peers. Therefore, assessing and targeting specific aspects of social disadvantage that are significant in the local context may be critical for success.

Other important moderating factors can affect effectiveness and may thus impact how such interventions should be optimally implemented at scale. For instance, Dietrichson et al. (2017) showed a decrease in the effects of tutoring as the intervention was extended, leading to diminishing returns that should be taken into consideration by program designers.

Finally, interventions in practice combine components and approaches to address multifactorial change processes. Collaborative interventions by multiple stakeholders may be combined into a single program. For instance, tutoring may be delivered not only by trained education professionals, but also by volunteer tutors or senior students. It may be part of an OST program delivered either by the school alone or through a collaborative partnership with community-based and non-profit organizations.

Such combinations can help bring out latent strengths and complementarities in interventions. For instance, while the evidence for home-based intervention alone is not strong, bridging home and community in a holistic setting may be an effective complementary approach. Parental training programs could enhance their ability to provide home learning support to their children while center-based instructional programs provide the additional lessons that parents may not be able to provide at home, thus reinforcing one another.

Moving Forward Together



To better propose potential next steps in view of these findings, we conducted a select number of informal informational interviews from December 2021 to June 2022, to gather stakeholder perceptions on potential efforts to reduce these disparities, changes in the current system that might affect them positively or negatively, and contextual factors.

Input was sought from individuals working in multiple sectors. A total of 10 individuals were consulted in their personal capacity, including current/former public sector officers in the social service sector (4), staff of social service organizations/NGOs and service designers engaged with child/family interventions (4) as well as academics in the social science and education research sector (2).

In general, discussions were conducted for approximately 1 hour on Zoom or face-to-face, during which key findings were shared and feedback solicited on potential intervention approaches and challenges. One respondent provided brief feedback over email. Respondents provided their insights on a confidential basis and only in their personal capacity.

What intervention approaches might be best suited for Singapore?

All stakeholders felt that the findings were relatable to the landscape in Singapore, especially concerning tutoring and feedback. They highlighted practical considerations, particularly that intervention approaches and mechanisms are not siloed and that there are further important local nuances.

For instance, as one respondent said, “tutoring has a range”, emphasizing the difference in attention as well as pedagogy between top elite programs and school tutoring or tuition. It was noted that typical group-based tuition classes are not equivalent to individualized or intensive tutoring. In Singapore, where a range of options for private tuition is readily available, the respondents further suggested that the value-add of the tutoring and feedback model is less related to academic content than to providing students with personalized, regular attention and a safe space to ask questions and obtain answers.

When discussing mentoring programs, the practitioners commented that generally in practice, relationships can be difficult to match and sustain without organic connections based on existing relationships, community affinities or pre-existing platforms. Certain individuals are better able to do so than others, and programs may end up drawing on community leaders who are thus engaged in many different initiatives but who have limited bandwidth.

As an alternative to having someone serve as a mentor or lecturer, some practitioners suggested that a “befriending” approach may be more acceptable to families/parents. “Befrienders” were characterized as “normal, everyday” families or individuals willing to be matched into a supportive peer-to-peer relationship, in contrast to “mentors” whose role is implicitly seen as guiding or providing instruction. However, this approach might require more time for matching and support.

The respondents generally agreed that giving financial incentives to students for performance (in addition to existing bursaries and schemes) was not likely to be desirable or feasible as a standalone program. However, there is recognition that financial and non-financial economic support, even if provided outside the education system, is of critical value to address SES-related factors directly, e.g., providing families with the day-to-day home help they need so that they may redirect attention to their children, or working with agencies such as the Ministry of Manpower to address issues such as work and unemployment assistance.

Multiple respondents from all sectors highlighted the complexity of the current system, which offers “many helping hands” and interventions, although views on how to address this were mixed. One respondent felt that interventions should work only through the school system and focus on reducing existing root cause factors, notably parental bandwidth, e.g., “consider fixing absenteeism rather than tutoring”. In contrast, another respondent felt that it would be critical to take a multipronged approach that included aspects of every kind of intervention.

In spite of their different views of how best to intervene, there was consensus among the respondents that long-term commitment to the children is required for programs to be effective.

Finally, the respondents noted that programs or interventions need to be embedded within the wider context of the household and education system instead of being standalone.

For example, programs targeting individual students should be embedded within programs for family coaching or have strong links with a neighborhood school. In particular, the practitioners strongly emphasized the need for programs to include significant time upfront to explain their goals and motivation as well as logistics and other practical matters, so as to obtain buy-in from the relevant stakeholders.

Considerations for design and implementation in the Singapore context

Reaching a pragmatic common definition of SES

Respondents from different sectors expressed their concern about conceptually defining SES as a basis for interventions in general. They pointed out that income (especially household income) could not be considered separately from factors such as family size and spending needs, which in turn determine actual roles and practical resources. Moreover, households may have sufficient income but still face issues related to “poverty of time” and bandwidth rather than resources, ironically as parents work overtime to generate income. The community-based stakeholders were particularly vocal in noting that SES is multifactorial and context-specific.

Operationally, the definition of SES was also considered a challenge. The practitioners noted that when implementing a program, they often depend on partner organizations for referrals or collaboration. However, different agencies have different definitions of low SES or at-risk families and children, some of which are explicitly codified whereas others depend on the judgement of program staff or social workers. As a result, working with partners may require flexibility and the de-facto adoption of varying definitions of SES.

Further developing an understanding of need

One researcher expressed the opinion that the SES lens is too narrow and that interventions in this space should seek to more broadly address the needs of children or families at risk (for instance, defined by behaviors or outcomes).

The respondents directly engaged in community work pointed out the impact of volatility or instability, making uneven or irregular school attendance a major driver of disparities. One respondent attributed this issue partly to the nature of the primary school curriculum, which requires building continuously on skills in a highly structured, time-bound manner. This approach disproportionately disadvantages children who are late developers or who experience major but temporary disruptions to their education because of events such as home moves due to family circumstances.

Most respondents felt that groups that are potentially at-risk in Singapore include not only the most economically disadvantaged households, but also children from lower-middle-income households. One respondent described the lowest SES group as “quite well covered”, particularly given the focus and resources of the social safety net and initiatives such as UPLIFT provided to a relatively small number of target participants.

Balancing the focus on achievement with more holistic objectives

One respondent noted that while academic achievement is critical for future well-being, focusing only on academic achievement runs counter to the efforts to encourage a new, more holistic vision of education in Singapore. Another respondent from the social sector expressed concern that overemphasizing academic results among young children could perpetuate existing systemic biases and an inappropriate focus on test scores.

Addressing barriers to sustained participation as a first-order concern

While long-term intervention was seen as desirable, based on prior experience, the practitioners and policy stakeholders emphasized that recruitment and maintenance are often challenging even though needs are high. Singaporean parents or caregivers in the target group are typically extremely busy or juggling multiple commitments, and they may not be able to sustain long intensive interventions or monitor their children’s participation. One respondent noted that it is a “well-known issue” that individuals who are most in need of the programs are the least likely to enroll.

The practitioners noted the challenge of recruiting initial participants for completely new interventions, even if provided free of charge. They highlighted that gaining both attention and trust is critical for enrolment, as parents need to “strongly believe they will benefit”. One respondent suggested that when parents are relatively disengaged, it may be necessary to find channels to work directly with the children. Others advocated working intensively with parents as well as trusted community partners or schools.

Notably, a few respondents questioned the value of a “program lens”. One respondent argued that adding more interventions would lead families to feel overwhelmed by their options and choices, and recommended focusing instead on the possibility of streamlining or paring down the existing system. Another respondent questioned the need for a targeted “low SES” approach instead of increasing the participation of all students in existing platforms such as Scouting, which build skills, teamwork, and interpersonal relationships across social groups without potential stigma.

How might we advance evidence-based dialogue on disparities in Singapore?

Making data insights accessible for practice

All stakeholders found that the presence and magnitude of SES-related disparities was

qualitatively consistent with their understanding of existing data and conditions on the ground. Across all sectors, the respondents were highly supportive of taking an evidence-based approach to design and implementation, although a major constraint is the availability of access to academic resources and the institutional capacity to do so.

Respondents from both agencies and academia made the important distinction between publicly accessible data and available data. They noted that while limited information might be freely published (for example, the annual Education Statistics), SES disparities are analyzed and shared internally at agency level. Most practitioners felt that there is a lack of accessible background data sources to clearly and objectively document disparities in an actionable manner, although a number of them reaffirmed the general value of new studies such as SG LEADS.

Building stronger evaluation capacity

Notably, all respondents were engaged in efforts related to research and evaluation, albeit at varying stages, although this may be a reflection of selection bias in the network of our respondents. From the practitioner's perspective, most efforts to conduct evaluation are still relatively nascent in terms of fieldwork and study design; all respondents recognized this as a gap to be closed. Few of them have adopted stringent intake or graduation measures or systematically track the long-term academic performance of beneficiaries. Instead, they tend to seek ad-hoc information and regular feedback through their relationships with schools and individual teachers.

Expanding the platforms and mandate to work collaboratively

Recognizing that different stakeholders have different roles, the respondents discussed possible ways in which these groups could best work together. One respondent suggested that non-governmental stakeholders could focus on the gaps in existing or planned programs. They could consider how to best leverage their strengths to address these gaps or how best to resource existing stakeholders, instead of entering as an independent player with new programs. It was proposed that scaling programs could be the role of stakeholders such as the government, who have the resources and mandate to do so. External stakeholders may be better served by focusing on "niches" in ongoing workstreams, potentially to provide highly specialized or tailored programs to a very small number of individuals.

Both agency and academic stakeholders emphasized the need to participate in already ongoing, highly-related policy discussions, such as the Whole of Government interest group focused on social mobility. One respondent suggested that the engagement efforts and its framing could focus on finding ways for this work to "add value", so that there may be truly beneficial contributions instead of duplicating existing efforts inefficiently or with poorer quality data.

Limitations of This Research

Our report is subject to several important constraints and limitations. Firstly, the local evidence review is limited due to the ongoing studies that have yet to be published. In addition, the global evidence review was limited to the research literature on “low SES” published in English, which introduces a publication bias towards an international and academic audience and mostly includes studies from high-income countries in North America and Europe. Many of the primary studies covered by the systematic reviews and meta-analyses came from the USA, especially because the use of the term “low SES” is used in discussions about the academic achievement of minorities, particularly African Americans. The global evidence review avoided overlap with the research literature on mental health interventions for students, which is outside the scope of this study.

Secondly, the scope of this report excludes key areas of intervention such as those aimed at early childhood and more importantly, system-level reform measures. Early childhood education tends to benefit students from lower SES backgrounds as it addresses the varying levels of school readiness between students (Dietrichson, Kristiansen, and Nielsen 2018). Other system-level measures would involve universalizing access to early childhood education. While these are highly significant levers, they are outside the scope of our study by design.

Finally, the impact of COVID-19 cannot be understated. It has affected our ability to extrapolate from recent past evidence as well as to make inferences about the future. For instance, as noted, much of the existing evidence on computer-assisted learning and educational technologies predate the shifts in teaching practices necessitated by the recent COVID-19 pandemic. The average quality of online solutions as well as their acceptability and adoption have been accelerated by investments made during the pandemic. Schools, private tutoring, and community programs were compelled to switch to online-only delivery and thus made the requisite investments in both technological infrastructure (e.g., videography, learning platforms) and pedagogy to do so. Meanwhile, households had to adjust to using digital technology as a primary enabler of instruction instead of as a supporting pillar. As such, evidence from the pre-COVID era (or the lack thereof) would not be reflective of any COVID-influenced paradigm shift in the use of educational technology.

More broadly, the effects of the COVID-19 pandemic, school disruptions, and home-based learning modalities on educational disparities in Singapore remain to be assessed thoroughly, although early evidence from other countries suggests that they may be significant. It also remains unknown whether these effects are temporary or lasting.

Final Highlights and Recommendations

There is strong cumulative evidence of SES-based disparities in educational outcomes at the primary school level in Singapore, in terms of both achievement and learning attitudes/dispositions. While differences are likely to emerge in the late pre-primary years, they are not redressed in primary school. Moreover, although evidence regarding the specific trends is mixed, it is clear that these disparities have not been eradicated over time.

To address these disparities effectively, one may draw on our evidence review while noting the insights highlighted during the informational interviews that we conducted with stakeholders in Singapore. To be successful, measures implemented elsewhere need to be adapted as appropriate for the Singapore context. For instance, a large proportion of students even in low SES households in Singapore already receive some form of tuition or after-school classes. However, while they may still address issues related to academic performance, group-based classes similar to in-school instruction that largely focus on content delivery may have less impact than interventions that address the core need for regular, personalized instruction, attention, and feedback. In another instance, although parental involvement is acknowledged to be vital, the take-up and success of interventions to improve parental engagement may be contingent on the bandwidth and capacity of parents themselves. Given parental time and resource constraints, it is important to recognize these issues and strongly communicate the value of such interventions while appealing to inherent motivation, so as to better enable active support and participation.

Based on our review of global and local evidence, we suggest the following areas for prioritization:

Academic and non-academic support models that incorporate regular, personalized attention and address specific disruptions due to personal circumstances that lead to gaps in basic needs such as tiredness, hunger or lack of parental support.

There is merit in focusing on individual performance (through tutoring and feedback) in the context of a sustained relationship with a constructive peer or adult while maintaining strong links with teachers and schools. Promising design features could include the following:

One-on-one interaction or small group instruction with similar personalization and focus on cognitive skills during one-on-one interactions.

Holiday programs that give opportunities for personalized tutoring to bridge potential learning gaps between low and high SES students.

Out-of-school programs that foster an environment that may be lacking at home, so as to build students' socioemotional well-being.

Feedback and monitoring of progress through sustained partnership between teacher and parent, including establishing (and increasing) expectations for student performance and specifically discussing what the parents can do at home.

Programs that focus on cognitive skills while supporting cooperative learning activities and socio-emotional competency-building

Such activities could aim to collaborate with schools and reinforce the knowledge and skills learned as part of the regular curriculum or provide independent but complementary activities and resources in a psychologically safe and supportive learning environment that may not be available at home.

Other innovative new approaches designed in response to needs assessment or stakeholder priorities could also offer opportunities for intervention, albeit subject to rigorous assessment of individual program potential. These may include:

Innovations in new technology that specifically enable identified evidence-based learning mechanisms for low SES students.

Approaches or interventions that relieve parental mental load or simplify their day-to-day lives as well as parenting in general.

Finally, **continuing outreach and engagement across stakeholders remains a top strategic priority, focusing on access to key ongoing interagency initiatives as well as new collaborations.** Such engagement would best enable productive discussion and alignment for the sector as a whole.

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