

Factors Influencing High-Performing Education Systems: A Case Study of Singapore

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Abstract. Singapore's remarkable performance in the Programme for International Student Assessment (PISA) has placed it among the world's high-performing education systems (HPES). Taking Singapore as an example, this article analyzes the factors that affect the high-performing education system. These factors include education reform, the quality of teacher education, school leadership, and cultural context. Firstly, the influence of the basic education curriculum reform on the high-efficiency education system in Singapore is mainly reflected in three areas, which are training objectives, school system, and curriculum setting. Secondly, quality of teacher education includes the following aspects, namely rigorous selection and training, continuous professional development, teacher performance evaluation, and career development paths. Thirdly, the strategic investment in school leadership programs has built a robust capacity for effective educational change and improvement. Fourthly, the cultural context of Singapore, with its test-oriented and centralized educational framework, reinforces a meritocratic ideology that supports standardized national curriculum and high-stakes exams, which have been instrumental in driving the system's high performance. Based on the above factors, this paper also puts forward some measures, taking educational diversion, setting up a special principal training program, and creating a high-quality teacher development road, that other countries can learn from to promote the development of their education systems.

Keywords: high-performing education system, Singapore, education reform, quality of teacher education, impact of school leadership, cultural context.

1. Introduction

Education stands as a cornerstone for national development, shaping the future workforce and contributing to the innovation and competitiveness of a nation. Among various education systems worldwide, Singapore's has emerged as a model of excellence, consistently ranking at the forefront of international assessments such as PISA (Programme for International Student Assessment).

PISA 2022 is the eighth round of assessment since its inception in 2000. In 2022, about 690,000 students took part in the Programme for International Student Assessment (PISA), representing about 2,900,000 15-year-olds from 81 participating countries and economies. Each PISA test assesses students' knowledge and skills in math, science and reading, with a focus on one subject and a summary assessment of the other two, with the focus in 2022 being math.

The innovation of PISA 2022 is to focus on assessing students' creative thinking, algorithmic thinking, socio-emotional development, and the impact of the pandemic on the global education system. Singapore ranked first in mathematics (575 points), reading (543 points) and science (561 points). Singapore is also one of the few countries to have made steady progress in reading and science since 2018, while math scores have remained stable (OECD, 2023).

The success of Singapore's education system has sparked interest and imitation among educators and policymakers globally. Despite the widespread recognition of Singapore's achievements, there remains a complex interplay of factors that contribute to its high performance (Bray Mason, 2014). Understanding these factors is crucial for nations seeking to emulate Singapore's success and for researchers aiming to expand the field of comparative education.

This study aims to explore the multifaceted factors that have influenced the high performance of Singapore's education system. By examining the systemic, cultural, and policy-driven elements, this

paper seeks to provide a comprehensive analysis that can inform educational reforms and practices elsewhere.

The study will address the following research questions:

- 1) What are the key education reforms that have contributed to the high performance of Singapore's education system?
- 2) What is the role of the quality of teacher education in the high performance of Singapore's education system
- 3) How does the school leadership in Singapore contribute to its high performance?
- 4) How does the cultural context in Singapore impact educational outcomes?

The paper proceeds as follows: After this introduction, the literature review will examine the current understanding of high-performing education systems and establish a framework for the subsequent analysis. The methodology section will detail the data collection and analysis processes. The findings, discussion, and conclusion will subsequently be presented to answer the research questions and offer implications for the broader educational community.

The findings of this case study are significant as they contribute to the global dialogue on educational excellence (UNESCO, 2020). By understanding the nuances of Singapore's education system, this paper aims to offer insights that can guide policy formulation and instructional practices in other contexts, ultimately working towards the enhancement of educational outcomes worldwide.

2. Literature Review

Strong student performance on international examinations, high literacy rates, and fair access to high-quality education are common characteristics of high-performing educational systems (OECD, 2010). A growing corpus of scholarly works, books, and articles on high-achieving educational systems exists. This body of literature identifies the enabling "conditions" concerning these factors in the systems and explains the PISA top rankings of high-performing systems in terms of contributing factors, which are broadly defined as teacher quality, educational reform, school leadership, system characteristics, and cultural context.

The quality of the teaching force is universally acknowledged as a critical component of educational success (Tatto et al., 2018). In Singapore, a rigorous selection process and a culture of continuous professional development contribute to a highly skilled and motivated teaching workforce (Lee & Gopinathan, 2010).

Singapore's education policy has evolved through deliberate stages, each marked by strategic reforms aimed at enhancing the quality and relevance of education (Balfour & Cartwright, 2008). The ability of the Singaporean government to implement and adapt these policies over time has been a key factor in the system's high performance (Kwok, 2013).

Another contributing factor to a system's high rankings in PISA is high-quality school leadership developed through leadership experiences and professional development programmes (see Barber and Mourshed 2007; Darling-Hammond and Rothman 2011; Harris et al. 2014).

System characteristics – such as academic expectations, standards, accountability measures, etc. – are also considered important contributing factors. High-performing jurisdictions set high academic expectations and standards for students and monitor their performance against those expectations and standards (Barber and Mourshed 2007; OCED 2010a).

Apart from the possible contributing factors noted above, the social, cultural and institutional contexts of a high-performing system which, many scholars have argued, is crucial for understanding the educational success of a country (see Aho, Pitkanen; Simola and Rinne 2011). It is important to consider the unique culture and context of Singapore, including its size, homogeneity, and the strong role of the state in shaping education policy (Gopinathan & Ho, 2007). These factors may contribute to the system's success but also limit the applicability of its model to other countries.

Based on Singapore's education reform, teacher quality, school leadership and cultural context, this paper analyses the influencing factors of Singapore's education system's high performance by PISA judges.

3. Methodology

The research methodology adopted for this study is the case study approach, which is particularly suitable for in-depth investigation of complex phenomena within a real-life context (Yin, 2017). Singapore was selected as the case for this study due to its consistent high performance in international educational assessments and its reputation as a model for educational excellence (OECD, 2010). Data were collected from document analysis and PISA to provide a comprehensive understanding of the factors contributing to Singapore's educational success.

4. Findings

This part analyses the factors that affect the high efficiency of Singapore's education system from the aspects of education reform, teacher quality, school leadership and cultural context.

4.1. Educational Reform

From independence in 1965 to the present, the development of basic education in Singapore has mainly experienced four stages: First, the survival-oriented stage (1965-1978), where the government focused on expanding basic education to meet the needs of educated and skilled workers required by the manufacturing industry; Second, in the efficiency-oriented stage (1979-1996), the government continued to increase the number of years of education for workers, and began to explore the education distribution system to meet the demand for diversified talents in capital - and technology-intensive industries; The third is the competency-based, aspiration-oriented stage (1997-2011). In 1997, the government began to implement the "Thinking School, Learning Country" and the lifelong learning program, to cultivate innovative talents who can become the core competitiveness of the country in the intellectually intensive social trend. In April 2014, the government released the 2nd Century Skills and Goals Framework for Singapore Students to meet the core competencies and values of Singapore's current youth to compete internationally.

The influence of the basic education curriculum reform on the high efficiency education system in Singapore is mainly reflected in three areas: training objectives, school system and curriculum setting.

4.1.1. Training Objectives: 21st Century Skills

In 2009, Singapore released The Desired Outcomes of Education (DOE), which set out four goals to develop people who are confident, who are active learners, who can contribute, and who care about their country. The Ideal Educational Outcomes set the direction for curriculum reform in Singapore. In 2010, the core Competencies, "21st Century Skills", were developed based on the goals set in the "Desired Educational Outcomes".

In Singapore, these competencies are broadly categorized into several areas:

Cognitive Skills: Critical thinking, creativity, and problem-solving. Metacognitive Skills: Self-awareness, self-management, and learning to learn. Interpersonal Skills: Communication, collaboration, and cross-cultural skills. Character and Citizenship: Integrity, responsibility, respect for diversity, and national education.

While quantitative data on the direct outcomes of these competencies can be challenging to measure, there are several indicators that suggest the effectiveness of Singapore's approach. First, PISA Results: Singapore has consistently ranked high in the OECD's Programme for International Student Assessment (PISA), particularly in collaborative problem-solving, which is a key 21st century competency. Second, TIMSS and PIRLS: Singaporean students have also performed well in the Trends in International Mathematics and Science Study (TIMSS) and Progress in International Reading Literacy Study (PIRLS), showcasing their strong cognitive and literacy skills. Third,

Graduate Employability: High employment rates and positive feedback from employers suggest that Singaporean graduates possess the skills sought after in the modern workforce.

4.1.2. School System: Separation in Primary Schools and Integration in Secondary Schools

Singapore's school system has been a key contributor to the country's high-performing education outcomes. It is characterized by "separation" and "integration".

Primary school is a six-year program that focuses on basic knowledge such as language, mathematics, and science. At the end of Primary Four, the school will give students a test in English, mother tongue, mathematics and science, and according to the results of the test, students will be divided into Subject-Based Banding classes. Before 2008, Singapore implemented the "primary four flow", according to the scores of students in the test, from high to low: EM1, EM2, EM3 three source classes for hierarchical teaching. But the small four diverts too early, has been criticized. More flexible subject grouping was introduced after 2008.

Thus, Singapore's primary education is very focused on language, math and science, which is exactly what PISA tests, so it is not surprising that Singapore is a high performing country. For example, the data of 2022 Pisa shows that Singapore scored significantly higher than all other countries or economies in mathematics (575 points) and, along with Hong Kong (China), Japan, Korea, Macao (China), and Chinese Taipei, outperformed all other countries and economies in mathematics. What's more, Singapore scored significantly higher than all other countries/economies in reading (543 points) and science (561 points) (OECD, 2023).

Secondary education lasts for 4-5 years, and Singapore secondary education is divided into two types: Express Curriculum and Normal Curriculum. The Normal Academic Curriculum is divided into the Normal academic Curriculum and the Normal Technology Curriculum. Based on the results of the Primary School Leaving Examination, different types of courses are studied. The Fast Track is a 4-year, academically advanced secondary education, followed by an "O" level examination and entry to a junior college or polytechnic. The general academic course is a "4+1" model, and the general academic course provides students with an ordinary level of academic education. Students of the General academic program can take the "N" level (academic) examination through 4 years of study and enter the technical education Institute or polytechnic, or they can enter the fifth year of secondary education after 4 years of study, and then take the "O" level examination together with students of the expedited program to enter the junior college or polytechnic. Students of the general craft program undergo four years of craft secondary education, and take the "N" level (craft) examination after graduation to enter the Institute of Technical Education or the Institute of Art Education. The three types of courses are not completely independent and can be integrated with each other under certain conditions. If a student enters a course of study and finds that the course is not suitable for his/her study, he/she can apply for another course of study if conditions permit. Singapore's secondary education also attaches great importance to the cultivation of students' language, mathematics and science, and selects students mainly by examination. Therefore, Singapore students' test-taking skills in PISA are relatively strong.

4.1.3. Curriculum: Life Skills, Learning Skills, and Subject Knowledge

The basic curriculum in Singapore is divided into three major areas: life skills, learning skills, and subject knowledge:

Life skills courses: "Education is life", the goal of education is to enable students to adapt to life and improve the quality of life. To this end, the Singapore curriculum puts Life Skills at the heart of the curriculum.

Learning skills courses: Learning ability is the foundation of a person's lifelong development. Learning skills are mainly carried out through Project Work. Through a real problem-solving process, students develop innovative thinking, critical thinking, information collection, processing, analysis and effective expression skills. This is a skill-oriented course that is assessed primarily by performance in problem solving and final presentation of results, without examination.

Subject knowledge courses: This part involves many subjects and can be divided into three modules: language, science and mathematics, humanities and arts. Language is a very important part of Singapore's basic education, and Singapore promotes the "bilingual policy" that everyone should master at least two languages, namely English and mother tongue. Mathematics and science subjects in the main science areas include mathematics, science, computer applications and other science subjects. Humanities and Arts mainly liberal arts and arts subjects, such as social studies, geography, fine arts, music and so on.

All in all, the above reform measures of Singapore's basic education curriculum, such as training objectives, academic system, and curriculum Settings, have promoted Singapore to become a high-performing country.

4.2. Quality of Teacher Education

A 2007 McKinsey report pointed out that teachers and the quality of teacher education are the key to the quality of basic education. The need to integrate the performance of the education system with the quality of teachers to attract the best students into the teaching profession. The Singapore Government recognizes the importance of teacher quality and the need for a strong and ongoing strategic partnership among education stakeholders that provides the necessary collaborative framework of shared values and goals to facilitate the achievement of uniform results. It has proved successful in attracting 10 to 30 percent of top graduates (Ee-Ling & Oon-Seng, 2017). Among them, the pre-entry selection and training of teachers, as well as post-service career development, salary and working conditions will all have an impact on the teaching performance of teachers. Therefore, the following will describe the recruitment, training and development of teachers in Singapore and the path of post-service development.

4.2.1. Rigorous Selection and Training

Singapore has a highly selective teacher education and training system. Only the top 30% of high school graduates are eligible to enter teacher training programs, ensuring that the teaching profession attracts individuals with strong academic backgrounds. In addition to meeting the basic academic criteria, they are also expected to demonstrate their passion for teaching, ability to communicate well with others, creativity and innovation, self-confidence, leadership skills and the potential to be a good role model. In the future they will also be able to apply for postgraduate or non-postgraduate education programmes depending on their academic qualifications.

4.2.2. Continuous Professional Development

Singapore's teachers are required to participate in 100 hours of professional development each year. This commitment to ongoing learning helps teachers stay abreast of the latest pedagogical methods and educational research, which in turn enhances the quality of instruction.

The NIE is Singapore's primary institution for teacher education and has been at the forefront of shaping the country's educators since its establishment. It offers a comprehensive range of teacher training programs, as well as professional development courses for in-service teachers. NIE provides both undergraduate and postgraduate programs that lead to teaching qualifications. The Bachelor of Arts and Bachelor of Science programs prepare graduates to teach at the primary and secondary levels. The institute also offers postgraduate diplomas and degrees for individuals seeking to specialize in various areas of education or take on leadership roles. In addition to initial teacher education, NIE plays a critical role in the continuous professional development of Singapore's teachers. It offers a variety of courses and workshops designed to keep teachers up-to-date with the latest pedagogical methods and educational technologies.

4.2.3. Teacher Performance Evaluation and Career Development Paths

Singapore has implemented an EPMS that focuses on both the performance and developmental aspects of teaching. This system evaluates teachers based on their professional knowledge, skills, abilities, and attitudes. It includes an assessment of work achievements and personal development

potential, with the latter comparing the teacher's current development status against their annual personal work plan. The EPMS is a capability-based performance assessment system that aims to improve work and professional growth (Ee-Ling & Oon-Seng, 2017). The evaluation process is not just about assessing performance but also about guiding teachers towards professional development. It includes regular feedback and mid-year reviews, which are non-evaluative and aimed at improvement rather than grading. In addition, the evaluation process involves multiple layers, including self-assessment, peer evaluation, and supervisory assessment. This multi-faceted approach helps in obtaining a well-rounded view of a teacher's performance.

At the same time, recognizing that teachers have different aspirations, the Ministry of Education has identified three career paths for teacher development. The Teacher Track provides opportunities for professional development and advancement for teachers who aspire to further develop their teaching abilities; The Leadership Track provides opportunities for teachers to assume leadership positions in schools and the education sector; The Senior Specialist Track is for teachers who are committed to applying advanced professional knowledge and skills in their quest for educational advancement (Cheng, 2011).

4.3. Impact of School Leadership

High-performing systems deliberately build the leadership capacity for effective change and improvement and secondly that this capacity building is part of an 'implementation science' that drives and to a certain extent, determines high performance (Harris, 2014).

One of the most significant aspects of the education system in Singapore is its investment in leadership development at all levels (Ng, 2008). In 2011, the Wallace Foundation also reported that Singapore has invested heavily in leadership development, believing that high quality school leaders can enhance the quality of the education system, highlighting the empirical link between school leadership and the high performance of the education system.

The Leaders in Education Programme (LEP) is a sixmonth, full-time program at the National Institute of Education (NIE) in Singapore for educators who are chosen based upon their performance and their potential leadership ability.

There are several elements to this project that can be seen as contributing to an efficient education system in Singapore.

First, form a syndicate group training model. The syndicate group training model is a key component of the programme and is designed to facilitate knowledge building, sharing and deepening. The trainers are in small groups of about five to six, and the leader of the group training is both a supervisor and a facilitator, overseeing the trainers' learning in school, on international visits, and more broadly on classroom-based learning, thus forming an intensive learning relationship between the participants and the leader and other participants. In addition, syndicate meetings are usually held once a week, aiming to actively encourage thinking divergence and exploration of thinking through the way of "brainstorming", promote the continuous thinking of the participants' minds, and "brainstorming" to promote creativity, novelty and innovative thinking.

Second, focus on teaching the concept of action learning. LEP emphasizes Action learning delivery (content as learning support). In this concept, trainers know that they will get something, but they cannot predict the content. They must create knowledge through team learning, report back in weekly meetings, and know what knowledge they have created at the end of the meeting.

Third, make the future school plan. The School of the Future project is the primary learning mission of LEP trainers and shows how the project has evolved from an individual cognitive learning model based on existing knowledge to a social constructivist paradigm based on the construction, sharing and application of knowledge. In this project, the facilitators will design an open school that will be future-proof in 15 to 30 years.

Since the introduction of LEP in Singapore in 2001, there has been a lot of international interest in it. Over the years, through the "Thinking Schools, Learning Nation" initiative, the education sector in Singapore has been decentralized, giving schools more autonomy and responsibility for their own

development plans, and through high-quality leadership programs such as LEP, enabling leaders to have a higher level of leadership and management capabilities. To address the challenges posed by the knowledge economy and fulfil Singapore's national agenda (Pi, 2002).

4.4. Cultural Context

We argue that Singapore's PISA performance may be attributed to a certain kind of pedagogy as well as the distinctive institutional and cultural frameworks that govern, encourage, and control this pedagogy. This does not negate the influence of other social and cultural variables on PISA test results, either. It is not easy to explain the PISA success of an Asian nation like Singapore; there are many possible contributing factors, including the Confucian cultural orientation, students' motivation, resilience, amount of time spent on homework, learning modes, and out-of-school tuition (Bulle 2011; Jerrim 2014). Our point is that the pedagogy and its surrounding cultural and institutional contexts are too important to be overlooked in explaining Singapore's top rankings in PISA (Deng & Gopinathan, 2016)

To use Simola's words, Singapore's better PISA performance "no longer appears to be a miracle" given the nature of exam-oriented education and the institutional and cultural frameworks that support it (2005). Like their counterparts in Finland, educators in Singapore continue to impart information in "the traditional way" due to ingrained views about the nature of knowledge, education, and learning as well as the institutional, social, and cultural contexts that foster and promote these pedagogical practices. But in Singapore, teachers' traditional pedagogical beliefs and practices are more supported, regulated, and constrained by a prescribed national curriculum, high-stakes exams, and an examination-based meritocracy ideology than they are in Finland, where they are "supported by social trust and their professional status". Therefore, the key to Singapore's top rankings can be attributed to the persistence of traditional pedagogical practices within the framework of a centralized educational system, which is supported by an examination-based meritocracy ideology and features a standardized national curriculum and educational standards enforced by high-stakes exams.

5. Discussion

The factors contributing to the high performance of Singapore's education system can be attributed to the following aspects: education reform, teacher quality, school leadership, and cultural context. First, the impact of Singapore's basic education curriculum reform on the high-efficiency education system is mainly reflected in three areas: training objectives, academic system and curriculum. Secondly, the path of teacher recruitment, training and post-service development in Singapore will have an impact on the effective education system. Then, the high efficiency of school leaders and the high efficiency of the education system have a two-way promoting effect. Finally, Singapore's cultural context, such as test-oriented, centralized and Confucian culture, will promote Singapore's high performance in PISA.

Singapore's development philosophy and practice in the field of basic education are reflected in the PISA results. It is a series of concepts and reforms in Singapore that make Singapore's education constantly adapt to the development of The Times and the needs of students, especially the proposal and implementation of 21st century skills in recent years, whose results are even more verified in PISA. Through the analysis of the promoting factors of Singapore's efficient education system, it can be used as a reference for the reform and development of basic education in other countries.

The method of diverting education maximizes the benefits of human capital. Students may identify, prevent excessive waste, and consider a range of education with the use of the education diversion system.

Second, set up a special principal training program to promote the ability and level of school leadership. It is very important to build a vision for the future and cultivate the ability of school leaders to grasp the overall situation and future development direction. In addition, the emphasis on cooperation and mutual assistance is not only conducive to the personal development of school

leaders, but also to the development of new models of development, and promote the efficient development of the education system with The Times.

Third, the high-quality teacher development path ensures the continuity and high level of the teacher team. First, strict admission standards make prospective teachers have higher teacher quality and potential development level. Secondly, high requirements and high-level training modes can make teachers at different levels obtain suitable development training programs. Moreover, the diversification of teachers' development paths provides a reference for ensuring the long-term stable and high-level development of teachers.

The reform and development of the education system should be based on the comprehensive situation of the society, culture and situation of the country. Singapore's education system is not necessarily suitable for all countries, and countries must consider their own actual history and current situation of education development to develop plans to promote more efficient education systems.

6. Conclusion

Based on the comprehensive analysis presented in this case study, the conclusion can be drawn that Singapore's education system exemplifies a model of excellence through a multifaceted approach that intertwines education reform, quality of teacher education, school leadership, and cultural context. The systematic curriculum reform has been pivotal in aligning educational goals with the demands of the 21st century, emphasizing cognitive, metacognitive, interpersonal skills, and character development. In addition, the rigorous selection and continuous professional development of teachers have cultivated a highly competent and motivated teaching force. Furthermore, the strategic investment in school leadership programs, such as the Leaders in Education Programme (LEP), has built a robust capacity for effective educational change and improvement. What's more, the cultural context of Singapore, with its test-oriented and centralized educational framework, reinforces a meritocratic ideology that supports standardized national curriculum and high-stakes exams, which have been instrumental in driving the system's high performance. The case of Singapore underscores the importance of a tailored approach to education reform that considers the unique social, cultural, and institutional contexts of a nation.

As other countries look to Singapore's success for inspiration, it is imperative to recognize that a one-size-fits-all approach is not viable. Instead, nations should adapt Singapore's principles to their specific contexts, focusing on developing a shared vision for education, fostering a culture of excellence, and creating an environment that supports innovation and continuous improvement. By doing so, they can strive towards enhancing their own educational outcomes and nurturing a future-ready workforce that can contribute to the global knowledge economy.

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