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Global Impact of Programme for International Student Assessment on Mathematics Learning of Hong Kong Secondary School Students

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The Programme for International Student Assessment (PISA) has become a pivotal global benchmark for evaluating 15-year-olds' ability to apply academic knowledge to real-life challenges, exerting profound influences on education systems worldwide. This paper focuses on exploring the multi-dimensional impacts of PISA on mathematics learning among Hong Kong secondary school students. It first outlines PISA's background and Hong Kong's consistent participation and outstanding performance since 2000. Subsequently, the study analyzes Hong Kong's core advantages in PISA under globalization, including the balanced professional development of mathematics teachers, curriculum alignment with core literacy, and the strong resilience of the education system. It also identifies critical challenges, such as the simplification of educational assessment and the erosion of the essence of education due to excessive exam-oriented tendencies. Finally, corresponding suggestions are proposed, including establishing a diversified evaluation system, endowing teachers with teaching autonomy, and relieving students' academic pressure. This research aims to provide insights for optimizing Hong Kong's mathematics education system and enhancing students' mathematical competence amid global educational competition.

Keywords: PISA, Hong Kong secondary school students, mathematics learning, global educational impact, educational assessment

Introduction

Introduction to PISA

International large-scale education assessments (ILSAs) are increasingly causing concern among policymakers, educators, practitioners, and the general public (Wang, Perry, Malpique, & Ide, 2023). The Programme for International Student Assessment (PISA) has become the most widely used international assessment among all ILSAs (Martens & Niemann, 2013). PISA has observed a substantial increase in participants from 32 in 2000 to 85 in 2022 (OECD, 2022). By 2030, 170 countries are projected to participate (Xiaomin & Auld, 2020).

The core objective of PISA is to assess the ability of 15-year-old children worldwide to apply their knowledge and skills to real-life challenges in reading, mathematics, and science (Li, Xue, & Guo, 2025). PISA has gained valuable insight into how education can prepare students for lifelong learning and solving practical problems since it was founded in 2000 (OECD, 2019). Wu (2025) advocates that, due to its rigorous methodology

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and international scope, PISA is widely regarded as a valuable tool for assessing the effectiveness of science education throughout the world. Moreover, PISA plays an essential role in international policy decisions and is a reference for global educational reform (Hastedt & Rocher, 2020). In addition to collecting students' cognitive ability data, PISA also aims to obtain students' motivation, self-assessment, learning style, school environment, family, and other data. These collected data are crucial to clarify the various influencing factors related to students' academic performance (Ozer & Anil, 2011).

The Significance of the Essay

PISA has had a multi-dimensional impact on Hong Kong middle school students' mathematics learning in the context of globalization. By analyzing the advantages and challenges of Hong Kong's participation in PISA, we can help Hong Kong recognize the current situation of mathematics education, optimize the education system, improve students' mathematics ability, and cope with the global education competition.

The Outline of the Essay

This article will introduce the background of Hong Kong PISA, analyze the advantages of Hong Kong in PISA under the background of globalization, point out the challenges faced by Hong Kong, and finally give some personal suggestions.

Background

PISA was first held in 2000 and continues to be held every three years. PISA 2021 was postponed to 2022 due to the new coronavirus pandemic (Bayirli, Kaygun, & Öz, 2023). Hong Kong has continued to participate since its first implementation in 2000. Hong Kong has always performed well in PISA. For instance, from 2012 to 2018, Hong Kong's mathematics scores were higher than the average level of the organization for Economic Cooperation and Development (OECD) (Wang et al., 2023). What is more, a PISA study in 2012 found that 79% of Hong Kong students are capable of mastering mathematical abstract abilities, compared to 78% of Shanghai students. The intuitive imagination ability reached 56%, which stood out in comparison to that of Macao (38%) and Taiwan (39%) (Zhang, Zhao, Jian, & Wu, 2025). Furthermore, in PISA in 2018, Hong Kong's mathematics performance was still at the forefront of the world. Meanwhile, the mathematics performance of Hong Kong students is similar to that of Singapore, Japan, and other Asia Pacific high-performance economies, reflecting the stability of their education system in the conventional environment (Bayirli et al., 2023).

Advantages of Hong Kong PISA in the Context of Globalization

Balanced Professional Development of Teachers

Hong Kong's mathematics teacher professional development system has shown significant advantages in the global education competition, which directly supports its continued excellent performance in PISA. Initially, Hong Kong's performance in PISA benefits from the systematic support for the professional development of mathematics teachers, especially in the balance of training pertinence and participation. In the study of 16 countries and regions, Yang and Zhuang (2025) find that the proportion of mathematics teachers in Hong Kong participating in professional development training in the past three months reached 51.19%, which was higher than that in Spain (51.19%), Hungary (30.38%), and other countries, and the coverage of on-campus training was high, especially in "invited expert training" and "targeted workshop", with an average proportion of 23.80% and 25.60% respectively.

In addition, Hong Kong's advantage lies in the close integration of teacher training and student needs. For example, the "seminar on specific issues organized by schools" in Hong Kong is higher than that in Spain and France (Yang & Zhuang, 2025). This kind of targeted training helps teachers quickly adapt to classroom challenges. As a result, Hong Kong teachers have mastered adaptive teaching skills through training, notably improving students' self-efficacy in mathematics (Zhu & Kaiser, 2022). On the contrary, although 71.54% of teachers in Thailand participated in the training, students' performance still lagged behind that of Hong Kong due to the lack of cohesion with students' learning goals (Yang & Zhuang, 2025). This reveals that the development of teachers in Hong Kong is not simply to pursue the participation rate, but to pay attention to the effectiveness of training, emphasizing that teachers' professional development needs to anchor students' development.

Courses Focus on Core Literacy

The Hong Kong Mathematics Curriculum and the PISA literacy framework are highly compatible, which makes it outstanding in cultivating students' application ability. Zhang et al. (2025) state that the proportion of Hong Kong Students' mastery of "intuitive imagination" literacy reached 56%, which was significantly higher than that of Macao (38%) and Taiwan (39%). This is closely related to the "learning to learn" curriculum reform in Hong Kong, which emphasizes interdisciplinary integration and real problem solving, and is highly consistent with PISA's emphasis on the application of mathematics in real situations. Thus, Hong Kong has been able to maintain a high ranking in PISA.

Moreover, Barba, Valeria, Caserial, and Gaylo (2024) propose that the Philippine curriculum has obvious gaps in "mathematical modeling" and "data analysis", while the Hong Kong curriculum covers more than 80% of PISA's "quantity", "uncertainty and data", and other fields, especially in the use of mathematical tools to solve financial and scientific problems. By contrast, although South Korea scored higher in "logical reasoning", its "intuitive imagination" literacy was weak, reflecting that the curriculum focused on theory rather than practice (Niu, Xu, & Yu, 2025). It can be seen that Hong Kong has achieved balanced development in all aspects of students' mathematical abilities through curriculum design, thereby maintaining high performance.

Strong Resilience of the Education System

In the face of sudden shocks brought about by globalization, such as the COVID-19 pandemic, Hong Kong's education system has demonstrated remarkable resilience, enabling it to maintain high performance. The research of Qiu et al. (2024) shows that the score of keeping school learning in Hong Kong is dramatically higher than that in the United States, indicating that Hong Kong reduced the loss of learning through measures such as network resource integration and support during the epidemic. However, South Korea's math scores declined significantly due to the 79-week school closure, while Hong Kong's closed for a short time and responded flexibly, and its scores remained relatively stable.

Similarly, the resilience is reflected in the stability of students' performance. In 2022, the mathematics scores of Hong Kong students decreased by only five points compared with 2018, while those of the United States decreased by 15 points and Brazil decreased by 22 points (Li et al., 2025).

Some Challenges of Hong Kong PISA to Mathematics Learning

Compared with PISA in 2018 and 2022, Hong Kong's ranking has not changed and has always been at the forefront of the world. However, in terms of mathematics performance, Hong Kong students' mathematics

performance in 2022 declined compared with 2018 (Qiu et al., 2024). Regarding subjective well-being, Hong Kong students' overall life satisfaction in 2022 was significantly lower than that in 2018, and the proportion of "very satisfied" decreased. Additionally, Hong Kong students' school belonging, teacher-student relationship, and other indicators in 2022 were lower than those in 2018 (Li et al., 2025).

Single Education Assessment

First of all, the global influence of PISA has led to the gradual simplification of education assessment. It ignores the individual differences of students. PISA focuses on standardized tests, while about 20% of students in Hong Kong have special learning needs, and their mathematical ability is difficult to measure by a single test (Zhang et al., 2025). In addition, a single assessment has weakened teachers' autonomy, and Hong Kong teachers have to give up more creative teaching methods to meet PISA questions (Huang, Zhou, Chen, & Wu, 2024). However, to avoid the simplification of assessment, Finland has adopted a multiple assessment system, including classroom performance, project results, etc., to reduce its dependence on PISA (Niu et al., 2025).

Eroding the Essence of Education

Additionally, the excessive examination-oriented approach erodes the essence of education. As Li et al. (2025) points out, to improve the PISA ranking, some schools in Hong Kong have reduced non-assessment content, such as the history of mathematics and interesting puzzles, and simplified the course to problem-solving skills training, resulting in a decline in students' interest in mathematics. At the same time, the PISA ranking competition in the context of globalization has brought a heavy psychological burden to Hong Kong students. The data show that Hong Kong students' mathematics anxiety level ranks high among the regions participating in PISA, and most middle school students express insomnia due to worrying about PISA scores (Li et al., 2025). This kind of pressure affects the learning effect and may lead to long-term psychological problems. In contrast, Finland pays more attention to students' interests (Waldow, Takayama, & Sung, 2014), so students who are more motivated in mathematics tend to achieve better mathematics scores (OECD, 2023). Likewise, Denmark has effectively alleviated the pressure of competition by de-ranking policy and not disclosing PISA scores among schools (Niu et al., 2025).

Suggestions

Given the above challenges, I will put forward some personal suggestions.

Establish a Diversified Evaluation System

Hong Kong can adopt a multiple assessment system, introducing assessment dimensions such as classroom performance, project results, and actual tasks. For instance, designing adaptability assessment tools for students with special needs, such as solving practical problems, such as shopping calculation and space construction, instead of pure paper and pen testing. It is also necessary to take into account the personal development of ordinary students when assessing interdisciplinary projects for ordinary students, such as analyzing traffic flow in a community with the help of mathematics. Therefore, we should reduce the excessive dependence on standardized tests and let the evaluation regression reflect the essence of the learning process, rather than simply pursuing scores.

Endow Teachers With Teaching Autonomy

Hong Kong teachers' abandonment of creative teaching in response to PISA (Huang et al., 2024) needs policy guidance and mitigation, and teachers' teaching autonomy should be given. "Teaching Innovation Fund"

can be set up to encourage the integration of non-evaluation contents, such as the history of mathematics, such as the design of "Mathematics Culture Week". At the same time, we should optimize the teacher evaluation system, reduce the direct link between achievement and performance, and include indicators such as teaching innovation, so that teachers can dare to teach in multiple ways.

Relieve Students' Pressure

Hong Kong can take some measures to ease the pressure on students. For example, secondary schools should add full-time psychological counselors and carry out relevant workshops to relieve pressure; restore the non-evaluation content and set up relevant elective courses to help students experience the value of the subject and rebuild their motivation.

Conclusion

To sum up, the purpose of this paper is to introduce PISA and its impact on middle school students' mathematics learning, explain how Hong Kong participated in PISA, and examine the advantages of the programme in the context of globalization, including the balanced professional development of teachers, the emphasis on core literacy in the curriculum, and the resilience of its educational system. Furthermore, it addresses the challenges of single assessment and erosion of education's essence, as well as recommending that a diversified evaluation system be established.

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