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The perceived impact of PISA on student learning in schools in a local Chinese context

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Abstract
The increasing concerns of the impact of the Programmes for International Student Assessment (PISA) on education policymaking along with its global reach call for the need of evaluating PISA's impact on student learning. However, most extant studies focus on arguing its impact at the policy level, without taking a further look into it at the local and school levels. This paper empirically investigates the impact of PISA on student learning in schools in a local Chinese context, that is, the Fangshan District of Beijing, through engaging local stakeholders' perspectives. Based on the interviews with local educational policymakers and practitioners, the findings reveal that PISA has motivated substantive local policy initiatives aimed at improving student learning, which have been enacted in schools to varying degrees. In many of these initiatives, some PISA concepts were incorporated in different ways. We discuss PISA's impact on the local educational policy and propose a provisional mechanism of its impact on student learning in schools.

Keywords PISA impact · Local context · School policy enactment · Student learning

1 Introduction

International large-scale assessments (ILSAs) have gradually become tools influencing educational policies in various domestic contexts (Johansson, 2016). The Programme for International Student Assessment (PISA) which is undertaken by the Organisation for Economic Co-operation and Development (OECD) is known as one of the most influential ILSAs. PISA results, considered a source of learning

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outcomes, have been used by European Union in setting its basic-skills target for member countries (Ratner, 2020) and are also synchronised into the World Bank's Human Capital Index (Liu & Steiner-Khamsi, 2020). Mainland China's first participation in PISA can be traced to the PISA 2006 China Trial, which involved four small areas (i.e. Haidian District of Beijing, Chaoyang District of Beijing, Tianjing, and Weifang City of Shandong) on a voluntary basis and was conducted by China's National Education Examinations Authority (NEEA) (Wang et al., 2017; Yang, 2008). The PISA China Trial aims to learn from PISA's advanced assessment ideas and techniques for informing national assessment reforms (Wang, 2007, 2009). In 2009 and 2012, NEEA continued undertaking PISA China Trials and extended participation to Fangshan District of Beijing and some provincial regions (Wang et al., 2017), in addition to Shanghai's formal participation which was conducted by Shanghai PISA Secretariat and Research Centre (SHPISA). Following PISA design and techniques, PISA China Trials administered cognitive assessment and background questionnaire to 15-year-old students and collected school questionnaire data. However, unlike the formal participation in PISA, PISA China Trials only targeted students enrolled in academic schools and excluded those in vocational education. Moreover, the result reports of those Trials, which were generated by the national PISA team rather than the OECD, are for domestic use and therefore not published in PISA official results reports; the data of the Trials were also not released in PISA international databases for public use (Wang & Jing, 2013). Since 2015, Mainland China has expanded formal participation in PISA with more regions involved.[1]

PISA has been used as a legitimate source evidencing education quality/issues in domestic policymaking (Lundahl & Serder, 2023), although it has limitations (e.g. methodological issues and limited content coverage) in robustly comparing and portraying the performance of education systems, tracking performance trends over time, and making causal inferences (Brown et al., 2007; Feniger & Lefstein, 2014; Gillis et al., 2016; Goldstein, 2018; Grisay et al., 2007; Jerrim, 2021; Popkewitz, 2022; D. Rutkowski et al., 2024; Rutkowski & Rutkowski, 2016; Sjøberg & Jenkins, 2022; Wu, 2014). It is claimed that various national-level educational reforms have been motivated or inspired by PISA in a number of countries including China (e.g. Breakspear, 2012; MOE (Ministry of Education), 2013a). PISA is even considered a political tool governing education systems through international comparison and with the numbers it generates and the education ideas it promotes (Elfert & Ydesen, 2023; Grek, 2009). With PISA's extension programme "PISA for Schools" which allows international benchmarking at the school level and aims to build schools' capacities and networks, and with its more recently launched online professional learning platform PISA4U which targets teachers, it is believed that such governance has been increasingly reaching into schools, classrooms, and local contexts (Lewis, 2019; Lewis & Lingard, 2023; Lewis et al., 2016). Meanwhile, concerns and

[1] In PISA 2015, a sample selected from Beijing, Shanghai, Jiangsu, and Guangdong, representing the whole of these four regions, participated. In PISA 2018, the aggregated sample was selected from Beijing, Shanghai, Jiangsu, and Zhejiang.

criticism of PISA's growing power in global education governance have been raised (Zhao, 2020). Nevertheless, in the extant literature, discussions and claims about PISA's impacts are largely based on national-level policy documents or discourses only. Although, theoretically, researchers suggested that the final outcome of PISA's policy impact is considered to be subject to the circulation and translation of PISA policy ideas in local contexts (Rautalin et al., 2019), empirical research gathering evidence on this remains rare. Given the prominent role of PISA in global education, it is important to understand whether PISA has an impact on local policy and practice, and on student learning in schools, and how the impact occurs.

This paper reports on our empirical research on evaluating PISA's impact on student learning in schools in a local Chinese context, based on the views of local educational policymakers and practitioners. The investigation seeks to address two research questions:

(1) How have local educational policymakers and practitioners used PISA in policies and practices?
(2) What are their perceptions of the impact of their uses of PISA on student learning in schools?

1.1 *PISA*'s worldwide influence on domestic education policies

PISA's impact on education policies has been widely discussed and documented (e.g. Breakspear, 2012; Ertl, 2006; Grek, 2009; MOE, 2013a; Neumann et al., 2010; Takayama, 2008; Teodoro, 2022). Its impact across different education systems may vary in terms of the "form, content, amplitude, and intensity" (Carvalho & Costa, 2015, p. 640).

1.1.1 International examples of policy responses to *PISA*

In some countries, their lower-than-expected performance in PISA brought them a PISA "shock", which subsequently triggered substantial reforms in their education systems. For example, in Germany, its unexpected below-average performance and large variation among students, as revealed by PISA 2000, raised the German public's awareness of the issues in their education system and wide debate on the need for educational reforms (Ertl, 2006; Markens & Niemann, 2010; Ringarp, 2016; Steiner-Khamsi, 2003; Waldow, 2009). As a reaction to the "shock", Germany then introduced National Education Standards (NES) to develop an assessment system for the end of secondary education to monitor education quality (Ertl, 2006). NES also incorporated literacy as defined in the PISA framework (Neumann et al., 2010). Similarly, Norway also experienced a PISA "shock", which mobilised the building of a national quality assessment system and the reform of the mathematics curriculum for compulsory education (Nortvedt, 2018).

In many education systems, policy responses to PISA are not as extreme as a "shock" (Pons, 2017). However, as claimed in national policies, there are still various PISA-motivated actions. For example, in Switzerland, the "intercantonal

agreement on the harmonisation of obligatory schooling" (HarmoS) was mobilised because its performance in PISA was not as high as expected (Bieber & Martens, 2011). HarmoS is an important structural reform on compulsory schooling, strongly following OECD's policy recommendations about social integration, equity, and education standards (Bieber & Martens, 2011). For Denmark, PISA is considered the "wake-up call" (p. 6) to reviewing their school system and introducing the mandatory standardised national testing for monitoring primary and secondary education (Ratner, 2020). Concerning its performance decline in PISA, Sweden introduced a standards-based curriculum and more extensive national testing which aligns the test criteria with those of PISA (Högberg & Lindgren, 2023; Ratner, 2020). Another example is the UK, claiming that its declining ranking in PISA 2009 is "a spur to action" (Gove, 2010). By learning from the characteristics of education systems successful in PISA 2009, the Department for Education issued the school white paper *The Importance of Teaching* to improve the quality of teaching (DfE, 2010). Following that, England promoted mastery teaching in mathematics education—an approach used in the education systems of PISA top performers Shanghai, Hong Kong, and Singapore (Cantley, 2019).

Japan, although generally performing well in PISA, also prompted education reforms by redirecting the *yutori* (low pressure/no cramming) curricula and introducing national achievement testing in response to its declined performance in PISA 2003 (Breakspear, 2012; Chung, 2016). PISA-type competencies were incorporated into the revised curricula, and PISA-type items were employed in the national testing (Breakspear, 2012). Later, referencing the technical design of PISA (and other international assessments), Japan developed its new standardised educational assessment Prefecture A, which also incorporated some content aspects (e.g. social-emotional skills) of PISA (Takayama & Lingard, 2021). In some countries where PISA results used to be relatively ignored, for example, France, along with the evolution of its domestic policy debate, PISA has been increasingly used in policy debate and linked to national education reforms (Pons, 2016; Regnault et al., 2022). Carvalho (2014) argues that PISA's impact in domestic education systems depends on factors such as knowledge traditions, theoretical or methodological proximity-distance from the PISA framework, and on-going reforms in the domestic contexts.

1.1.2 China's policy responses to *PISA*

In China, the national PISA team has made attempts in translating PISA concepts and techniques into the reforms of the content and format of the National College Entrance Examination (known as Gaokao) (Wang & Tong, 2015, 2016). For example, inspired by PISA, Gaokao has begun to employ real-life contexts in assessment items (Wang & Tong, 2015). The PISA framework also has an influence on national educational assessment system reform which was started by the MOE in 2013 for students' all-round development in primary and secondary education (MOE, 2013b). By making reference to and adapting some concepts of PISA (MOE, 2013a), this reform promotes the assessment of five aspects in student development including students' morality, academic achievements, well-being, interest, and learning burden (MOE, 2013b). Accordingly, the National Quality Monitoring System

for Compulsory Education, which made a reference to PISA and other ILSAs in developing its methods and indicators but covered wider subject areas, has been established (Xie et al., 2023). Along with PISA's important influence in educational policy discourses, "competence", although not a totally new concept, seems to become a buzzword in China. In 2016, the student development framework "core competencies" (Hexin suyang) has been developed and promoted (Lin, 2016). Like the polysemy of competence in many competence-based reforms in other countries (Anderson-Levitt & Gardinier, 2021), "core competencies" in China embodies cultural foundations, independent development, and social participation, which appear to be different from the competence list of PISA (Xie et al., 2023). It is suggested that China's national education policies responded to PISA "in a glocalized fashion" (p.6) translating PISA ideas and techniques for developing assessment capacity and shaping assessment system reforms whilst legitimising and advancing policy agendas in its own education context and for its own political, economic, and cultural needs (Candido et al., 2020). At the local level, Fangshan District of Beijing is a particular case, which has continuously participated in PISA 2009 China Trial, PISA 2012 China Trial, and PISA 2015 with locally representative samples (Wang et al., 2017), and it published its results (Wu, 2015). Following their PISA participation experiences, the Fangshan local government has initiated three projects, respectively focusing on improving teaching and learning in mathematics, science, and reading in the local context. It appears that Fangshan PISA scores and PISA assessment ideas have been actively used in motivating and informing these policy initiatives (Guo et al., 2015; Wu, 2015).

1.1.3 The dynamics of *PISA*'s impact on policies

Due to the global reach of PISA and its widely claimed impact on domestic education systems, researchers argue that PISA has had soft governance power over global education (e.g. Fulge et al., 2016; Grek, 2009; Teltemann & Klieme, 2016). Participating jurisdictions, influenced by the peer pressure brought by PISA to some extent, compete to rank high on PISA league tables (Elfert & Ydesen, 2023). Among their policy responses to PISA, sometimes borrowing or learning policies or practices from the systems having high performance in PISA is involved (e.g. Auld & Morris, 2016; Cantley, 2019; Davis et al., 2020; Forestier et al., 2016; Santos & Centeno, 2021; Steiner-Khamsi & Waldow, 2012). It is also suggested that since educational reforms in various systems tend to follow the recommendations on the indicators related to student performance that underpin PISA frameworks and are highlighted by the OECD in PISA results reports, PISA has been contributing to policy convergence (Bieber & Martens, 2011). Therefore, its possible consequences that decontextualised data of PISA (e.g. rankings, performance trends) are accepted at face value by policymakers and thereby mislead policymaking are critiqued (Komatsu & Rappleye, 2021; Ratner, 2020; Rutkowski et al., 2020; Sjøberg & Jenkins, 2022). Moreover, concerns of PISA narrowing the understanding of the definition of education quality and prioritising achievement results are also raised (Engel & Rutkowski, 2014; Rutkowski et al., 2020).

However, Michel (2017) argues that such convergence is limited due to the diversity in historical, sociological, and cultural contexts among jurisdictions. It is also subject to the social, economic, and cultural resources available in the domestic contexts (Stray & Wood, 2020). Niemann et al. (2017) argue that neither PISA nor the OECD alone could stimulate education reforms, unless domestic contextual conditions provide the ground for the occurrence of PISA impact. The translation of PISA concepts is not a unidirectional process (Stray & Wood, 2020). Instead, it involves "reinterpretation, de-contextualisation, and re-contextualisation, and where national, local, regional and international agencies intertwine" (Carvalho & Costa, 2015, p. 640).

Policymakers face the pressure to find solutions to address the issues in their domestic education systems, and PISA "opened a window of opportunity" (Bieber & Martens, 2011) for legitimising the necessity of educational reforms for addressing accumulated problems in education and provided direction for such reforms (Niemann et al., 2017). However, in seeking solutions from PISA, the policy initiatives may not necessarily be closely linked to PISA results (Baird et al., 2011; Volante & Mattei, 2024) or those in claimed reference societies (Morris, 2015). Compared with PISA performance, geopolitical and historical relationships, and shared cultural and social values between countries, might be a more important factor in the decision of choosing the reference society (Hansen et al., 2020; Santos & Centeno, 2021). Moreover, PISA or reference societies may only be used in political rhetoric (Baird et al., 2016; Santos & Centeno, 2021) and referred to for the sake of convincing audiences and strengthening arguments of pre-shaped policy ideas (Pons, 2012; Volante & Mattei, 2024), which in some cases even run counter with each other (Hansen & Jóhannesson, 2023). In the education systems where policy initiatives are legitimated with PISA, those initiatives may not make fundamental changes to the system (Bringeland, 2022) or localise some PISA concepts to make it compatible with domestic policy purposes (Cave, 2023).

When putting policy initiatives into practice, school-level responses and enactment of these initiatives are also a complex process, in which policies are further translated and interpreted by various policy actors such as school leaders and teachers (Braun et al., 2010, 2011). Despite that PISA's impact on formal policies has been considerably claimed, it is possible that this impact only remains in policy texts without bringing actual changes to practices at schools (Niemann et al., 2017). The school enactment of policies is subject to specific resources, teaching, and learning challenges in different schools (Braun et al., 2011; Maguire et al., 2020). Moreover, as suggested by Maguire et al. (2015), policy types and power are also related to policy enactment. Teachers are the key agents and final policy brokers in school enactment of what and how students learn at school; otherwise, learning would not be influenced by policies if teachers do not make changes in their teaching practices (Cohen & Ball, 1990; Spillane, 1999). Policy enactment can be mediated by the negotiation between teachers' own priorities in teaching practices and those implied in policies (Schwille et al., 1982) and also depends on teachers' will as well as the capacity to enact policies (McLaughlin, 1990).

Considering the above-discussed factors involved in the circulation and translation of PISA concepts through PISA-motivated policy initiatives, it is important to

research PISA's impact on student learning in local contexts with contextual considerations. Fangshan District of Beijing was chosen as the local context for our research, for its high engagement and continuous participation in PISA.

1.2 Conceptual framework

This research employs the theories about washback (Alderson & Wall, 1993; Hughes, 1993, cited in Bailey, 1996) and ecological systems (Bronfenbrenner, 1979) as the conceptual framework informing the research design, data analysis, and interpretation.

The washback effect refers to the impact of a test on teaching and learning (Alderson & Wall, 1993; Buck, 1988; Hamp-Lyons, 1997; Hughes, 1989; Shohamy, 1992), on individuals, education systems, and even society (Bachman & Palmer, 1996). It has been considerably discussed in language testing and high-stakes educational assessment. Depending on the design and use of the test, washback could be positive or negative (e.g. Watanabe, 2004; Xu & Liu, 2018). To promote positive washback, besides improving the test quality, facilitating test users' knowledge about the test and increasing communication between test developers and users are suggested as the main approaches (Xu & Liu, 2018). Although PISA is not explicitly high-stakes for schools and students, it is considered high-stakes for policymakers in the education systems that participate in PISA (Sellar et al., 2017), and the term "washback" has been (e.g. Aloisi & Tymms, 2017; Baird et al., 2016) used in discussing PISA's impact on teaching and learning, and on domestic education systems.

To investigate the washback of a test, Hughes' (1993, cited in Bailey, 1996) trichotomy model suggests to consider the "participants" (e.g. administrators, classroom teachers, students, material developers, and publishers) involved in the washback effect, participants' actions contributing to the "process" of student learning, and student learning "product" (i.e. what is learned and learning quality). Participants' perceptions and attitudes towards teaching and learning would be first affected by the nature of the test; their changed perceptions and attitudes would then affect their actions which would subsequently influence what is learned and the quality of learning (Hughes, 1993, cited in Bailey, 1996). This model provides insights into designing our current research that (1) participants who are involved in the process of student learning through taking actions in response to PISA shall be recruited for data collection; (2) their actions motivated by and using PISA, and their perceptions of teaching and learning affected by PISA shall be identified; (3) the changes in the content and quality of student learning could be seen as the evidence suggesting the existence of PISA's impact on student learning and shall be investigated. According to washback studies (Alderson & Hamp-Lyons, 1996; Alderson & Wall, 1993; Green, 2013; Spratt, 2005), for different teachers and students, the washback effect may vary in terms of strength and types, subject to factors such as participants' perceived importance of the test, their knowledge about the test, and beliefs about teaching and learning. It is further suggested that washback intensity can vary among different areas in teaching and learning (e.g. curriculum, teaching materials and methods, and teachers' attitudes), conditioned by the agency of a variety of

participants in addition to the nature of the test itself (Cheng, 1997; Spratt, 2005). To triangulate and expand the understanding of the washback mechanism, gathering perspectives of different groups of participants is proposed (Bailey, 1996; Cheng et al., 2015; Wall, 2012). For our research, it is therefore meaningful to involve both educational policymakers and practitioners to investigate PISA's impact, especially considering the complexity of school-level policy enactment.

As reviewed above, the interpretation and translation of PISA data and concepts in domestic education systems usually involve agencies at different contextual layers and their interactions (e.g. Carvalho & Costa, 2015). Identifying how the washback occurs and evaluating its type, value, and intensity in the local area can only be achieved through looking into it in its specific educational and social contexts, including that at the macro level, in which the use of the test is situated (Cheng, 1997; Cheng et al., 2015), and such contextual considerations are also essential in investigating PISA's impact on student learning.

Building contextual considerations into our empirical investigation is further underpinned by the ecological systems theory (Bronfenbrenner, 1979). This theory specifies that factors in different contextual layers, their interconnections with each other, and with the developing person can influence human development (Bronfenbrenner, 1979; Tudge et al., 2009). It suggests that the ecology of human development involves nested contexts, that is, micro-, meso-, exo-, and macrosystems (Bronfenbrenner, 1979). The most inner contextual layer, microsystem, is the immediate setting which contains the developing person (Bronfenbrenner, 1979). It is constituted by factors of activities, roles, and interpersonal relations perceived by the developing person (Bronfenbrenner, 1979). For students, typically, microsystems could be the school and the home (Bronfenbrenner, 1979). Mesosystems refer to the interconnections among microsystems, for example, the ties between the school and home (Bronfenbrenner, 1979). An exosystem is the setting in which the developing person is not directly involved as an active participant; however, it influences or is influenced by the factors in microsystems (Bronfenbrenner, 1979). The macrosystem denotes the consistencies shared by all these three lower-order layers of systems in terms of the form and content of the culture, beliefs, and ideology within a given society (Bronfenbrenner, 1979).

The ecological systems theory underpins our research in terms of identifying different contextual systems and their interrelations that are involved in the translation of PISA data and concepts into education policies and practices in the local area to understand PISA's impact on student learning. According to this theory, the local education context could be seen as an exosystem that local PISA-motivated policy initiatives may influence student learning. When the initiatives are put into practice in the school microsystem, conditions in specific school settings and teacher-related factors may be further involved in mediating PISA's impact on student learning. Regarding the mesosystem involving the interrelations between school settings and home settings (Bronfenbrenner, 1979, 1986), whether it plays a role in PISA's impact is rarely documented. However, parents engaged in school-home interconnections can also be involved in the processes of school enactment of PISA-motivated initiatives through developing a home-learning environment for students. It is therefore meaningful to explore it in our empirical investigation. According to

ecological systems theory, all the lower-order systems share some consistencies in culture, belief, or ideology which shape the macrosystem within a given society. Local policymakers, school leaders, teachers, students, and parents may share some common beliefs about the importance of some form and content in the national education system. Hence, local educational policymaking and school practices could be influenced by national-level contextual factors, which mediate PISA's impact on student learning.

We use the framework, as described above, as a theoretical lens for our research to engage with the perspectives of different local stakeholders in evaluating PISA's impact on student learning and interpret how the impact occurs with contextual considerations.

2 Methods

2.1 Field site

Fangshan District of Beijing as the local context was chosen for this research. As introduced before, Fangshan participated in the PISA 2009 China Trial and PISA 2012 China Trial with locally representative samples and continued to participate in PISA 2015 with all its eligible schools. Table 1 summarises Fangshan's sample size in each of the three PISA cycles. As their policy response to PISA, the Fangshan local government has initiated three educational projects, respectively, focusing on student learning in reading, mathematics, and science (Guo et al., 2015). Fangshan, historically an agriculture area of Beijing (Tao & Wang, 2014), has been developing its urbanisation and industrialisation rapidly (Cao, 2014). At the end of 2015, there were 56 secondary schools with 40,631 enrolled students in Fangshan (Fangshan District Bureau of Statistics and Fangshan Survey Team of National Bureau of Statistics, 2016).

2.2 Data collection

Semi-structured interviews (Bryman, 2016) were employed for data collection. Key informants of the launch and administration of the local PISA-motivated policy initiatives and school leaders as well as teachers who could provide insights into understanding school enactment of the initiatives were approached and purposively sampled. In total, 16 participants, see Table 2, were recruited. All interviews were conducted individually and face-to-face between September and October of 2017.

One local educational official, who was responsible for the administration of PISA and PISA data translation in Fangshan, was interviewed first, followed by the three key informants of the initiated projects. Interviews with these local-level interviewees were to investigate how PISA data and concepts are used and translated in shaping the PISA-motivated policy initiatives, and interviewees' perceptions of these initiatives' impact on the content and quality of student learning.

Table 1 Fangshan's sample size in PISA

Fangshan's participation in PISA	School sample size	Student sample size	Mean assessed students per school	Median assessed students per school	Min assessed students per school	Max assessed students per school
PISA 2009 China Trial	25	610	24	27	11	34
PISA 2012 China Trial	23	624	27	32	14	35
PISA 2015[1]	42	1407	34	42	4	42

[1]In PISA 2015, besides the students from academic schools which are displayed, 156 students from 4 vocational schools participated in this assessment as well

Table 2 Summary of interviewees

Local level (codes/pseudonyms)	School level (codes/pseudonyms)
One local educational official (the local educational official)	Five school leaders (SchL1, SchL2, SchL3, SchL4, SchL6)
The reading project leader (RL)	One reading teacher (Sch5-R)
The mathematics project leader (ML)	Six mathematics teachers (Linyun, Mobai, Yunlian, Wenting, Zhushan, Mingyi)
The science project assistant (SA)	

In addition to local education policymakers, education practitioners from schools were also involved for data triangulation (Bailey, 1996; Cheng et al., 2015) and identifying the agency of school-level contextual factors in the process of PISA's impact on student learning. With the recommendation of the local educational official or the project key informants, six secondary academic schools were selected and approached. Considering that school conditions may affect policy enactment (Ball et al., 2012) and student learning (Bronfenbrenner, 1979), the six schools were selected from different locations (i.e. rural/town/city) and different educational programme levels (i.e. lower/upper secondary) to allow data to cover different types of schools. School leaders and teachers who had been working in their schools for years were selected and interviewed to investigate school enactment of PISA-motivated initiatives and their perceived impact on student learning. In one of the selected schools, the eligible school leader who could provide insights into the understanding of this aspect was transferred to another school before data collection. Hence, one reading teacher who was involved in PISA-motivated reading initiatives was interviewed instead. Considering the projects' timelines, only mathematics teachers were approached when selecting teachers. The variation of the degree of teachers' involvement in local PISA-motivated initiatives was considered to identify whether washback strength differs among them. The duration of each interview varied, depending on the interviewees' responses and their available time. The interview with local-level interviewees took 1 to 1.5 h, whilst each interview conducted at school took 40 min to 1 h. Ethical review was approved, and written consent was obtained from each interviewee before the commencement of each interview. All the interviews were conducted in Chinese and were audio recorded with interviewees' consent.

Although students are also involved in the washback of PISA in the local area, this research did not directly interview students for data collection, considering the mobility of enrolled individual students over the years. Besides, as this research focuses on identifying local educational policymakers' and practitioners' perceptions of PISA's impact on student learning and their perceptions of contextual factors influencing that impact, national-level stakeholders therefore were not involved in data collection.

Table 3 Summary of themes and subthemes

Themes	Subthemes
The use of PISA in local educational policy initiatives	• Catalysing initiatives to address student weaknesses in reading performance • Integrating PISA concepts into mathematics and science teaching
School enactment of the PISA-motivated policy initiatives	
Perceived impact on student learning	• Impact on what is learned • Impact on the quality of learning

2.3 Data analysis

Audio recordings of interviews were transcribed and then anonymised. Data analysis on anonymised transcripts was conducted with the software NVivo 11. The thematic analysis approach (Braun & Clarke, 2006; Braun et al., 2016) was employed in data analysis to identify themes. Informed by the above-described conceptual framework, codes were clustered as themes and subthemes in relation to the use of PISA in local educational policy initiatives, school enactment of the PISA-motivated policy initiatives, contextual factors of different layers of ecological systems that mediate and negotiate the shaping and enactment of those initiatives, and perceived impact of PISA on student learning in terms of what is learned and the quality of learning. Perceptions of different groups of participants (e.g. educational policymakers versus practitioners) were analysed for triangulation (Bailey, 1996; Cheng et al., 2015; Wall, 2012). Data of participants in the same group (e.g. mathematics teachers) were compared to evaluate the intensity of PISA's impact across teaching practices (Alderson & Hamp-Lyons, 1996; Cheng, 1997). Data analysis was conducted by the first author. However, the authors regularly met to discuss data analysis to ensure consistent interpretation of data between the two authors. A two-page transcript extract, which contains rich information, was used for an inter-coder reliability check with the second author. A high inter-coder agreement (80%) was reached, and any inconsistencies were discussed and addressed. All the excerpts employed in this paper were translated from Chinese to English.

3 Results

The interview data clearly show that local policymakers have made use of PISA to review and take substantive actions to improve local education quality. Motivated and inspired by PISA, a number of policy initiatives focusing on improving student learning in reading, mathematics, and science have been taken. Table 3 summarises

the themes and sub-themes that we have identified. In the following, we will present them in detail.

3.1 The use of *PISA* in local educational policy initiatives

3.1.1 Catalysing initiatives to address student weaknesses in reading performance

As the local educational official stated, Fangshan local results in PISA 2009 China Trial uncovered students' weakness in reading. To address this issue, Fangshan launched the reading project in 2011 to increase students' exposure to reading. PISA concepts were intentionally translated into the project's initiatives. As stated by the local educational official, the initiatives "use the concepts of PISA 2009 assessment framework as a reference".

For example, practical reading has been promoted in line with PISA reading. Moreover, a specific reading textbook for Year 8 students which follows thePISA reading style was developed. The reading project leader (RL) said:

> Actually, we selected stimulus aligned with the text formats of PISA released items. …We imitated PISA in terms of the design of questions as well. (RL)

According to RL, to guarantee the time for practical reading, reading, as required by Fangshan local educational policy, was added into the local curriculum as a course separate from the Chinese course. Furthermore, a final examination on reading had been introduced to motivate the school enactment of this policy.

Taking the opportunity of local policy support of improving teaching and learning of reading, the reading project had initiatives of promoting PISA-style practical reading and beyond. For example, it has also promoted broad reading of whole books, which follows the needs in local and national education contexts. The *Recommended bibliography* recommending books for Fangshan secondary academic school students was therefore developed. It includes various types of books, not limited to literature which was traditionally recommended. RL stated that the initiatives promoting broad reading aimed to "first meet the requirements of Zhongkao[2] and Gaokao", and then further expand the range of reading.

Regarding promoting these initiatives, interviewees considered that home/family environment can be important in determining whether students would read widely, whilst it can be influenced by the dynamics of the national educational context. RL commented that "for parents, I think they would not encourage students to read for pleasure". She went on to say:

> Because they wanted them to do better and achieve higher in mathematics, physics, and chemistry, which would be certainly hindered by spending time on pleasure reading. … Now Zhongkao and Gaokao have begun to assess reading of some books (on classics). You see, in bookstores, parents become

[2] Zhongkao refers to the Senior High School Entrance Examination.

> willing to buy the books that are required by the new curriculum, Zhongkao and Gaokao. (RL)

Under this context, the reading project therefore has consciously encouraged schools to involve parents in supporting students to read more widely. According to the reading teacher Sch5-R, reading is underlined in parents' meetings, and parents are also invited to participate in students' reading events in schools.

3.1.2 Integrating *PISA* concepts into mathematics and science teaching

The experience of the reading project further convinced the local policymakers that some PISA concepts are indeed helpful for improving teaching. The mathematics project and the science project were then therefore launched successively, both of which focused on improving teaching by integrating PISA concepts to improve learning. After the participation in the PISA 2012 China Trial, the local educational policymakers conducted classroom observations, from which they found out that some issues in student learning were linked to teaching. Teachers were also seen as the best agents bringing PISA concepts into teaching and gradually influencing their students' learning, captured by the excerpt below by the science project assistant (SA).

> Teachers know about their own students. …Besides, students' learning is a gradual and cumulative process. If we would like to translate PISA concepts into practices to change students, we must do it through teachers. …Besides of the specific lessons involved in our project, teachers also give lessons of other content. We want teachers to bring our ideas and our practices to their daily teaching. (SA)

Interview data also revealed that some teachers from different schools in Fangshan were involved in the mathematics project or the science project in various initiatives such as developing instruction materials and giving demonstration lessons. Many more teachers across schools got involved in these initiatives by receiving these materials and attending related training sessions.

Embedding PISA concepts into mathematics instructional design The mathematics project proposed seven categories of "mathematics literacy" based on domestic research resources, the project leader's and other key members' perception of PISA concepts, and the issues in student mathematics learning. It promoted mathematical concepts, mathematical methods, mathematical language, mathematical thought, mathematical communication, mathematical modelling, and mathematical computation that shall be emphasised in teaching. For example, the mathematics project leader (ML) said:

> Why did I propose "mathematical modelling"? Because we found that previously Fangshan students had issues in this aspect once they met applied problems. …Seen from PISA, it has high requirements on applying knowledge to

> solving problems, and rarely includes problems purely assessing mastery of knowledge. The literacy in PISA is actually what I think worthwhile for learning from. (ML)

Another perceived feature of PISA mathematics, embedding problems in real-life contexts, was also promoted by this project. Nevertheless, some of the categories, for example, "mathematical computation" and "mathematical language", were proposed specifically to address the issues of student learning identified from Zhongkao or Gaokao, rather than PISA. ML emphasised that "*no matter* in which run of the examination, students always have problems in two aspects, one is computation, the other is communication".

The mathematics project then assembled teachers and developed Unit-Based Instructional Design (UBID), a reference material of lesson preparation for mathematics teachers, as the means to address these issues in teaching and learning, and promote the proposed "mathematics literacy". As ML stated, "besides the aim to address the issues in our district, we'd like to apply the quite good concepts of PISA to our classroom teaching, and we also want to accumulate some classroom teaching resources of rather good quality".

Translating PISA science framework into science teaching practices The science project was working on translating the PISA science framework into teaching practices by integrating it with the science curriculum. SA, with reference to the scientific competencies defined in PISA 2015, said "the launch of our project aims to explore the way to realise some concepts of PISA or some abilities defined in PISA in our classes under our current curriculum system". Such competencies include explaining phenomena scientifically, evaluating and designing scientific enquiry, and interpreting data and evidence scientifically. As SA reported, to achieve this aim, the science project focused on helping teachers modify teaching methods to highlight developing the proposed competencies of students.

The science project merges the PISA framework with the national science curriculum, rather than simply copying PISA concepts into teaching practices.

> On the basis of merging, we emphasise the abilities that promoted by PISA, so that we have a focus in *our* classes, meanwhile, we are not losing what *our* current curriculum aims to develop students. (SA)

The emphasised word "*our*" indicates that the project team still acknowledges the importance of implementing the national curriculum whilst promoting some elements featured in PISA, for the reason that "our teaching has to accomplish the teaching tasks required by national curriculum" (SA).

3.2 School enactment of the *PISA*-motivated policy initiatives

Interview data reveal that school enactment of the PISA-motivated initiatives varies in teaching practices, depending on a range of factors in specific school settings.

The reading course was formally required by Fangshan local policy for students in Year 8, but some schools (e.g. School 2, School 3) have set the reading course for students in other Years as well. In some cases, the adjustment in school enactment is linked to schools' own policies. In School 3 which is a lower-secondary school (Year 7–9), following its own policy issued in 2017 promoting reading, it is Year 7 rather than Year 8 that has a reading course.

The content focus in the reading course may not be aligned with that originally intended by the local policy, that is, practical reading. For example, SchL3, one leader of School 3, said "they are probably using a textbook … developed by Fangshan", but "currently we are still focusing on reading classics". However, practical reading is not absolutely omitted from the teaching agenda, because students have to attend the final reading examination. As SchL4 reported, practical reading may "just take some time from the Chinese course".

School enactment of PISA-motivated mathematics initiatives seems to depend more on the degree of teachers' direct involvement in these initiatives, for example, developing and editing UBID materials. In School 2, mathematics teacher Mobai's experience as one of the key members of the mathematics project team enabled her to facilitate the enactment of the initiatives in her school. SchL2 stated:

> This project has selected some teachers from schools and involved them in the training and research on mathematics thinking. The (selected) teacher (of our school) then leads our mathematics teachers to implement the corresponding initiatives promoted by that project. (SchL2)

By contrast, Wenting, a mathematics teacher from School 4, who participated in a tiny part of developing UBID materials, reported that she still felt confused of how to employ those proposed ideas into her teaching practices. Like mathematics teacher Mingyi who was another key member of the mathematics project team reported:

> I can implement these ideas because I attended the (PISA-related) training luckily. Yet, many teachers didn't attend it. Through our teaching team led by me, or through (observing) my lessons, some teachers might be impacted. However, the scope of this impact is limited after all. …Without wide concern, I think it's hard to assert its impact. (Mingyi)

Zhushan said:

> Every mathematics teacher has got one copy of it. You could read it, use it for reference, or employ it. However, that is up to individuals. …The original intention (of the UBID initiative) is good, but I think whether it is applied by teachers we are not very clear {laughs}. (Zhushan)

The laugh at the end of this quote indicates that the school-level real practice—as perceived by Zhushan—might be different from the mathematics project's expectation. It might be because that "students are not exactly the same" and "schools are different with each other", as SchL1 who is also a mathematics teacher stated.

In some cases, it is the ideas embedded in UBID rather than the UBID physical materials that are drawn on by teachers, especially for those involved in PISA-related work, for example, PISA coding (i.e. scoring), and developing UBID. Regarding the UBID materials, Mingyi said "I think I did not use it a lot". However, as she reported, her instructional design has intentionally echoed the ideas proposed by the mathematics project.

National education context influences school enactment of the local policy initiatives as well. Among the ideas and content proposed by the initiatives, those perceived by teachers as significant for students' achievement in national high-stakes examinations such as Zhongkao and Gaokao would be enacted better. For example, regarding the books listed in the *Recommended bibliography*, Sch5-R said:

> Actually, we usually pay more attention to the must-read books, because they are related to Zhongkao. After all, you have to attend that examination. (Sch5-R)

These contextual interactions may also involve parents' agency. Based on parents' increasing participation in students' reading events in schools, as observed by Sch5-R, she perceived that "the whole society seems to have paid attention to reading, which is especially noticeable in recent years" and this broader context "definitely has an impact" on enhancing parents' positive attitudes towards reading and their engagement in school enactment of reading activities.

For some concepts of PISA that are also considered valuable by school-level educational practitioners, for example, applying knowledge in real-life contexts, some interviewees (e.g. SchL6) even suggested that those ideas probably could draw higher and wider attention if they are incorporated into high-stakes examinations. Echoing this, Zhushan stated that because "on the one hand, under the context of (the influence of) PISA which employs a lot of applied problems, on the other hand, there also has been such a trend in the examinations in Beijing", he had been highlighting applied problems in teaching.

It is important to note that, national high-stakes examinations do tend to be convergent with some PISA concepts, which lends stronger power to school enactment of related initiatives. Besides increasing the employment of mathematics-applied problems (as perceived by Zhushan above), high-stakes examinations tend to have higher reading demands. As SchL1 stated, "everyone immediately realised that reading is very important" as soon as the Academic Achievement Test in 2015 included one mathematics problem with "more than 200 words".

3.3 Perceived impact on student learning

Interview data reveal that the content and quality of student learning had been gradually changing along with the changes in teaching practices due to teachers' refreshed understanding of teaching. As the local educational official said, "First of all, teachers have had to some extent recognition of the 'mathematics literacy'. They have been gradually accepting it and starting to pay attention to it in teaching". This perception is consistent with the teaching practices reported by mathematics teachers.

3.3.1 Impact on what is learned

According to ML and mathematics teachers, students have had more exposure to applied mathematics and contextualised problems since they have been highlighted in teaching practices. For example, Zhushan reported that he "engages students in activities as much as possible which allow them to apply mathematics knowledge to real life". Mobai stated that, following the ideas proposed by the local PISA-motivated mathematics project, mathematics problems with real-life contexts were intentionally employed in her lessons to stimulate students' learning interest.

With the increased employment of applied mathematics which usually contains relatively long text for describing problems, mathematics-related reading has also been highlighted. As Mingyi said:

> Like the reading comprehension in PISA. To solve the applied problems I give to students, students need to retrieve useful information from the problems, that is, reading comprehension. (Mingyi)

Students of some mathematics teachers (e.g. Mingyi, Mobai, Yunlian) were even asked to read mathematics textbooks in class or after class.

3.3.2 Impact on the quality of learning

It is admitted by interviewees (e.g. the local educational official, RL, ML) that the impact of PISA-motivated initiatives is hard to quantify. However, they believed that the initiatives had contributed to the improvement of overall students' mathematics performance, using the local performance trends in PISA and domestic examinations as evidence.

Reading initiatives, especially promoting exposure to practical reading, are perceived as helpful for performance improvement, as the below quote reveals.

> After we launched this (reading) project, reading performance had a great improvement in PISA 2012 compared to that in PISA 2009. Moreover, performance in the other two subjects also had improvement. … PISA-style reading highlights information collection and processing from various texts. Therefore, it is actually helpful for (learning in) other subjects as well. … The improvement is very obvious. This should be the most persuasive evidence. (Local educational official)

As to the impact of mathematics initiatives, the local educational official and ML perceived that with these efforts, in PISA 2015, Fangshan maintained its relatively high mathematics performance compared to other participating systems.

Students' improvement in mathematics learning was further evidenced by resources from domestic examinations. For example, the effect of highlighting applied mathematics problems has been observed in students' performance. ML said:

> Through the emphasis on this, teachers have highlighted it in teaching, and students have paid attention to it as well. We do see the effect. Previously, as long as students were examined with applied problems, teachers would worry about students' performance. Now they don't worry about that. Basically, most students could perform quite well in responding to applied problems. (ML)

As presented previously, the mathematics project also focused on promoting communication with mathematical language. With the evidence from domestic examinations, ML perceived that the related mathematics initiatives have had a positive impact on students' ability of mathematics communication. He said:

> Our teachers have been emphasising precise communication with standard mathematical language. … The issue of communication with mathematical language is most typical in solving analytic geometry problems. … Our (students') average score points on those problems (in Gaokao) used to be really low, just over 1 (out of 14), sometimes over 2. Now on average our students could attain about half of the full score, that is, about 7. (ML)

This quote shows that students' ability of applying standard mathematical language has been enhanced as teaching practices changed. This perception of ML is consistent with students' cognitive performance observed in class as reported by mathematics teachers and school leaders. For example, Mingyi reported that her students had become more proficient in using mathematical language in communication after she underlined mathematical communication, which she learned from PISA, in her teaching practices. For SchL2, students' enhanced ability in mathematical communication was perceived as one of the impressive changes students have had in class. She said "With regard to changes, first, it is communication with mathematical language. Now students could use relatively specialised terminologies". She considered that this change "has at least a certain relationship" with the school's efforts in response to the local PISA-motivated mathematics initiatives.

It is worthy to note that the extent of the impact on student learning varies across classrooms. As SchL2 pointed out, "due to the difference of teachers' understanding and their enactment in classrooms, the effects observed in different grades are different".

4 Discussion

4.1 *PISA* has had direct impact on the local educational policy

The use of PISA in Fangshan suggests that PISA has a direct impact on its local educational policymaking that motivates and inspires initiatives to improve local educational quality. The findings show that educational policymaking in Fangshan has explicitly been influenced by PISA, especially, in the reading, mathematics, and science initiatives. Across these initiatives, the washback intensity (Cheng, 1997; Spratt, 2005) in different areas of teaching and learning varied. Nevertheless,

inconsistent with previous studies which found PISA's impact a "rhetoric response" or a legitimacy tool (Baird et al., 2016; Ho, 2016; Pons, 2012; Volante & Mattei, 2024), our findings provide solid evidence that in Fangshan, some PISA concepts have been translated into the local educational policies and have been gradually permeating into teaching practices.

In response to students' weakness in reading as identified in the PISA 2009 China Trial, Fangshan local government launched the reading project, through which a reading course for Year 8 was added to the local curriculum to encourage practical reading as featured in PISA, and the corresponding PISA-style reading textbook and the reading examination were developed. Moreover, the *Recommended bibliography* was edited to encourage students in secondary education to have a broad reading of whole books. On the experience of the reading project, the local educational policymakers were convinced that some PISA concepts were helpful for improving teaching. Hence, the mathematics project and the science project were then launched successively to explore the way of integrating PISA concepts into teaching to improve student learning in mathematics and science, respectively.

The local area's participation in PISA presented the opportunity for educational policymakers and practitioners to systematically investigate and reflect on teaching and learning. The mathematics project developed UBID materials for mathematics teachers, which adopted some PISA concepts, for example, highlighting applied mathematics problems and embedding problems in real-life contexts. Inspired by PISA "mathematics literacy" to some extent, the mathematics project suggested seven categories of "mathematics literacy". However, it was based on the project leader's (and key members') own interpretation and understanding of elements of mathematics literacy. The science project sought to integrate the competencies defined in the PISA science framework with the national science curriculum in teaching practices. Rather than make changes to curriculum standards, as some national education systems did (Breakspear, 2012; Hopfenbeck et al., 2018), this local area focused on changing and improving teaching methods and strategies to develop students' PISA-like science competencies. We argue, therefore, that in drawing on concepts from PISA for shaping the initiatives, it was the project members' intuitive understanding of PISA and more importantly their knowledge of local teaching practices and students that were influential. Adding to extant discussions on the "glocalization" of translating PISA concepts in national-level education policies (Candido et al., 2020; Cave, 2023), we found that concepts from PISA were localised in the policy practices in the local area as well. Moreover, rather than borrowing policies from elsewhere (Auld & Morris, 2016), it was the evidence collected from teaching practices and other domestic resources that was instrumental for shaping the PISA-motivated policy initiatives in Fangshan. Therefore, our findings support Michel (2017) and Stray and Wood (2020) who argue that policy convergence is limited due to the diversity of contextual factors and the resources available to engage with.

The findings also suggest that, although PISA has had a direct impact on the local educational policy in Fangshan, it seems not to have had motivated structural reforms in this local area (Bringeland, 2022). Probably, the local capacity of assessment in terms of analysing and interpreting PISA data and translating PISA

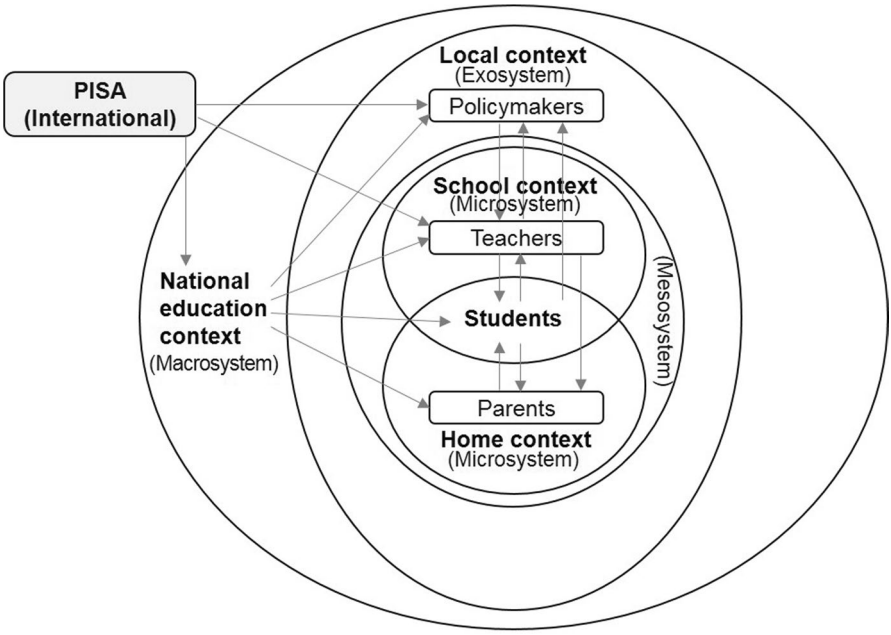

Fig. 1 The mechanism of PISA's impact on student learning

concepts restrains the range and depth of the use of PISA and PISA's impact in the local context. According to literature (e.g. Breakspear, 2012), at the national level, participation in PISA has built and developed national capacity for assessment in some participating jurisdictions. However, at the local level, due to proximity distance (theoretical or methodological) from the PISA framework (Carvalho, 2014), resources for developing this kind of capacity might not yet be widely accessible and sufficient for the local users of PISA data.

4.2 *PISA* has had limited, indirect, and yet growing impact on student learning in schools

The findings of this research show that, in Fangshan, generally, PISA has had a rather limited and indirect impact on student learning in schools. Despite that PISA is not high-stakes for individual students, its impact on students has been progressively increasing through local PISA-motivated policies, teaching initiates, and the influence of the national education context. The strength of the impact on learning content and learning quality of students of different teachers and schools varies, which echoes the suggestions of washback studies (e.g. Alderson & Hamp-Lyons, 1996; Green, 2013; Spratt, 2005). It is negotiated and moderated by various washback participants and their agencies during the translation of PISA concepts into local educational policies and practices. Based on the conceptual framework and our

research findings, we propose the preliminary mechanism of PISA's impact on student learning in schools in the local area, as shown in Fig. 1.

This combination of findings provides some support for the washback model proposed by Hughes (1993, cited in Bailey, 1996). Fangshan's participation in PISA influenced local educational policymakers' perceptions of PISA and their local education quality, and therefore, policy initiatives closely linked to schools were mobilised. Through the involvement in PISA-related training or PISA-motivated initiatives, teachers' perceptions of their teaching practices were, in turn, influenced by PISA and these initiatives. Student learning is subsequently influenced by the changes in teaching. Moreover, our research found out that PISA's impact is mediated not only by washback participants' (i.e. educational policymakers' and practitioners') perceptions of PISA, but also by their willingness and capacity of making a change through translating PISA ideas into practices.

Furthermore, our research found that the mechanism of PISA's impact on student learning in the local area is not simply a top-down process (Engel, 2015); rather, it involves multidirectional processes in which various contextual factors are intertwined (Carvalho & Costa, 2015). The local educational policymakers' perceptions about students' performance in PISA and the observed issues in student learning contribute to shaping the local policy initiatives, even though students are not involved in the launch of these PISA-motivated initiatives as active participants. This finding is consistent with the ecological systems theory in terms of the reciprocal relations between factors in different contextual layers (Bronfenbrenner, 1979). In the exosystem, PISA impacts student learning mainly in two ways. One way is through the local PISA-motivated initiatives (e.g. practical reading, applied mathematics problems, scientific enquiry), some PISA concepts are translated and incorporated into teaching and learning practices. The other way is, as an impetus to local educational reforms, PISA provides local policymakers with an opportunity to take systematic measures to improve teaching and learning in the local area.

Consistent with Braun et al. (2011) and Maguire et al. (2020), we found out that when the local PISA-motivated initiatives are put into practice through school enactment, the impact of these initiatives on student learning is further recontextualised according to schools' specific settings. The school enactment of the initiatives varies across schools, as they are adapted according to schools' own interpretation of the policies and their own interests (Rautalin et al., 2019) to fit-in with their specific teaching and learning practices.

Our findings suggest that teachers play a crucial role as key agents for PISA's impact on student learning in classrooms, which concurs with Spillane (1999). Consistent with McLaughlin (1990), we also found that this process greatly depends on teachers' capacity and willingness of changing their teaching practices in response to these policy initiatives, which subsequently contribute to the strength variation of washback (Green, 2013; Spratt, 2005) on student learning. For mathematics initiatives and science initiatives which aim to improve learning through improving teaching, their impact on student learning substantially relies on teachers' teaching. As responses of mathematics teachers (e.g. Mingyi, Wenting) indicate, teachers' capacity and willingness are built based on their understanding of the PISA-motivated initiatives which to some extent is subject to the degree of teachers' involvement in

these initiatives. Those who were key members of the PISA-motivated mathematics project and even were involved in PISA coding have a relatively deep understanding and acceptance of PISA concepts and have been actively translating the concepts valued by them into their teaching practices. PISA's impact on student learning may be more explicit in those teachers' classrooms. For many other teachers who were only temporarily involved in a small part of these initiatives or only exposed to PISA concepts in an unconscious way (e.g. attending a demonstration class led by the mathematics project), their teaching and their students' learning may be impacted by PISA in a progressive and unconscious way.

Confirming ecological systems theory as to the influence of mesosystems which involves the transitions between school setting and home setting on human development (Bronfenbrenner, 1979), our findings provisionally suggest that factors in this layer of systems can also mediate PISA's impact on student learning. Among the PISA-motivate initiatives enacted at school, those valued by parents, for example, whole-book reading, tend to be more supported by parents. Students would also be more likely to be encouraged by parents to engage in similar activities at home. In this case, parents play a role in facilitating school enactment of related initiatives, thereby strengthening PISA's impact on student learning in related aspects.

PISA's impact on student learning in the local area is also mediated by national education contextual factors, especially national high-stakes examinations and national curriculum, which are consistently considered important by all the participants in PISA's impact in lower-order systems. Besides PISA concepts, these national contextual factors are also considered in shaping the local policy initiatives. At the school level, meeting the requirements of these examinations and curriculum is prioritised in developing students. Preparing students to achieve high in national high-stakes examinations is also of great importance for parents. Nonetheless, there is evidence in our findings supporting that, to some extent, national high-stakes examinations and curriculum have become convergent with some PISA concepts (Wang & Tong, 2015; Zhao, 2017). This perceived convergence endows related local policy initiatives more power. Consistent with the suggestion proposed by Maguire et al. (2015) that policy types and power influence policy enactment, our research found the local policy initiatives that echo high-stakes examinations and curriculum are enacted better. This also indicates the washback effect of PISA and that national assessments are interwoven in this local area. The resonance and tension between them suggest that the local PISA-motivated initiatives are filtered in school enactment with the mediation effect of national education contextual factors. PISA's impact on student learning is therefore enhanced or diluted to some extent, depending on the strength of the initiatives' link with the contents featured in the national education context.

5 Contributions and limitations

Moving from the theoretical debates and critiques on PISA in terms of its global governing power on national education policies and the theoretical assumption of the mediation effect of contextual factors on PISA's impact, our empirical

research provides insights into understanding PISA's practical impact on teaching and learning and provides substantial evidence of how the impact occurs in a local area in China. We found that, to some degree, PISA has been gradually influencing some aspects of student learning; however, its impact is not as strong as governing the local education. The conceptual framework of our research which employs theories about washback (Alderson & Wall, 1993; Hughes, 1993, cited in Bailey, 1996) and ecological systems theory (Bronfenbrenner, 1979) could provide theoretical insights into further research on examining the impact of ILSAs (including PISA and PISA for schools) on local and school policies and practices. In addition, our findings could inform educational researchers and policymakers in terms of the possible ways that could support the effective and appropriate use of ILSAs (including PISA) in local contexts.

It is admitted that our research has limitations. As it only focuses on a Chinese local context and gathers views of purposively sampled stakeholders in that specific local area, the findings, therefore, may not be generalisable to other local areas in China or other education systems. Nevertheless, the provisional mechanism of PISA's impact on student learning as conceptualised in our research indicates some common contextual factors and their interconnections that are worthy of consideration by future research investigating how PISA's impact on student learning would occur and be mediated in other local contexts.

In our research, the knowledge about the national education context is basically drawn from literature and perceptions of interviewees in the local context. Future research could additionally collect data from national-level policy actors to obtain a deeper understanding of the use of PISA at the national level, its impact on the whole education system, and the dynamics and agencies of macrosystem factors (e.g. educational, social, political) involved.

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Data availability The authors declare that all relevant data supporting the findings of this study are included in the article.

Declarations

Conflict of interest The authors declare no competing interests.

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