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The Reproduction of Social Class Differences through Recontextualizing in Pedagogical Practices in Secondary Mathematics Classrooms in China

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Eidesstattliche Erklärung

Hiermit erkläre ich, die vorliegende Dissertation selbstständig verfasst und ohne unerlaubte Hilfe angefertigt zu haben. Alle Hilfsmittel, die verwendet wurden, habe ich angegeben. Die Dissertation ist in keinem früheren Promotionsverfahren angenommen oder abgelehnt worden.

Abstract

This study investigates how social class differences are recontextualized into pedagogic practices in mathematics classrooms, shaping distinct social consciousnesses across different social groups, and ultimately perpetuating social insulation in subtle ways. The research is situated in secondary schools in Xi'an, the most developed city in Northwest China, in terms of population size and diversity of school types. Three school streams were selected to represent varying levels of social insulation.

The theoretical resource of this study is mainly drawn from Bernstein and Dowling. Bernstein's theory of pedagogic discourse offers fundamental guidance that instructional discourse in pedagogic practices is governed by underlying regulative discourse like the principle of social class. His concepts like classification and framing, different values of knowledge, and a set of rules of pedagogic discourse, alongside Dowling's Social Activity Method, which includes domains of practice and distributive strategies, offer concrete analytical instruments for examining the processes of recontextualization. Both quantitative and qualitative methods were used to address different research questions. Quantitative techniques were employed to investigate whether statistical class differences exhibited at the regional level where these samples were located, while qualitative analyses were conducted as tentative and exploratory study.

The thesis comprises three distinct but interconnected sub-studies, each representing a potential pathway of recontextualization. These pathways explore how class distinctions are transformed within pedagogic practices to legitimize and maintain social insulations. As a result, students are interpellated into accepting disparities in school achievements, which serve as indicators for their future roles within different divisions of labour and social positions.

The first part takes various forms of pedagogic communication as a possible way of recontextualization, which carries differentiated power relations. The quality of classroom interactions was extracted as a linking variable between forms of communication and differences in school achievement. The findings reveal that class differences transform into varying durations of peer interactions with a flatter hierarchy, prompting students' engagement and autonomy. Therefore, social segregation is legitimized at the level of consciousness, as different social groups internalize these power relations through their engagement with specific forms of communication.

The second part explores pedagogic messages and the methods of their transmission by teachers as another pathway for recontextualization. By analyzing class differences in these two dimensions across different school streams, this exploratory study reveals that social class differences are converted in the range of esoteric mathematical knowledge conveyed and the methods used to transmit it. This process covertly legitimizes and reproduces social stratification.

The third part investigates the evaluation criteria contained in the content of teacher feedback and the way it is provided, serving as a further pathway for recontextualization. This sub-study found that class differences are translated in differentiated criteria for school success and in teachers' perceptions of their students' abilities, thereby legitimizing and reproducing social segregations through pedagogic practices.

Together, these three pathways provide evidence from different perspectives on how macro-level social class differences are recontextualized into micro-level mathematics pedagogic practices to achieve their legitimizing transmission. The contributions of this study are twofold: first, it extends the cross-cultural applicability of Bernstein and Dowling's theories; second, it offers empirical support for how the principle of social class is transformed and legitimized in mathematics classrooms. These findings have implications for teacher training programs, particularly in integrating educational equity into three aspects: the arrangement of communication forms, the selection and organization of pedagogic tasks, and the provision of feedback, all aimed at narrowing the achievement gap between students from different social groups. Additionally, this thesis points forward to future research to explore other recontextualized pathways and the role of teachers' personal backgrounds on the transmission of class differences.

Zusammenfassung

Diese Studie untersucht, wie soziale Klassendifferenzen in pädagogische Praktiken des Mathematikunterrichts rekontextualisiert und so ein unterschiedliches soziales Bewusstsein in verschiedenen sozialen Gruppen geformt und letztlich soziale Abschottungen auf subtile Weise aufrechterhalten werden. Die Forschung ist in Sekundarschulen in Xi'an, der bevölkerungsreichsten und in Bezug auf Schulformen vielfältigsten Stadt in Nordwestchina, angesiedelt. Drei Schulen wurden ausgewählt, um unterschiedliche soziale Kontexte und Abschottungen abzubilden.

Die theoretische Grundlage dieser Studie stützt sich hauptsächlich auf Basil Bernsteins und Paul Dowlings Arbeiten. Bernsteins Theorie des pädagogischen Diskurses verweist darauf, dass der Unterrichtsdiskurs in pädagogischen Praktiken durch einen im Prinzip der sozialen Klasse verankerten regulativen Diskurs gesteuert wird. Bernsteins Begriffe der Klassifikation und Rahmung, seine Unterscheidung von Wissensformen sowie eine Reihe von Regeln des pädagogischen Diskurses bieten, zusammen mit Dowlings Unterscheidung verschiedener *domains of practice* und *distributive strategies*, konkrete analytische Instrumente zur Untersuchung der Rekontextualisierungsprozesse. Quantitative und qualitative Methoden werden verwendet, um die Forschungsfragen zu adressieren. Quantitativ wird untersucht, ob sich soziale Klassendifferenzen in der Region, in der die Stichproben erhoben wurden, in der Kommunikation im Unterricht statistisch abbilden lassen, während sich mit den qualitativen Analysen eher explorativ der Thematik angenähert wird.

Die Arbeit besteht aus drei eigenständigen, aber miteinander verbundenen Teilstudien, die jeweils eine mögliche Weise, in der sich Rekontextualisierung zeigt, darstellen. So wird untersucht, wie Klassendifferenzen innerhalb pädagogischer Praktiken transformiert werden, um soziale Abschottungen zu legitimieren und aufrechtzuerhalten. Die Schüler:innen werden letztlich dazu bewegt, Unterschiede in schulischen Leistungen als Indikatoren für ihre zukünftigen Rollen innerhalb unterschiedlicher Arbeitsteilungen und sozialer Positionen zu akzeptieren.

Die erste Teilstudie untersucht verschiedene Formen pädagogischer Kommunikation als eine mögliche Rekontextualisierung, die differenzielle Machtverhältnisse transportiert. Die Qualität der Interaktionen in der Klasse wurde als verbindende Variable zwischen den Kommunikationsformen und den Unterschieden in den schulischen Leistungen herausgearbeitet. Die Ergebnisse zeigen, dass sich Klassenunterschiede in unterschiedlich lange Peer-Interaktionen mit einer flacheren Hierarchie verwandeln, was das Engagement und

die Autonomie der Schüler:innen fördert. Die soziale Segregation wird also auf der Ebene des Bewusstseins legitimiert, da verschiedene soziale Gruppen diese Machtverhältnisse durch ihre Beschäftigung mit bestimmten Kommunikationsformen verinnerlichen.

Im zweiten Teil werden Unterrichtsinhalte und die Methoden ihrer Übermittlung durch die Lehrkraft als weitere Dimension der Rekontextualisierung untersucht. In der Analyse von sozialen Klassenunterschieden bezüglich dieser beiden Aspekte zeigt die explorative Teilstudie, dass soziale Klassenunterschiede in der Bandbreite des vermittelten esoterischen mathematischen Wissens sowie der Methoden zu dessen unterrichtlicher Vermittlung umgesetzt werden. Dieser Prozess legitimiert und reproduziert im Verborgenen die soziale Schichtung.

Der dritte Teil untersucht als weitere Dimension der Rekontextualisierung die Bewertungskriterien, die sich im Feedback von Lehrer:innen widerspiegeln, sowie die Art und Weise, wie das Feedback gegeben wird. Diese Teilstudie ergab, dass sich soziale Klassenunterschiede in verschiedenen Kriterien für schulischen Erfolg sowie in der Wahrnehmung der Fähigkeiten der Schüler:innen durch die Lehrkraft niederschlagen, wodurch soziale Segregation durch pädagogische Praktiken legitimiert und reproduziert wird.

Zusammengenommen liefern diese drei Teilstudien aus unterschiedlichen Perspektiven Belege dafür, wie soziale Klassenunterschiede auf der Makroebene in fachbezogene pädagogische Praktiken auf der Mikroebene rekontextualisiert und so legitimiert werden. Die Dissertation leistet zweierlei: Erstens stellt sie einen Beitrag zur kulturübergreifenden Anwendbarkeit der Theorien von Bernstein und Dowling dar. Zweitens zeigt sie empirisch, wie das Prinzip der sozialen Klasse im Mathematikunterricht transformiert und legitimiert wird. Die diesbezüglichen Ergebnisse sind im Kontext von Lehrer:innenbildung relevant, insbesondere in Hinblick auf Bildungsgerechtigkeit, und zwar in drei Aspekten: der Ausgestaltung von Kommunikationsformen, der Auswahl und Organisation von (hier) Mathematikaufgaben sowie der Bereitstellung von Feedback, die alle darauf abzielen können, die Leistungsunterschiede zwischen Schüler:innen aus verschiedenen sozialen Gruppen zu verringern. Darüber hinaus weist diese Arbeit auf das Desiderat hin, weitere Dimensionen von Rekontextualisierung im Unterricht zu untersuchen und die Rolle des sozialen Backgrounds von Lehrer:innen bei der Weiterschreibung von Klassenunterschieden einzubeziehen.

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I feel very fortunate to have found such an interesting research topic and to have completed this thesis. I would first like to express my sincere gratitude to my supervisors, Professor Gellert and Professor Jablonka.

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Chapter 1 Introduction

Locating to This Study

It was a long journey to locate to this study. The thesis is the outcome of interaction of these factors: personal experience, individual interests, social background, and theoretical exposure. The absence of any one of these factors could have significantly altered the research topic. It is certainly fortunate that my personal interests and the issues I wanted to explore coincided with the theories I encountered, leading to the development of this research.

1.1 Motivation for the Dissertation

1.1.1 Experiences in Germany

As a foreigner observing German society from an external perspective, I noticed that boundaries between social classes are more pronounced in Germany compared to China. For instance, there is a clear segregation in residential areas: wealthy individuals live in the southwest of Berlin, while poorer residents are concentrated in e.g. Wedding (a famous workers' district). This segregation extends to everyday shopping habits: low-income families shop at Aldi, a discount supermarket, while middle class families prefer Edeka or Bio-company, supermarkets for social groups from middle- and upper- streams. Additionally, public transportation services are more frequent in wealthy neighbourhoods during peak hours, even though the higher population density and greater dependence on public transport in some certain areas like Wedding would justify increased services there. Conversations with German friends implied that this social stratification is widely accepted, with little desire to break through these barriers and ascend to a higher social class.

In contrast, such boundaries are more obscure in China. Rapid urbanization, the expansion of urban spaces, and collective ideology have blurred the segregations between different social groups. However, data indicates a gradual solidification of social strata in China. This trend is particularly evident in the increasing disparity between the proportions of urban and rural students in universities. Moreover, the representation of rural students in top-tier higher education institutions (such as those in the "985" and "211" projects) is steadily declining (Yang, 2006; Zhang & Liu, 2005) . Similarly, urban students dominate lucrative fields such as finance and computer science. Despite the use of the same textbooks and curricula across schools (excluding international schools), and standardized exams within the

same administrative regions, differences in family background still impact educational outcomes. Schooling not only fails to narrow the achievement gap stemming from students' different backgrounds but also legitimizes and reinforces these disparities, making lower-class students accept their subordinate social positions at a conscious level.

1.1.2 Discontent with the Certain Aspect of Educational Culture

One significant way schooling legitimizes class disparities is through its emphasis on the Chinese tradition of the "culture of effort," rather than gift (Leung, 2001), which is also a major motivation for this study. Confucian culture has long valued personal effort over innate talent as the key to high academic achievement. This "culture of effort" has spread throughout Asia, promoting the belief that hard work can lead to good grades and change one's destiny and realize social mobility. While this culture may have played a decisive role in certain historical periods, the current reality is that social mobility is increasingly difficult. Chinese scholars have collectively agreed on social stratification based on longitudinal surveys, revealing a slowing pace of vertical mobility and a concurrent rise in horizontal mobility (Bian, 2002; Wu & Treiman, 2004; Zhang, 2011; Zhou & Xie, 2019). Therefore, overemphasis on the "hard work" obscures the true causes of social stratification and exacerbates the psychological burden on those who do not succeed academically. Many students who do not perform well in exams, especially university entrance exams, believe their failure is due to a lack of effort rather than structural societal factors (Wong et al., 2004). These students often enter the labour market earlier or attend less prestigious colleges, ultimately ending up in low-paying jobs, blaming themselves for their situation. Meanwhile, those who enter high-paying professions often do not realize that their success is largely due to their family background rather than personal effort. Thus, this research aims to provide empirical evidence to challenge the culture of effort and alleviate the self-blame among exam "failures."

Based on these personal motivations, this study focuses on how schooling legitimizes differences in students' family backgrounds, leading to their acceptance of subordinate social positions rather than resistance. Given the significant role of mathematics education in the school achievement and its gate-keeping function in the labour market, this thesis narrows its scope to explore how mathematics education legitimizes social class differences and reproduce social segregation.

1.2 Situating the Study within Mathematics Education

1.2.1 Mathematics Education in China

Mathematics education plays a crucial role in Chinese school education. According to compulsory education curriculum plan and standards formulated by the Chinese Ministry of Education of the People's Republic of China (2022), mathematics is one of the most important subjects from grades 1 to 9, accounting for 13-15% of total class hours, second only to the Chinese language. Additionally, mathematics is a core subject in the examination system. From grades 3 to 5 in primary school, mathematics is the only subject besides Chinese allowed for end-of-term exams. In various entrance exams nationwide, particularly the college entrance exam, mathematics accounts for a significant portion of the total score. High mathematics scores can determine students' choices of schools and majors, significantly impacting their future career prospects and income. Thus, mathematics serves as an indicator in selection and exclusion for social stratification.

Mathematics is generally considered the least influenced by family background compared to subjects like linguistic or social sciences. This perception is firstly based on the abstract and highly logical nature of mathematics. High achievers in mathematics are often seen as having innate talent rather than a privileged background. Additionally, the content and curriculum of mathematics education are relatively fixed, with less variation between regions and schools compared to other subjects. The scoring of mathematics exams is more standardized, allowing for fairer assessments. Large-scale international tests like PISA (Programme for International Student Assessment) support this perception, showing that students' performance in mathematics, science, and reading correlates differently with their family background. Typically, mathematics performance is more influenced by teacher quality and teaching methods; while reading and science scores more reflect the socioeconomic background of students' families (Organisation for Economic Co-operation and Development, 2019).

Accordingly, if mathematics education also contributes to perpetuating class differences, it does so in a hidden manner. As Althusser (2001) described the school system, it operates silently as an ideological state apparatus, maintaining class boundaries subtly and often unnoticed. Mathematics education, in this context, might play a similar role by transmitting seemingly objective and neutral knowledge embedded with the ideology of the ruling class, thus maintaining class distinctions in a covert way. Therefore, a brief review of research on students' mathematics achievements and class disparities is presented as follows.

1.2.2 Review of Mathematics Achievements and Class Differences in China

Research addressing the relationship between Chinese students' educational outcomes and their family Socio-economic Status (SES) has focused on their general school achievement. Studies specifically focusing on mathematics subject are still scarce (Wang et al., 2014) . Existing studies have demonstrated a positive correlation between family SES and students' mathematics achievement. Some Chinese scholars have provided empirical support for this positive correlation (Huang & Cheng, 2011; Xiao et al., 2009; Zhang et al., 2005). Higher SES families typically have access to better educational resources, both in terms of school quality and supplementary educational opportunities. This access is facilitated through two primary pathways:

1. **Access to Quality Educational Resources:** Families with higher SES are more likely to enrol their children in higher-quality schools through various ways, benefiting from better teachers and higher teaching quality. These families are often well-informed about special admission policies and then can have the advantage of long-term preparation to meet school criteria, such as excelling in math competitions, starting from primary school.
2. **Financial and Time Investment:** Higher SES families are able to invest more financially and in terms of time. They can afford private tutoring and higher-quality extracurricular programs. Moreover, parents from higher SES backgrounds are found to be more involved in their children's mathematics learning, indicating a strong link between family background and students' mathematics achievement (Huang & Cheng, 2011).

In terms of the relationship between education inside schools and students' mathematics achievement differences, mathematics is still considered a talent-based subject rather than one heavily influenced by teaching. Due to the traditional Chinese belief that hard work can compensate for lack of innate talent (Xu, 2010), students' failures in mathematics are often attributed to a lack of talent or insufficient effort. Nevertheless, according to statistical data provided by (Xuan et al., 2019), there is a strong positive correlation between a school's SES and students' mathematics achievement.

However, how education within schools perpetuate the SES-based differences in mathematics achievement and legitimize these differences as variations in talent and effort has not yet been explored. Therefore, this thesis aims to investigate whether mathematics education

within schools helps to legitimize family SES differences through the differences in students' mathematics achievement.

1.3 Theoretical Exposure

Introduced to Bernstein's theories through my supervisors, I first encountered his code theory. Bernstein's code theory posits that students from different social classes acquire different language codes through family interactions. These codes then interact with a school system built on the middle-class language code. Schooling selects and rejects different orientations of these codes, distributing students to their respective social positions. The language codes, whether elaborated code of middle-class or restricted code of working-class, translate into students stratified cognitive abilities, thus legitimizing class differences within the school system and maintaining middle-class dominated positions in an invisible manner.

Secondly, Bernstein's pedagogic discourse theory provides the foundational theoretical foundation for this study. It posits that pedagogic practices are governed by underlying regulative discourses, such as social class, aiming to transmit power relations. The theory elaborates on the concept of recontextualization and the pedagogic device model, demonstrating how these regulative discourses transform and legitimize themselves within micro-level classroom practices, thereby deeply embedding power relations into students' social consciousness. Bernstein also developed conceptual tools —classification and framing— to analyze the specific processes of power relations and control principles during recontextualization.

Additionally, Dowling's Social Activity Method, focusing on pedagogic texts, is used as a framework to analyze the pedagogic messages and distribution strategies employed by teachers.

Currently, there is no research specifically examining the relationship between social stratification and mathematics classroom pedagogy in China. Hence, my personal interest, current social background, and theoretical exposure have converged to form the research aim of this dissertation: How are social class differences recontextualized into mathematics pedagogy in China to maintain social stratification?

1.4 Social Stratification in China

Bernstein's social class is rooted in the 1960s British society, which differs significantly from the class structure in current China. The complexity and diversity of social strata in China due to historical development and population size necessitate a nuanced understanding. This section delineates three typical social streams in China and the resulting streams of schools. The segregation between these school streams, reflecting the segregation of the family backgrounds of their respective students, is taken as the class differences to be examined in this study.

1.4.1 Social Stratification

Social stratification in Chinese society is complex and multifaceted, primarily attribute to the substantial population, as well as the socialist ideology, grounded in the elimination of the bourgeoisie and the establishment of a proletarian-dominated society. Some scholars have endeavoured to segment the classes in contemporary China from various research perspectives (Li & Qi, 2016; Liu, 2020; Lu et al., 2002; Wu & Zhang, 2021)). However, regardless of the research viewpoints, the Household Registration System (Hukou) has been widely regarded as one of the most unique and crucial determinants in shaping the current social stratification in China. Some scholars have even directly described Chinese social stratification as Hukou stratification(Boffy-Ramirez & Moon, 2018; Cheng, & Selden, 1994; Li et al., 2015; Lu, 2008; Wang, 2005; Wu & Wallace, 2021; Wu & Treiman, 2004).

The Hukou system, instituted in the People's Republic of China (PRC) in the 1950s and persisting to the present day, functions as a population management system. Hukou status is acquired through the registration of an infant at birth, adhering to the Hukou status of the parents (pre-1998, based solely on the mother's Hukou status). This status comprises two dimensions: the place of registration (local and non-local) and the type of Hukou (agricultural and non-agricultural). Beyond its primary role in population registration, the Hukou system serves as a mechanism for administrative control and the provision of public services since the establishment of PRC. Notably, the Hukou status determines the allocation of various benefits, encompassing education, medical care, social security, among others. Consequently, the Hukou system operates as a multifaceted tool that not only regulates population data but also significantly influences access to essential services, thereby contributing to the intricate tapestry of social stratification in China.

The inception of the Hukou system can be attributed to the planned economy implemented since the establishment of the PRC. In the context of a planned economy, the state and government assert ownership and control over the means of production, encompassing resources, land, factories, and other key elements. Economic activities are meticulously prearranged by the central government, covering aspects such as production, consumption, investment, and employment. Subsequently, resources, are allocated in the forms of wages and benefits, etc, according to the established plan to ensure adherence to predetermined objectives and uphold principles of social equity. Within this framework, the Hukou system emerges as a pivotal institutional tool for resource distribution.

Over the initial three decades following the establishment of the PRC, the central government apportioned benefits based on Hukou types, prioritizing urban Hukou while relegating rural Hukou to a lower priority. Urban residents, benefiting from this preferential treatment, gained access to essential services such as food, education, medical care, social security, and employment opportunities based on their Hukou status. Notably, a significant proportion of urban residents occupied roles within the public sector, and their children were afforded the privilege of inheriting parental jobs upon retirement (Bian, 2002).

In contrast, residents with rural Hukou were compelled to self-rely for the benefits, underscoring the socio-economic disparities perpetuated by the Hukou-based distribution system. This stratification manifested in a categorical division of the entire Chinese population into urban and rural segments. Simultaneously, the stringent Hukou-based distribution system posed formidable barriers to geographic mobility, particularly inhibiting rural-urban migration. Individuals migrating from rural to urban areas found themselves bereft of benefits and even basic necessities in cities due to the Hukou-based distribution system.

The conversion of Hukou status was a restricted avenue, accessible only through specific channels such as marriage to an urban Hukou holder, military service, higher education enrolment, or job assignment. Consequently, the Hukou system entrenched a distinct urban-rural dichotomy, shaping and perpetuating societal stratification within China (Cheng & Selden, 1994).

In 1978, with the death of Mao and the end of the Cultural Revolution, the reformists within the Chinese government, led by Deng, took over the power. Recognising inherent flaws in the planned economy system, such as inefficient resource distribution and a lack of economic flexibility, they initiated a comprehensive set of economic reforms commonly known as "reform and opening up." This initiative aimed at both engaging with the global community and restructuring the domestic economy.

The opening up component involved granting permission for foreign enterprises to invest and conduct business in China, while simultaneously allowing Chinese enterprises to venture into overseas markets. The reform aspect entailed a shift away from the planned economy toward a market-oriented one. Diverging from Western market economies, China adopted a socialist market economy, wherein the government plays a more substantial role. The introduction of this system significantly enhanced production efficiency, fostering economic development and generating a heightened demand for inexpensive labour.

Concurrently, rural areas witnessed the replacement of the collectivised agricultural system with the family contracting system. This transition motivated peasants, increased agricultural production efficiency, and liberated farmers to engage in non-agricultural pursuits. Importantly, these reforms facilitated a relaxation of geographical mobility restrictions on the population, enabling rural residents to work in urban areas (Hao et al., 2014).

Despite these advancements, the Hukou system endures as a tool for administrative population control and social stratification (Bian, 2002; Chan, 2010). While various economic reforms have somewhat mitigated its impact on mobility, the system persists in maintaining social hierarchies, showing resilience against substantial alteration. Consequently, a substantial "second class" of urban residents lacking permanent urban Hukou has been systematically formed (Chan, 1994). This group primarily comprises migrant workers, defined as labours who transition from the agricultural sector to non-agricultural sectors but still retain rural Hukou in paper (Li, 2013). Consequently, they face restricted access to social security benefits and encounter limitations in pursuing certain occupations within urban areas.

In contrast to local citizens, individuals in this second-class category often exhibit lower levels of education, possess fewer skills, and are predominantly engaged in physically demanding, low-skilled, and low-paid occupations. Many of these jobs lack formal employment contracts and have minimal entry requirements. According to available data, only approximately 13% of workers in the non-state sector have signed contracts with their employers (Cheng et al., 2014). Consequently, this segment of the population lacks crucial benefits such as medical insurance, unemployment insurance, and housing funds. Furthermore, their children, generally called as migrant children, are excluded from the urban educational system. Based on the 2020 census data, the total number of migrant children under the age of 14 surged to 53.18 million (National Bureau of Statistics, 2021). This underscores the pressing challenges faced by this marginalised demographic and emphasises the need for comprehensive policy considerations to address their socio-economic and educational disparities.

Simultaneously, the majority demographic in China continues to be comprised of peasants. As of the conclusion of 2020, excluding rural migrants, approximately 510 million people reside in rural areas, constituting 36.11% of the total population. This class locates at the bottom of Chinese society, characterised by limited educational attainment and low income. In 2022, the monthly per capita disposable income—representing the sum available for both consumption and savings—in rural areas amounted to 1,631 Yuan. In stark contrast, urban residents enjoyed a significantly higher monthly disposable income of 4,167 Yuan, exceeding 2.5 times that of their rural counterparts (National Bureau of Statistics, 2021). Chinese scholar Li (2016) depicts China's social structure as resembling the character "土" (tu), differing markedly from the spindle-shaped social structure prevalent in many developed countries, where the middle class dominates. In China, the middle class represents a notably smaller proportion. Using indicators such as income, education, and occupation, scholars assert that only 25.8% of the Chinese population falls within the middle-class categorisation (Li & Zhang, 2008). This distinctive social composition underscores the prevailing socio-economic disparities and challenges faced by a substantial portion of the Chinese population.

Taken together, the interplay between the socialist Hukou system and the capitalist market economy has sculpted the intricate social structure observed in contemporary China (Wu & Wallace, 2021). Presently, Hukou status remains a crucial determinant of income and social strata, dividing the society into three primary streams: urban local, rural migrant, and rural local. Of course, in reality the social stratification in China is more complex because of the vast population, expansive land area, and diverse cultural identities.

For example, within the urban-local class, the administrative hierarchy of cities establishes a corresponding hierarchy of urban Hukou, ranging from municipalities (e.g., Beijing, Shanghai) to provincial capitals and county-level cities. Acquiring a Beijing Hukou, for instance, is inherently more challenging and confers greater resources and benefits compared to obtaining a Hukou in a provincial capital like Xi'an. The migration of urban Hukou to cities at higher administrative levels is perceived as a form of upward mobility among social classes. Moreover, distinct social groups with specific Hukou types emerge, exemplified by citizens with local agricultural Hukou, often referred to as the "urban village" population. The proliferation of "urban villages" is a consequence of China's rapid urban expansion, where once-rural areas encircling a city now exist within its bounds as rural villages. Residents of these urban villages remain their Hukou status as agricultural.

This study straightforwardly identified the three Hukou-based social streams, characterized by substantial overall numbers and relatively discernible boundaries. Furthermore, these three social streams have transcended into the realm of education, outlining the contours of school stratification in China.

1.4.2 School Stratification

Hukou-based social stratification categorises schools into three distinct streams: the upper stream, serving urban residents; the middle stream, serving the children of migrant workers; and the bottom stream, catering to the rural population. Empirical evidence supporting the stratification of these three streams is provided by Tao et al. (2010) survey on the family backgrounds of students in secondary schools across ten cities.

Before the era of reform and opening up, China adhered to radical egalitarianism under Mao's leadership, extending to the realm of education. During this period, the educational mantra in China was "cultivate socialist builders and successors," emphasizing education for the Chinese proletariat, workers, and peasants. Notably, the Cultural Revolution witnessed the abolition of the examination system for higher education, replaced by an application system. Admission and selection criteria were grounded in the social group of the student's family (Ying & Liu, 2015). Applicants from families of workers and peasants are favoured, while applicants from those of landowners, rich peasants, and intellectuals encountered challenges in accessing higher education because of their possible bourgeois and feudalistic ideology (Bian, 2002). Consequently, students from these backgrounds faced reduced opportunities for higher education enrolment, disrupting the intergenerational transmission of educational advantages and artificially interrupting the reproduction of social inequality. In comparison to other countries, China achieved an absolute egalitarianism in education during the Cultural Revolution (Wei et al., 2022).

However, as the entire society was preoccupied with political struggles during that period, a significant number of schools were closed, nearly bringing basic education to a standstill. Consequently, the urban-rural disparity in educational quality was not evident during this tumultuous time.

Since the initiation of reform and opening up, the reinstatement of the college entrance examination (Gaokao) and high school examination (Zhongkao) systems has been geared towards promoting economic development. However, the role of education has shifted from imparting knowledge to workers and peasant families to the selection of talents and elites to

support economic growth. Particularly following the implementation of China's college expansion policy in 1999, data indicates a significant discrepancy in higher education access between students with urban Hukou and their rural counterparts (Li, 2010).This disparity has subsequently permeated lower levels of education, including high school, secondary school, and primary schools, with urban Hukou emerging as a predictor of higher years of schooling than rural Hukou (Wu & Treiman, 2004). Furthermore, to enhance the efficiency of talent selection in education, the government established a system of key schools in 1953. This system aimed to allocate resources effectively to specific schools, officially stratifying education institutions into key point schools and ordinary schools. Key schools were further categorised into national, provincial, municipal, and district/county key schools at various levels of jurisdiction. Distinct levels of schools enjoyed access to differentiated educational resources, facilities, high-quality teachers, and enrolled better-performing students. Graduates of higher-ranked middle schools had a higher likelihood of admission to top-ranked universities, translating into enhanced educational returns (Ye, 2015). Consequently, these key schools have cultivated a hierarchical reputation, attracting and recruiting students from higher social stream.

The majority of students in key schools hail from families where parents occupy high-ranking cadres and professional positions, affording them a higher standard of healthcare, retirement benefits, and other perks compared to occupations like factory workers. Additionally, these key schools are typically situated in urban centres, mirroring the early stages of urbanization when key universities and government departments clustered in city centres, and these schools were established to cater to the staff of these institutions. Another avenue for accessing high-quality educational resources involves purchasing a residential property within a designated school district to secure Hukou registration in the district where the high-quality school is located (renting a school district housing does not qualify for Hukou registration). The acquisition of a school district residence is intricately tied to Hukou status. In many cities, possessing a local Hukou is a prerequisite for purchasing property. Furthermore, due to the limited availability of housing and the high demand, prices in high-quality school districts are considerably elevated. This, in turn, excludes those migrant workers without a local Hukou and with lower incomes, preventing them from accessing quality educational resources.

Until 1999, the Chinese Government ceased conferring the title of "key school" nationwide and introduced "exemplary ordinary high school" as the new designation for high-quality high schools. However, this is essentially a disguised attempt to amalgamate the multi-tier system of key schools into a unified category of quality high schools. Despite this shift, a discernible objective gap between schools persists.

In contrast, urban ordinary schools comprise institutions catering to the children of workers from large factories or suburban schools. Most of them are located in peripheral districts that were once suburbs but have now transformed into urban villages due to rapid urbanization, or, since large factories were generally located on the outskirts of cities. Historically, ordinary schools received comparatively less educational investment than key schools, resulting in a lower quality of education. Presently, many of the large state-run factories have closed down, and those still operational often employ lower-paid workers due to profitability challenges. As a result, these ordinary schools become the primary choice for admitting children of migrant workers who gather in urban peripheries due to lower housing and living costs.

Before 2012, children of migrant workers did not have equal access to free public schools as urban-local children and had to contend with high tuition fees. Unlicensed private schools specifically designed for children of migrant workers emerged as an alternative. These schools, being essentially private, do not require a local-urban Hukou, and their tuition fees are more affordable than elite private schools. However, lacking state educational investment, these schools face challenges in terms of the quality of educational facilities and teachers, with safety concerns prevalent in many cases. In Shanghai, the largest city in China, these schools are colloquially referred to as "vegetable market primary schools," a name that vividly reflects their location and the social group they serve.

As the migrant population increases, attention has turned to the issue of education for the children of migrant workers. In 2012, China's Ministry of Education introduced the "two-main" policy, mandating destination governments to bear the main responsibility for providing free education to the children of migrant workers, mainly in "public schools." Consequently, those schools for the children of migrant workers have been phased out, with some integrated into the public education system. However, despite gaining access to public education in their destination cities, migrant children still face exclusion from quality education. Criteria set by high-quality schools and local governments, such as the number of years parents have paid for social security and additional fees (despite claims of free tuition), continue to limit their access to quality urban educational resources.

Urban school resources, shaped by the Hukou system, can be broadly categorised into two streams: quality school resources catering to urban local Hukou households and ordinary public schools serving the children of rural migrants.

Historically, China's rural areas have faced a significant educational disadvantage compared to urban areas. The most prominent educational inequities in China today exist

between urban and rural regions, a consequence of the Hukou system that prioritises urban areas in resource distribution and public service provision, often marginalising rural areas. This disparity manifests across various fields, including the economy and education, leading to substantial differences in educational investment, facilities, teacher quality, and student demographics between urban and rural areas.

For instance, in Xi'an's Beilin district, located in the urban centre, the total educational funding was 1.506 billion yuan in 2019, whereas in the Gaoling district, an outlying rural area, the total educational funding amounted to only 875 million yuan (Shaanxi Provincial Bureau of Statistics, 2022). The situation in rural areas is exacerbated by issues such as misappropriation of educational funding by county governments or delayed disbursement, as reported by the central government.

Additionally, the teacher-student ratio further accentuates the urban-rural educational disparities. In accordance with the Educational Department's requirements in Shaanxi Province, the teacher-student ratio is 1:15 in urban average secondary schools but increases to 1:17 in rural secondary schools (Education Department of Shaanxi Provincial Government, 2015) . This disparity not only restricts the educational opportunities available to rural students but also has lasting implications for their future prospects.

In conclusion, the current Hukou-based social stratification organises schools into three streams: upper, middle, and bottom. These three school streams were employed to investigate the class differences exhibited between them.

1.5 Research Aim

The aim of this study is to explore how differences in social class are recontextualized into mathematics classroom pedagogy to legitimize social stratification. This involves examining how class differences are transformed and legitimized within the pedagogic practices of schools from different social streams. To achieve this, the study examines and explores class distinctions exhibited in various dimensions of pedagogic practices to uncover their underlying regulative principles. These dimensions are considered as recontextualized pathways. Three potential recontextualized pathways are identified and will be explored in this study.

1.5.1 Forms of Pedagogic Communication as A Potential Recontextualization Path

The research question here is whether class differences in different streams are recontextualized into forms of classroom communication, thereby maintaining social stratification. This involves sequentially answering the following questions:

1. Is the quality of classroom interaction related to the forms of communication?
2. Do the forms of communication in classrooms of different streams present differences?
3. Does the interaction quality in different streams' classrooms show differences?

Forms of communication are selected for exploration based on Bernstein's focus on forms of pedagogic communication, which carries varying degrees of power relations. Different forms of interaction incorporate appropriate individuals, instilling them with these power relations (In this study, "communication" and "interaction" are considered synonymous and are used interchangeably). In Chinese mathematics classrooms, class differences may similarly transform into differentiated forms of communication for transmission. These communication forms likely influence the quality of interaction, which is widely accepted as directly affecting students' academic achievement and maintaining social stratification.

1.5.2 Pedagogic Messages and Their Transmission as A Potential Recontextualization Path

The research question here is whether class differences in different streams are recontextualized into the pedagogic messages and their transmission, thereby legitimizing social stratification. This involves answering the following questions:

1. Do the pedagogic messages transmitted in classrooms of different streams reflect differences?
2. Do the methods of transmitting pedagogic messages in different streams' classrooms exhibit differences?

The selection of pedagogic messages as a potential recontextualization path is based on Bernstein's theory, which posits that pedagogic practices comprise a blend of vertical

knowledge and horizontal knowledge. This knowledge carries varying degrees of power relations. This implies that class differences in classroom pedagogy might manifest as pedagogic messages carrying different hierarchies of power relations. Moreover, the methods of transmitting these pedagogic messages might result in students ultimately receiving different messages. Therefore, the ways of transmitting pedagogic messages are also investigated in this study.

1.5.3 Classroom Feedback as A Potential Recontextualization Path

This section investigates whether class differences in different streams are recontextualized into the feedback provided by teachers to legitimize and sustain social stratification. The following questions are addressed sequentially:

1. Does the content of teacher feedback in classrooms of different streams present differences?
2. Does the manner of providing feedback in classrooms of different streams reflect differences?

Classroom feedback is identified as a potential recontextualization path due to its crucial role. Feedback involves teachers assessing students' current status of knowledge based on students' responses and providing cues and skills to guide them towards achieving the lesson's objectives. It is a crucial pathway in determining whether students can achieve learning goals. Moreover, the core function of feedback is to continuously convey criteria, which Bernstein emphasizes as indicator of selection and exclusion in pedagogic practices to realize social stratification.

1.6 Overview of the Thesis

The thesis consists of nine chapters. Chapter 1 introduces the process of locating this study, including personal experiences, social background, and theoretical exposure. The core research aims, and specific research questions are outlined in this chapter.

Chapter 2 reviews the literature relevant to this study, focusing on the evolution of the concept of recontextualization and its current empirical studies.

Chapter 3 presents the theoretical framework of this study. It begins with an overview of the development of the theoretical antecedents to facilitate understanding of the abstract

theories. Bernstein's pedagogic discourse theory and detailed discourse rules, which serve as the central resource for constructing the analytic framework for forms of communication and classroom feedback, are discussed. The conceptual tools, classification and framing, derived from the notions of power relations and control principle, are elaborated as key analytical instruments throughout the dissertation. Dowling's SAM, including domains of practices and instructional strategies, are incorporated to analyze whether the distribution of pedagogic messages by teachers functions as a recontextualization path.

Chapter 4 details the research methodology. It describes the data sources, data collection, specific analytical units for recontextualization paths, and analytical methods, including quantitative linear regression and mediation effect models for analyzing forms of communication, qualitative text analysis for pedagogic messages and feedback, and specific analytical procedures.

Chapter 5 presents the forms of communications identified in Chinese mathematics classrooms and analysis of class differences in the arrangement of these forms in classrooms from different streams. The quality of classroom interaction is considered as a mediator variable through which forms of communication may influence student achievement.

Chapter 6 analyzes the pedagogic messages transmitted by teachers during the process from preparatory activities to presentation of new mathematics content in classrooms of different streams, including the instructional strategies employed.

Chapter 7 examines the differences in the criteria embedded within feedback and ways teachers provide feedback in different stream schools.

Chapter 8 summarizes the findings from these three chapters, discusses the study's limitations, theoretical and practical implications, and offers suggestions for future research.

Chapter 2 Literature Review of the Concept of Recontextualization

Introduction

In the previous chapter, I stated my research concern is to examine how social class differences are recontextualized in pedagogic practices in mathematics classrooms for the reproduction of social structures. In this chapter, I conduct a literature review on the concept of recontextualization of social class differences. The aim of this review is to examine existing theoretical and empirical studies on recontextualization and then to identify a research gap that remain unexplored, which will assist in framing my specific research questions.

This chapter consists of four sections. Section 1 firstly renders the historical evolution of the concept of recontextualization within the field of social reproduction. It subsequently narrows the focus to the recontextualization of social class as an underlying regulative principle in schooling. Specifically, it reviews literature about how social class relations are transformed and legitimized in educational systems to perpetuate social stratification. This primarily entails a comprehensive revisiting of Althusser's, Bowles and Gintis's, and Bourdieu's works, which elucidate how the ideologies of dominant class disguise themselves as universal interests and are then transmitted through educational systems. Section 2 and 3 are dedicated to review the literature of recontextualization within pedagogy. Thereinto, section 2 reviews Bernstein's theories involving recontextualization and its empirical applications, primarily on studies about differential degrees of control over pedagogic communication across different social classes. Section 3 reviews Dowling's work involving recontextualization, which focuses on studies regarding pedagogic texts stratifiedly transmitted by teachers. Section 4 reviews the current research of theory in terms of recontextualization in China. Ultimately, the results of review locate the potential recontextualized dimensions in pedagogic practices which have not been explored.

2.1 Recontextualization

Before I review the literature of recontextualization I should give an explicit definition of it. Although Althusser's and Bourdieu's work both involve the concept of recontextualization, they did not claim that their respective theories (ideological state apparatus and cultural capital) are recontextualization, but mediators for the dominant class to exert ideological control or facilitate the reproduction of social structure. The concept of recontextualization was first

explicitly introduced by Bernstein. It refers a process that a discourse is selectively appropriated or disembedded from an original context, then simplified or condensed and inserted into a new context. But activities or practices in the new context are still dominated by the original gaze (Bernstein, 2000). Afterwards, Dowling provided another concise summary of this. He defined recontextualization as, "the contention that texts and practices are transformed as they are moved between contexts of their reading or enactment" (Dowling, 2020, p. 717). Specific to the field of social reproduction, recontextualization refers that knowledge, ideology, culture, etc. are extracted from their original site and then converted to another site through a complex transformation. However, the knowledge, culture, ideology, etc. in the new site are still organised by the original principle of social classes. In this process, the unequal class differences are transformed and legitimized so that dominant and subordinated relationships are passed through generations to perpetuate social reproduction. Therefore, obviously, recontextualization is a prerequisite for the sustained and stable social reproduction.

2.1.1 Recontextualization in Social Reproduction

The concept of reproduction is originally proposed by Marx in his book, Das Kapital. Marx (1999) claimed that:

> *Capitalist production, therefore, under its aspect of a continuous connected process, of a process of reproduction, produces not only commodities, not only surplus value, but it also produces and reproduces the capitalist relation; on the one side the capitalist, on the other the wage labourer.*
>
> *(Karl Marx. Capital Volume One, Chapter Twenty-Three: Simple Reproduction)*

The reproduction of capitalism, in Marx's view, involves not only the reproduction of the means of production and the productive forces, but also the reproduction of the relations of production. That is, the relations between the bourgeoisie and the proletariat. The relationship between these two is one of class antagonism, of exploitation and the exploited. As such, it is bound to be broken by the dominated parties. Thus, Marx convinced that capitalism was destined to collapse (Apple, 1992). However, capitalism persists and thrives for several centuries. The dominated parties do not protest and even accept their subordinate positions. Consequently, we are compelled to delve into these following questions: why does this antagonistic class relation

continue to reproduce? What mechanisms support its reproduction? How does the dominated class come to accept their subordinate status rather than challenge it?

Althusser posits that the reproduction of capitalism, specifically the reproduction of production relations (i.e., relations of exploitation), is ensured through the operation of both State Apparatuses and Ideological State Apparatuses. The concept of the State Apparatus, first introduced by Marx, refers to the coercive force responsible for protecting the interests of the ruling class. This includes institutions of violence such as the government, the army, the police, and the courts. Marx and Engels also defined ideology as the "production of ideas, of conceptions, of consciousness," encompassing everything that "men say, imagine, conceive," including "politics, laws, morality, religion, metaphysics, etc." (2000, p. 47). Althusser (2001) further refined this definition, describing ideology as "the system of the ideas and representations which dominate the mind of a man or a social group."

Additionally, Marx conceived structure of every society as constituted by base and superstructure built on it. The former is economic base, while the latter includes politico-legal (law and the State) and ideology. That is to say, economic base of a society determines people's thoughts, values, and culture, superstructure (social consciousness). Nevertheless, although Marx suggested that the reproduction of the economic base includes the productive forces, means of production, and surplus value, etc., he has not explained how the superstructure, namely, ideology was reproduced(Althusser, 2001).

This flaw was initially noticed by Gramsci. In his *Prison Notebooks*, Gramsci (1992) formulated "State = political society + civil society". In Marx's place this formula suggests that a superstructure consists of two divisions. Political society is what Marx termed the coercive state apparatus. Civil society refers to a collection of private and civic organisations, including religious groups, trade unions, schools, the media, and other nonviolent institutions that disseminate ideologies the ruling class. Civil society assists the state apparatus in maintaining a ruling class's dominance over society through functioning as an "ethical state" or "educator" to cultivate its citizens living in a certain way of life. Thus, civil society can perhaps be a precursor of concept of recontextualization in social reproduction.

Althusser developed his theory of Ideology State Apparatuses by adapting the concept of Gramsci's civil society. Unlike Marx who concerned about the reproduction of productive forces and relations of production, Althusser focused more on how these were reproduced.

According to Althusser (2001), in the pre-capitalist era, the primary ideological apparatus was the church, which integrated religious, communicative, and cultural functions. Under the mature capitalist system, schools have replaced the church, becoming the dominant

ideological state apparatus. Schools primarily ensure the reproduction of labour power within the relations of production, which is to reproduce the skills required for them in the social-technical division of labour. This process has been shifted from the apprenticeship in factories to take place outside the firm, namely, schools. This also obscures the true function of schools, which is to serve as a tool for the ruling class to exert ideological control. Firstly, the various skills students acquire in school are embedded within an ideological framework. Additionally, they are taught purely ideological content, such as civics, philosophy, which essentially represents the current social order established by the class domination, that is, the consciousness of the subordination to the ideology of the ruling class. Secondly, schools take children from all social strata from an early age and gradually eject them, providing with the ideology which suits their class roles, thus positioning them within different social divisions of labour.

Althusser (2001) recognized schools as silent recontextualized sites of ideological control for the ruling class. In schools, the relations of exploitation are recontextualized into various skills within the social divisions of labour. These skills are transmitted to all children, gradually positioning them within the appropriate ideological roles as they progress through the sequence of educational system. However, Althusser does not delve deeply into the exact process of recontextualization within schools. He treats students as passive recipients of behavioural norms and morals, neglecting their individual rationality and intelligence. Althusser does not explain how children unconsciously accept, rather than reject, the norms imposed by the ruling class within the school system.

Bowles and Gintis agree with Althusser that the role of schools is to provide the technical skills demanded by a capitalist economy and the capitalist values and way of life. Nevertheless, they proposed specific paths of recontextualization within schools to explain how schools function to recontextualize the economic structure and thereby maintain the capitalist social reproduction.

2.1.2 Recontextualization and Schooling

Bowles and Gintis (2002) asserted that capitalist societies established schools corresponding to structures of capitalist firms. This structural correspondence allows students to be constantly reinforced in schools to identify with the workplace, consequently recontextualizing the economic structure and reducing students' resistance in acquiring hierarchical status.

The structural correspondence between education and the economic structure is reflected in the following four ways: firstly, both the employees in firms and the students in schools are in dominated positions, each required to accept their respective work content and curriculum. Next, their reward and punishment systems show structural similarities: passing and failing in exams at schools correspond to promotion and unemployment in the workplace. Third, the specialized subjects in schools and the competition among students epitomise these aspects in labour markets. Finally, the sequence of schooling typically progresses from primary to secondary to tertiary education, corresponds to different hierarchies within occupational structures. A gradual drop in the schooling sequence implies an entry into a differentiated hierarchical division of labour.

However, Bowles and Gintis's corresponding principle explores the forms, not the content, of schooling. These forms are recontextualized paths of the economic structure for an intergenerational perpetuation of social reproduction. But their work does not involve educational content transmitted in schools. Therefore, corresponding principle is criticised by some scholars as an overdetermination of the economic structure but ignoring the role of culture and subjectivity of agents such as teachers and students (Hoadley, 2005; Sadovnik, 2006).

Bourdieu's theory of cultural reproduction bridges this gap. Firstly, studying the relationship between education and class structure, Bourdieu provided a mediator, culture, for the correspondence between the economic and educational structures. By recontextualizing to the dimension of culture, differences in economic structure are transformed and legitimized as cultural differences. School is then disguised as a neutral apparatus for conveying knowledge and culture, which, in fact, are knowledge and culture of dominant class. This serves to maintain dominance of the ruling class.

Furthermore, Bourdieu (1983) introduced the concept of field, referring to an open structure composed of multiple social agents with certain dispositions or capitals in social space, such as the school field, the church field, and so on. Bourdieu claimed the boundaries of the field are a stake of struggles of the social agents. The power relations inherent in a field determine its structure and function. He argued within each filed, multiple agents endeavour within their field to struggle for their own interests. For example, in the school field, the agents including teachers and pupils are also not passive receivers of dominant culture but achieving for their own interests. Here, Bourdieu extracted Marx's concept, Capital, to term the interests that the agents are struggling for. Nevertheless, Bourdieu argued that the economic interests emphasised by Marx are overly simplified. Since in social practice people do pursue some non-

economic interests, sometimes even some other forms of interests that conflict with their economic interests. For example, some people donate money to gain a higher social reputation, even it means sacrificing their financial interests.

Accordingly, Bourdieu (1986) subdivided the capital pursued by social agents within each field into three guises, economic capital, social capital, and cultural capital. Economic capital refers to financial resources which can be directly and immediately transformed into money and property. Social capital refers to the institutionalised relationships that an agent possesses in a particular social network, or called membership in a group, which can help agents to reach their goals. Cultural capital is a broad concept, thereby Bourdieu has not given a precise definition. Gorder (1980) described it in a generalised way, "cultural capital is possessed in greater amounts by the ruling class and can be cashed in in the form of diplomas or credentials at a later date in exchange for economic capital". But Bourdieu clearly categorised cultural capital into three states: the embodied state, which mainly consists of dispositions, linguistic habits, taste inherited from family; the objectified state, which is mainly in the form of material objects and media, such as books, paintings and instruments, etc.; the institutionalised state, like academic qualifications issued by authoritative institutions, such as diplomas, academic degrees and professional qualifications. In comparison with economic capital, the accumulation of cultural capital takes a longer time.

In addition to these, Bourdieu also proposed symbolic capital, what is derived from a combination of social, economic, and cultural capital. It is the symbols that are universally accepted in a given society, such as academic titles and diplomas. Symbolic capital and cultural capital overlap in many respects, and both are also hidden forms of economic capital. These forms of capital can be interconverted under certain conditions. For example, high economic capital can be converted into cultural capital by acquiring more cultural goods. Or high degrees in institutional state can be converted into economic capital by accessing higher-income intellectual division of labour. Besides, high social reputation may bring higher economic benefits, which in turn can help to accumulate symbolic capital under certain conditions. The interconversion of these different types of capital is a fundamental strategy to ensure the reproduction of capital.

Bourdieu further proposed the concept of habitus as a path for social structures to exert control over social practices. Habitus is "durable, transposable dispositions which functions as the generative basis of structured, objectively unified practices" (Bourdieu, 1979, p. vii). It is embodied in a wide range of social practices, such as behaviour, language, clothing, taste, etc., which are acquired and constantly being formed in the daily practices of children with their

family, peers, community, etc. Habitus serves to delineate the boundaries of different classes in social practices and to represent differences in the amount of cultural capital of the classes. For instance, in terms of taste for art, the middle class prefers abstract, formalised works of art, whereas the working class tends to view works of art from the perspective of practicality in life. As well as in eating habits, the middle class favours exquisite food and table manners which distinguish them from the dietary preferences of the working class. These differentiated types of habitus in various aspects of life are a socially constructed structure. Their hierarchy is delimited and legitimized by the ruling class.

As structured structure, habitus functions in turn to maintain this existing class structure. By means of habitus, differentiated cultural capital is implicitly transmitted to next generation, which ultimately is converted into economic capital to maintain the dominance of ruling class. To be specific, the behaviours, linguistic habits, etc. that middle-class children tacitly acquire from an early age within their families are favoured as natural abilities and gifts in schools which operate based on the middle-class habitus. By contrast, their working-class counterpart's, with behaviour, linguistic habits, etc. alien to those in schools, are perceived as untalented, which ultimately results in their school failure. During this process, school plays the role of a neutral provider of knowledge, selecting and excluding students on the basis of their "natural gifts" through mechanisms such as teachers' linguistic assessment and the examination system. Through schooling, students with predisposed differentiated habitus are gradually distributed into different social divisions of labour, which are subsequently converted into their economic capital, thus structuring the structure.

However, as can be seen from the relationship between education and class difference in Bourdieu's work, education functions to achieve reproduction through the selection and exclusion of pre-existing recontextualized class differences. Therefore, Bourdieu's school serves as a site for reproduction rather than a site for recontextualization (Jenkins, 1982). As Hoadley described, Bourdieu's "schools operate upon pre-existing social inequalities and pre-existing unequal distribution of cultural capital, and they perpetuate these." His school presents an "apparently neutral" attitude (Hoadley, 2005), without actively producing class inequities within them. Accordingly, furthermore, the role of school within Bourdieu's work is unable to explain how differences in cultural capital and habitus are internalized as differences in students' cognitive abilities. This question is answered by Bernstein in his work.

2.2 Bernstein and Recontextualization in Pedagogy

In contrast to Bourdieu's exploration of differentiated habitus in various aspects of social life, such as sports, leisure activities, political opinions, lifestyles, etc., Bernstein who also concerns about the transmission of macro-social structures in micro-social practices, based on the perspective of sociolinguistics, narrows his focus on pedagogy.

In Bernstein's corpus, schooling plays a different role from that of Bourdieu's. Bourdieu's education is neutral, transmitting class differences external to it through mechanisms of selection and exclusion. Bourdieu concerns with the "relation to" education. However, Bernstein's view of education moves from "education reproduces class structures to one where education constitutes the social order through a state-managed process of symbolic control" (Tyler, 2004). Bernstein (2000) proposed that schooling not only conveys recontextualized class differences for maintaining social reproduction but is itself a site of recontextualization and reproduction. Bernstein concerns with the "relation within" education. Accordingly, Bernstein (2003, p. 148) argued that the educational system of Bourdieu "concerned only to understand how external power relations are carried by the system, they are not concerned with the description of the carrier, only with a diagnosis of its pathology". Moreover, Bourdieu's habitus as a relay of class structure to social practice lacks a discernible internal structure, making the concrete process of internalizing class differences into various forms of social consciousness remain inaccessible.

By contrast, Bernstein's pedagogic device as a relay of power relations presents an internal grammar and functioning rules that can be analysed in detail. As such, pedagogic device can be utilized to examine how power relations are transformed, legitimized into pedagogic communication and content, and constantly reproduced.

Before presenting the model of pedagogic device, I must briefly describe Bernstein's theory of pedagogic discourse, which is the fundamental organising principle underlying the pedagogic device.

Pedagogic discourse is a "recontextualizing principle which selectively appropriates, relocates, refocuses, and relates other discourses to constitute its own order and orderings" (Bernstein, 2003b, p. 159). It is used for describing the forms in which macro-power relations are converted into specialized pedagogic communications. Bernstein focuses on pedagogic communication since he considers that it is through different forms of communication, that is, the process of differential transmission and acquisition, that power relations are internalized into different forms of social consciousness. Specialized pedagogic communication in

Bernstein's work refers to the marking of the boundaries of the different forms of communication to distinct them from each other, thus shaping the respective identities of the pedagogic subjects. Pedagogic discourse consists of instructional discourse embedded in, and dominated by, regulative discourse. Specifically, instructional discourse refers to the selection, sequencing, pacing, and evaluation of knowledge and skills in pedagogic communication. Regulative discourse is a discourse of social order. This description can lead to a misconception about pedagogic discourse, suggesting that it comprises two distinct discourses. However, Bernstein emphasised that pedagogic discourse is a discourse. It is just in pedagogic practices we can only experience instructional discourse. The regulative discourse can only be understood analytically and that it cannot be proven empirically (Bernstein, 2000; Straehler-Pohl, 2013).

Bernstein (2000) developed two concepts, classification and framing, to illustrate the way of specializing the forms of pedagogic communication, which are also a description for pedagogic discourse. Classification refers to the degree of insulation between different categories, which are different groups, genders, classes, and more. Agents in each category share common attributes, with a boundary between categories created, legitimized, and reproduced by power relations. At the macro level, classification refers to the insulation between social divisions of labour produced by power relations. At the micro level, classification is the degree of insulation in pedagogic practices regulated by the social division, existing in social space, school subjects and so on. Framing is the principle of control that supports the maintenance of classification. At the macro level, framing refers to the control within social relations, i.e., within a social division of labour. In contrast, framing at the micro-level refers to the control over the pedagogic communication of the pedagogic subjects (teachers and students). In pedagogic practices, the utilization of different strengths of framing specializes various communication forms and thus maintains the classification. These specialized forms of communication select and create different hierarchies of pedagogic subjects through context and content, which in turn construct different pedagogic identities and subjectivities. Consequently, class differences are internalized as differences in social consciousness. The realization of this specialization is achieved through pedagogic device. Because of the complicity of the theory of pedagogic discourse and its relevant concepts such as categories, classification, and framing, I will elaborate them in chapter of theoretical framework. In the following I articulate the pedagogic device model.

2.2.1 Pedagogic Device

Pedagogic device is "an internal grammar of pedagogic discourse" (Bernstein, 2000, p. 28). It consists of hierarchically organised ensemble of rules: distribution, recontextualization, and evaluation. Of these, the recontextualizing rules derive from the distributive rules, and the evaluative rules derive from the recontextualizing rules. The three rules also create their respective discourse field, the production of discourse, the recontextualizing, and reproduction field, which constitute the whole stage of the pedagogic device. Each field serves a specialized role in reproducing social relations in schooling (Bernstein, 1981, 2000).

Firstly, in the field of production, two different classes of knowledge are produced. This is intrinsic to the structure of language, which is also regulated by social division of labour. "The simpler the social division of labour, and the more specific and local the relation between an agent and its material base, then the more direct the relation between meanings and a specific material base and the more restricted the coding orientation. The more complex the social division of labour, the less specific and local the relation between an agent and its material base, then the more indirect the relation between meanings and a specific material base and the more elaborated the coding orientation" (Bernstein, 1981). Therefore, the intellectual labour who are elaborated coding orientation yields abstract, esoteric, context-independent language termed as elaborated code, as well as knowledge, termed as vertical knowledge by Bernstein. On the contrary, the manual labour is restricted coding orientation, limiting to the concrete, everyday, context-bound language, termed as restricted code, corresponding to their horizontal knowledge (Bernstein, 1999). Thereinto, the notion of official knowledge is the most distinctive proposition of Bernstein, which because it reverses traditional perceptions. "Official knowledge, as both content and form, was implicated in the reproduction and subversion of power relations" (Apple, 1992). Typically, people believe that educational stratification arises from factors like unequal access to educational opportunities due to differentiated family backgrounds, differentiated effectiveness of teachers and quality of pedagogy, etc. But people have not doubted the knowledge itself. Official knowledge is generally perceived as neutral and ideology free, especially in mathematics and some natural sciences like, physics, chemistry, etc. However, in Bernstein's view, in any given society, knowledge has already been distributed hierarchically when it is produced. These two forms of stratified knowledge, in turn, shape the differential forms of consciousness of those who acquire them. Thus, "knowledge is far from neutral" (Straehler-Pohl & Gellert, 2013).

Following this comes the field of recontextualizing, in which the structured knowledge is transformed and legitimized. The agents who accomplish this task comprise the Official Recontextualization Agents (ORA), dominated by State, like the educational ministry, and the Pedagogic Recontextualization Agents (PRA), like textbook editors, teachers, etc. The former is primarily responsible for curriculum design, i.e., the content selection, which is also the result of the functioning of power and is organised by principle of social classes (Bernstein, 2000; Lilliedahl, 2015). The latter mainly controls the rules or procedures to construct pedagogic texts and communications (Singh, 2002). Both ORA and PRA have their own autonomy. However, PRA's autonomy is weakened when the state attempts a strong control to ORA.

This study is concerned with the agents in PRA, teachers, as sub-relay, how they transform and legitimize structured knowledge into concrete pedagogic communications in classrooms, which is then transmitted to students of the corresponding class. This process of recontextualization regulates what pedagogic discourse become content and subject of pedagogic practices and how they become. In the field of recontextualization, teachers selectively create specialized subjects by selecting differential valued knowledge and utilizing differential modes of transmission, such as different degrees of control over sequencing, pacing of transmission, and so on. These differential forms of knowledge and transmission implicitly construct different forms of pedagogic communications, in which different forms of social consciousness are shaped. Bernstein identifies three specialized transmission modes for pedagogic communications. They are whole class/ teacher monologue, triadic dialogue, and seatwork activities, each with different strengths of framing (Bernstein, 2003b; Singh, 2002). The triadic dialogue refers to a sequence in teacher-student pedagogic communication that is usually a teacher initiates, students respond, and then the teacher evaluates or feedback (IRE/IRF) (Mehan, 1979). Through different forms of pedagogic communications, recontextualized class differences are reproduced. This process, in turn, is the functioning of the specific pedagogic discourse described above. Regulated by the underlying principle of social class, the classification between students of different social classes is maintained through the conduct of different strengths of framing of instructional discourse. In the recontextualizing field, class differences are legitimized by converted into differences in the forms of pedagogic communication.

In the field of reproduction, the recontextualized instructional discourse, governed by regulative discourse, is transformed into specific pedagogic practices to actualize reproduction. This is accomplished through continuous evaluation, whose one purpose is "to transmit criteria" (Bernstein, 2000, p. 28). Specifically, at the institutional level, evaluative criteria manifest in

formal, summative assessments, such as final exams, which function as apparatus for selection and exclusion when advancing to the next educational institutions (Wong, 2017). These assessments gradually eliminate students who fall below the standard from the sequence of the pedagogic device. At the micro level of classroom practice, teachers continuously transmit criteria within instructional tasks, aiming to "provide a symbolic ruler for consciousness" (Bernstein, 2000, p. 36), enabling students to specialize their differentiated social consciousness by meeting these differentiated criteria. However, in specific teaching practices, the transmission of criteria is often very implicit, since they are typically embedded within the pedagogic content. Moreover, pedagogic practice is a blend of vertical and horizontal knowledge, with vertical knowledge being particularly valued. Therefore, in the classroom, when students engage with the pedagogic content provided by teachers or in textbooks, those from working-class backgrounds tend to lack the ability to recognize the criteria to access to vertical knowledge. They are unable to recognize which part of the textual information in a question is valued and which is not (Gellert, 2008). This is because these students do not acquire the ability to understand knowledge and its underlying power relations beyond their cognition because of their families' positions in social division of labour. As a result, they are unable to provide the response expected by teachers, i.e., they lack the realization rules. Consequently, in the continuous evaluation students from working class are procedurally excluded and thus reproduce their family's position in the social structure. As Moore et al. (2006, p. 3) described, "the pedagogic device creates the conditions for the realization of the message, but always in a recognisable form".

On the other hand, in classroom teaching practice, the continuous transmission of pedagogic content that is transformed from evaluation in classroom reflects the non-neutral role of schools. Students with different coding orientations are stratified based on their social class, even if they are in the same classroom and receive the same messages from the same teacher. "Universal or public access to state-sponsored education does not imply universal acquisition of knowledge" (Singh, 2002).

Overall, the pedagogic device, structured by three fields created by their own rules, illustrates the complete and tangible process of recontextualization organised by the principle of social class. Its role as a symbolic regulator of consciousness, along with its structure, is drawn and presented in Figure 2. 1.

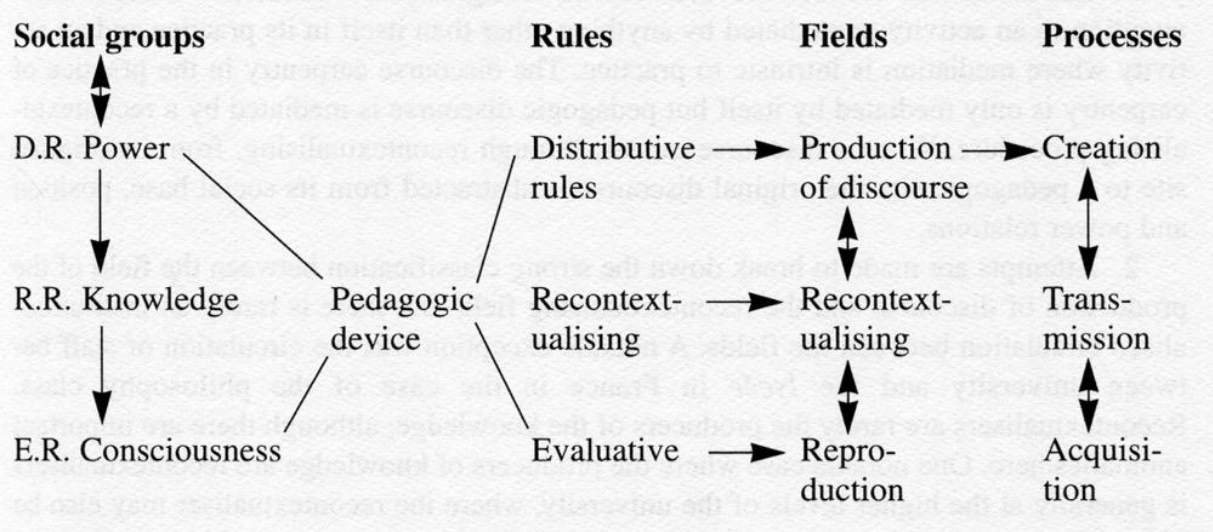


Figure 2. 1Pedagogic device and its structures, taken from Bernstein, 2000, P52

In summary, this section introduces the pedagogic device and its structuring, along with Bernstein's pedagogic discourse theory. It also covers the concepts of coding orientations, classification and framing, and recognition and realization rules. Many researchers have since theoretically extended and empirically applied these theories and concepts concerning recontextualization. These applications will be selectively presented in the following section.

2.2.2 Empirical Applications of Recontextualization of Bernstein

Bernstein's theories have been viewed as demanding and difficult to read because of his specialized terms and an absence of concrete examples (Davis, 2004). As such, many scholars have elaborated and articulated his theories (Apple, 1992; Atkinson, 2002; Atkinson & Bernstein, 1995; Ensor, 2001; Moore & Muller, 2002; Singh, 2002). Moreover, many scholars have applied Bernstein's theories in many countries, such as in Germany (Gellert & Straehler-pohl, 2011; Jablonka, 2008; Straehler-Pohl & Gellert, 2013), South Africa (Davis, 2005; Hoadley, 2007, 2008; Reeves, 2005), the United States (Lubienski, 2004), and Portugal (Morais et al., 1992; Morais, 2002). Naturally, his theory has been empirically applied to different research fields, such as teacher education (Ensor, 2004; Neves et al., 2004), family background and language using (Hasan, 2001; Holland, 1981), vocational and higher education (Breier, 2004; Gamble, 2004; Stavrou, 2011), specific subjects education like science (Morais & Neves, 2018), French (Pandraud, 2011), Mathematics (Dowling, 1998, 2013; Gellert & Straehler-pohl,

2011), gender differences (Daniels et al., 2004), pedagogic practices (Davis, 2005; Hoadley, 2005; Reeves, 2005).

This dissertation centres on pedagogic practices at the micro classroom level. To be specific, within pedagogic practices, this study primarily concerns forms of pedagogic communications, which in fact are various strengths of framing on communication aiming to maintain classifications, i.e., class differences. Therefore, this dissertation commences with an empirical investigation of different strength of framing on pedagogic communication in classrooms, including two radical strength of framing, monologue (the strongest) and peer interaction, also called as whole-class discussion (the weakest), as well as IRF, or triadic dialogue (a strength in between). This review attempts to display class distinctions in different forms of pedagogic communications and to present the research depths, methods, and ranges, in order to locate the empirical gaps concerning pedagogic communication forms. Therefore, finally, the review aims to formulate my specific research questions.

Bourne (2004) presented a case of a *strong* framing of pedagogic communication. She analysed nine classroom teaching videos, in which all teachers operated within the constraints of Curriculum and assessment system, displaying limited flexibility in instructional discourse. Bourne extracted a notably successful sample in which students' school examination achievement was improved. Then she conducted an analysis of the communication process to identify the teachers' approaches that facilitated social enhancement of social disadvantaged students. The analysis of the framings of pedagogic communication and exploration of classifications, as observed in various details in the videos, provide a significantly informative template, including identification of the strengths of hierarchical rules and teacher-students relationship through teacher's positions in the classroom and her gestures, respectively. Additionally, Bourne's study revealed that the teacher improved students' school achievement using varying strengths of framing, as well as through an integration of students' everyday knowledge and subject knowledge. This paves a potential path for social disadvantaged students to enhance their educational achievement.

In contrast, Lubienski (2004) provided an analysis of a *weak* framing of pedagogic communication. Her objective was to investigate the views, experience, and performance of seventh-grade students in participating whole-class discussion in mathematics classrooms. Her data gathered from three rounds of interviews with students, her teaching journal entries, and daily audio recordings. The results of Lubienski' s interviews first show differences in the preferences of different classes of students for whole-class discussion activities. Higher SES students are more confident in whole-class discussions as they enjoy presenting their own ideas

and appreciate others' viewpoints, which characterise different methods of solving a problem. Their confidence, in turn, lead to their high participation in whole-class discussions. On the contrary, lower SES students exhibit lower confidence level in whole-class discussions and are fearful of making mistakes. Consequently, these cause them to keep away more and more from participating in whole-class discussions. Furthermore, lower SES students also view their roles in whole-class discussion as obtaining right answers rather than sharing ideas and arguing. In addition, they easily get confused by ideas shared by other students. Accordingly, lower SES students prefer a teacher-centred classroom with clear guidance or instructions. Moreover, the understanding of the teacher's role as a facilitator in whole-class discussion also shows class distinctions. Higher SES students could recognise the teacher's intention in giving vague responses as hints to prompt students to think and solve problems themselves. In contrast, lower SES students are unable to access to teachers' intention.

Rose (2004) displayed a textual analysis of pedagogic communication using the form of IRF, with a moderate strength of framing. He presented four extracts regarding reading activities, encompassing a mother-child interaction, and three other classroom interactions. His participants comprise students from indigenous and less highly literate families in Australia and their highly literate counterpart. Rose first rendered a textual analysis of dialogues at the micro level. He identified interactional cycles in each extract, which resemble IRFs, triadic dialogues. Rose described in detail the teacher's evaluation, including affirmation, neglect, and admonishment of indigenous students' responses in IRFs. His analysis results revealed that pacing in classrooms accelerate progressively as the grade level increase. This means that students have less time and fewer opportunities to receive feedback. As a result, indigenous students face even greater challenges in obtaining teacher affirmation in a strong framing of pacing, since they have not tactically acquired the ability from their families or primary schools to recognise teachers' expected responses. Hence, they are unable to develop a successful learner identity to access the curriculum. As a result, they are gradually demotivated and excluded from the quick IRF cycles in pedagogic communications. Additionally, he viewed schooling as an entire pedagogic device, with the internal sequence from preschool to secondary school. Pedagogy in each stage in this sequence builds on the mastery of content and competences cultivated in previous stage. The study of linear equations taught in secondary school builds upon the mastery of basic arithmetic rules acquired during primary school. Yet, as a result of the inaccessibility of the curriculum due to the strong framing of pacing, indigenous students are excluded in entering into the next stage in pedagogic device. Ultimately, for indigenous people, generally in secondary school, they drop into the labour market or enter

vocational schools. Whereas, throughout this process, the unequal access to curriculum is invisible.

Morais (2002) argued that pedagogic practices generally encompass a multitude of communication forms, rather than a single one. Meanwhile, she also considered pedagogic practices with varying strengths of framing as a means to facilitate students' recognition of the teacher's expectations and to access the hierarchical power relations embedded in these differentiated forms of communication. Accordingly, Morais et al. (2004, p. 75) "attempt to distinguish the characteristics of these practices as a whole and individually". In light of this, they introduced the model of mixed pedagogy, which refers to a pedagogic approach consisting of varying strengths of framing in each dimension of the instructional discourse. This model serves to overcome the unequal access to valued forms of knowledge. In addition, they also developed a specialized scale for measuring the strengths of each dimension of framing and classification. This scale provides an implementable tool for the empirical applications of Bernstein's theory, which has since been employed directly or modifiedly by several scholars in their own studies (Arnot & Reay, 2004; Chiang et al., 2021; Hoadley, 2008; Koustourakis & Zacharos, 2011).

Through a comprehensive review of existing empirical research on Bernstein's work, I found that some forms of pedagogic communication, such as seatwork activities identified by Bernstein, as well as whether communication forms in mixed pedagogy display stratified differences, have not been investigated yet. Furthermore, previous studies mainly employ qualitative research methods, such as interviews, text analysis, and classroom observations (Bourne, 2004; Hoadley, 2005). Only a limited number of studies conduct quantitative methods (Chiang et al., 2021; Morais, 2002). Overall, these empirical gaps led me to frame my first sub-question: Does the conduct in various forms, i.e., different strengths of framing, of pedagogic communications exhibit class differences?

2.3 Dowling and Social Activity Method

Dowling's SAM, a concept of recontextualization as well, is indebted to Bernstein's corpus. Yet, it takes a different orientation from Bernstein's. Bernstein' theory is inspired by Durkheim's social division of labour. Bernstein structures knowledge into two orientations: horizontal knowledge of the division of manual labour and vertical knowledge of intellectual labour, dominated by power relations. In addition, for Bernstein, recontextualization is achieved by different degrees of control within pedagogic communications. In practices,

teachers transform class differences to different strengths of control over the selection, sequence, and pacing in instructional discourse in classrooms. These varying controls are then employed to orient learners from social groups to distinct knowledge structures, therefore, prepare them into their destined positions in social structures. Bernstein's theory provides a means of analysing control in pedagogic practices to recover the underlying regulative principle. Yet, drawn from Bernstein, Dowling developed his SAM with a specific focus on pedagogic texts (Dowling, 1998, 2013). The SAM is a practical instrument for exploring the selection of pedagogic texts and the strategies used to integrate these texts, or called as tasks, which impact in the access of students to the hierarchy of knowledge, i.e., power relations.

Dowling mainly analyses the messages transmitted as well as voices of the pedagogic subjects in pedagogic practices. He appropriated linguistic methods of analysis that use the dialectic between texts (messages) and structures (voices) to access positions in socio structure the pedagogic subjects enter by analysing pedagogic texts they acquire. Dowling deconstructed the messages in practices in terms of their expression (signifiers) and content (signified). Then he subdivided further into more hierarchical domains of practice according to the amount of abstract knowledge contained in the contents and expressions, termed as discursive saturation degree. The different domains of practice correspond to the different positions in hierarchies of power that different acquirers can access. In addition to considering the power relations inherent within pedagogic texts, Dowling also focuses on the ways they are assembled, analogous to the way words form sentences. Dowling centres on exploring how these ways influence positions within power relations the pedagogic subjects can enter. He identified two approaches teachers assemble messages because of proximity and similarity between texts or classroom tasks. These two approaches are defined in SAM as the abstracting and particularizing. He intends to investigate whether the usage of these two approaches is also organised by the principle of social class.

In contrast to the abstract nature of Bernstein' theory and the lack of empirical examples, Dowling presented a relative clear diagram of SAM for analysing pedagogic practices. Furthermore, he provided an empirical application of SAM, making the method more accessible. Dowling contrasted the pedagogic texts in mathematics textbooks used in middle- and working-class schools. He found that there existed class differences in both the discursive saturation of messages in pedagogic practices, (i.e. the amount of esoteric mathematical knowledge contained), and in the approaches in assembling pedagogic messages. Specifically, pedagogic texts adopted in middle-class schools enable students to access high valued forms of mathematical knowledge, whereas textbooks used in working-class schools confine students

to practical non-mathematical domains, both in terms of mathematical expression and content, which orient them to a lower position in social structures.

Dowling's SAM is a new perspective that views pedagogic texts as a recontextualized path in social reproduction and performs as an analysis instrument for examining the process of recontextualization. Some scholars drew notions from his SAM for study at the textual level. Koustourakis & Zacharos (2011) extracted the concept of domains of practice for an analysis of changes in school mathematical knowledge in Greek primary schools over two decades, aiming to examine the effects of mathematics curriculum reforms. Straehler-Pohl and Gellert (2013) developed a three-dimension model of boundaries to explore factors limiting access to valued forms of mathematical knowledge for lower social class students. One of the constraint dimensions, that of mathematical content, is extracted from Dowling's domains of practice as well. Reeves (2005) examined the content and skills acquired by lower SES students in South African classrooms, as well as the pedagogic types, drawn from Dowling's distributive strategies of messages, conducted by their teachers. Then Reeves analysed whether the combination of these two factors had a greater impact on the students' educational achievement. She concluded that teachers' capacity to more expose learners in principled rather than procedural knowledge in instruction, feedback, and response to students' mistakes is a determinant of differences in student achievement.

Till now, in terms of research on recontextualization in social reproduction, Hoadley's empirical study for my research purpose is the most comprehensive, integrating Bernstein's study on control over pedagogic communications and Dowling's transmission of pedagogic texts (Hoadley, 2005, 2008). She explored how social class is recontextualized at the micro level of the mathematics classrooms for protecting social reproduction. First, she employed Bernstein' theory to compare differences of framing in selection, sequence, and pacing in instructional discourse in primary school classrooms of different SESs in South Africa. Also, she analysed the corresponding classifications of different strengths. Hoadley concluded that teachers in middle-class schools preferred weaker framing of instructional discourse and weaker classification of disciplinary knowledge. By contrast, teachers in working-class schools had a stronger control over all dimensions of classrooms. In terms of the pedagogic texts, Hoadley found that teachers' transmission of pedagogic messages, including the amount of esoteric mathematical knowledge contained in the messages and transmission strategies, both exhibited class differences. Teachers specialized the voices of pupils from different social classes through pedagogic texts.

In summary, empirical studies based on Bernstein's and Dowling's works on recontextualization support the idea that class differences recontextualize to the differential control of pedagogic communications and transmission of pedagogic texts, contributing to implicit social reproduction. However, research specifically examining class differences in the transmission of pedagogic texts within pedagogic practice remains scarce. This gap informs my second specific research question: Are there class differences in teachers' transmission of pedagogic messages, both in terms of messages themselves and transmission strategies in mathematics pedagogy?

2.4 Study of Bernstein's Recontextualization in Chinese Context

At present, relevant study on recontextualization in cultural reproduction in China is still predominantly focused on the empirical application of Bourdieu's concept of habitus and cultural capital. However, study on maintaining social reproduction through investigating how macro social class differences are transformed and legitimated different forms social consciousness among students from different social classes, that is, application of Bernstein's theories involving recontextualization is complete absent. The majority of current Chinese studies of Bernstein are translations and introductions of his theories, including code theory (Shi & Zhou, 1999; Wu, 1992), classification and framing (Xie & Zhou, 2008), structured knowledge (Hu, 2023) , the positioning role of schools (Zhou, 2017), a new perspective of educational sociology for the training of novice teachers (Zheng, 2011) and so on. Some scholars compared Bernstein's theory with other sociolinguistic theories, such as Halliday's Systemic Functional Linguistics (Hu & Wang, 2024). Up to now, there are very few empirical applications of Bernstein's theory in the Chinese context. Extant empirical studies focus on examining whether the issue of different linguistic code orientations exists in the Chinese context as well (Ji, 2004; Li & Yu, 2017; Wu & Shen, 2022). Li and Yu (2017), who analysed teacher-student communications in two kindergartens of different SESs, found that indeed children's linguistic codes showed interscholastic differentiation, which actually represents the differentiation of their families' SES. Children in higher SES families spoke with more uncertain words, such as "may", "may not", representing a kind of generality. These children were also imposed fewer constraints by their teachers. In additional, their teachers conveyed specialized or formal vocabulary during interactions, especially in scientific activities. In contrast, children from lower SES families had a more certain expression of meaning. Besides, their expression of emotions was more restricted by their teachers. Ji (2004) examined the

questions presented in the college entrance examinations. His results showed that those questions used more linguistic materials of urban contexts, such as cinema, traveling, and tips, but lacked rural contexts, which undoubtedly widened the inequality between urban and rural education. Wu and Shen (2022)) conducted a statistical survey by utilizing data from the China Education Panel Survey (CEPS), which demonstrated that different linguistic codes did correlate school achievement of students from different classes. By far, the most in depth and microscopic application of Bernstein's theory in Chinese context is conducted by Chiang et al. (2021), which is also the closest to the topic of my study: exploring how the regulative principle is recontextualized in pedagogic practices. Chiang et al concluded from a large volume of teacher questionnaires that teachers display different attitudes (defined as recognition rules in their study) towards students with different code orientations. Specifically, teachers preferred to interact with elaborated code orientated students for facilitating fluency of instructional practices. However, teachers more likely treated students with restricted code as marginalised other (Singh, 2001). Moreover, teachers' attitudes evoked teachers' ideas and actions (defined as teachers' realization rules). Accordingly, in pedagogic interactions, teachers exhibited differentiated ideas and actions towards students with different code orientations, guided by their recognition of students' code orientations. Teachers established a specialized form of instruction for interacting with elaborated code students, i.e., recontextualizing the principle of social class in hierarchical instructional forms, thereby legitimizing the privileged status of these middle-class students. However, their theoretical framework represents a misinterpretation of Bernstein's concepts. According to Bernstein, "recognition rules are at the level of acquirers" (Bernstein, 2000, p. 17), and this applies equally to realization rules, which are also situated at the level of acquirers rather than transmitters. Additionally, Dowling's work has yet to be introduced and integrated into academic discourse in China.

Moreover, it is imperative to critically assess the applicability of Bernstein's theory, formulated in the 1960s UK, within the present-day Chinese educational context. Despite the stark contrasts in social structures and ideologies—where the UK was a capitalist society with well-defined class boundaries during that era, while China identifies as a socialist state with less distinct class boundaries and adheres to a socialist system—both countries embrace market economies. Despite China's socialist market economy featuring substantial government intervention, the shared economic structure inevitably gives rise to some parallels in social structures. Since the 1980s, when the market economy was implemented in China, the income gap among the population has gradually widened (Wang & Wang, 2005). This economic gap also extends to the field of education. As Chinese culture has attached great importance to

education since ancient times, both the upper and lower classes are very concerned about investing in their children's education. As a result, the widening of the income gap has led to a differentiation in the educational resources accessible to children from different income categories. In recent years, this income inequality is being passed on through generations, leading to a gradual solidification of social classes. Therefore, the function of education as a facilitator of upward social mobility is weakening (Pan et al., 2022). Some researchers even argued that education not only fails to promote social mobility, but rather reinforces solidification of social class. The frequent use of words like "couch potato", "impoverished families can hardly nurture rich sons" in Chinese social media reflects class solidification and the loss of the role of education in social mobility.Zhang and Chen's (2021) analysis results by investigating data from the Chinese General Social Survey (CGSS) in 2015 showed that parental educational advantage was being passed on to the next generation. In turn, this educational advantage was translated into employment opportunities that significantly influenced the transmission of their privileged social status. In addition to this, Zhang and Chen' study also found that the type of household registration (Hukou) significantly impacted the income level, with the Hukou factor explaining up to 69.4% of the higher incomes obtained by urban Hukou residents compared to their rural. Based on this, Hukou is taken as the most crucial indicator in my study for classifying the streams of schools, which has been thoroughly described in the chapter of Introduction. The different social and school streams characterised by Hukou show the similar characteristics of maintained insulations, as Bernstein's middle class and working class do. According to these described, Bernstein's theory can be used as a research method in Chinese pedagogic practices to explore the implicit means by which the segregation between different streams is maintained.

2.5 Conclusion

In conclusion, this chapter first retraces the evolution of theories related to the recontextualization in social reproduction. It briefly outlines Bernstein's theories including coding orientation, pedagogic discourse, and highlights the pedagogic device as a model for realizing recontextualization. Dowling's SAM concerning selection and transmission strategies of pedagogic texts is also reviewed. In addition, this chapter also reviews empirical applications of Bernstein and Dowling's theories to this study. To sum up, both pedagogic communications and pedagogic texts are paths through which the ruling class performs recontextualization of social reproduction. The social classes of the students regulate the way their teachers control

them in pedagogic practices. However, there are still many unexplored means of recontextualization, especially in the mathematics classrooms, and in the Chinese context, in particularly. Therefore, this review helps to locate to my specific research questions.

In next chapters, this study aims to formulate a theoretical framework drawn from Bernstein and Dowling and subsequently apply it to analyse the Chinese mathematics classrooms, for the purpose of a tentatively exploration of how social classes in China are recontextualized in mathematical pedagogic practices.

Chapter 3 Theoretical Framework

Introduction

This study analyzes how social class, as an underlying regulative principle, is recontextualized in pedagogic practices at the micro-classroom level for implicitly maintaining social stratification. Based on a review of theoretical and empirical antecedents, three possible recontextualized pathways have been identified in Chapter 1. This chapter aims to construct the theoretical framework to explore potential recontextualized functions and realized process of these three pathways. The chapter consists of six sections: Section 1 discusses some theoretical antecedents, which have both personally inspired me and directly or indirectly informed the theories employed in the subsequent sections. These antecedents are demonstrated also for a better understanding for the following abstract theories. Section 2 and 3 are drawn from Bernstein's work, which is mainly employed for analyzing teachers' control over pedagogic communication in classrooms. These sections elaborate on the concepts of classification and framing and the theory of pedagogic discourse and a set of discursive rules. The two section also discusses how teachers, as agents of transmitting power relations, i.e., principles of classification, achieve the recontextualization process in pedagogic communication through applying varying strengths of framing on to these discursive rules. Section 4 presents visible and invisible pedagogic practices, which also functions as a summary of formulation of different strengths of framing and classification. Sections 5 presents Dowling's SAM, which focuses on the domain of practices within which these pedagogic messages are selected, and the transmitting strategies employed by teachers. This section is conducted for investigating the pedagogic messages transmitted by teachers in classroom practices. Concepts from other scholars like Lacan's notions of metaphor and metonymy are integrated into this framework to make it more suitable for the data types and analysis process. Section 6 presents a short conclusion.

3.1 Some Theoretical Antecedents

These theoretical antecedents can be traced back to Saussure whose concepts are pivotal in understanding the theoretical framework in this study. Concepts presented here mainly include

the relationship between language and speech as related to Bernstein's theory of pedagogic discourse, the signifier and the signified drawn by Dowling' to his domains of practices. Additionally, the chain of signifying and subjectivity developed by Lacan are based on his reinterpretation of the signifier and the signified, and his metaphor and metonymy are developed as the ways of connecting signifiers. These concepts from Lacan are integrated into Dowling's text distributive strategies within SAM to analyze the use of differentiated instructional strategies by teachers and construction of student subjectivity, all of which serve as methods of recontextualization in micro pedagogic practices.

3.1.1 Saussure' Language and Speech

Saussure (1959) introduced the crucial distinction between concepts of "language" (langue) and "speech" (parole) to understand the structural and functional aspects of language. "Language" refers to the symbolic system used within a particular period, encompassing the current grammatical order, accent systems, phonetic rules, word formation, and syntax. Language is obligatory and imposed, but also collective and generally accepted by the community or by a specific group of members. In turn, it is relative stable and that individuals cannot unilaterally change. Conversely, "speech" refers to individuals' daily use of spoken and written language in specific contexts, characterized by its diversity and variability, with occasional exceptions that introduce small-scale changes. These changes only affect the entire language system when they gain general acceptance.

The relationship between "language" and "speech" underpins structuralism: despite changes in speech, they are governed by the linguistic system of the period. According to Saussure, when individuals select words, writing style or a way to talk, they are still regulated by the grammar and syntax in their linguistic system of the period. Although Bernstein does not explicitly acknowledge Saussure's influence, Saussure's distinction between language (langue) and speech (parole) closely parallels Bernstein's theory of pedagogic discourse. In pedagogic practices, activities and communication are governed by underlying principles, which form the theoretical foundation for this study. This study aims to investigates class differences exhibited in different dimensions in pedagogic practices to recover their deeply governing principle. In return, it attempts to explore how the governing principle transform into micro-interaction level to realize its legitimized transmission, thereby subtly reinforcing social stratification.

3.1.2 Signifier and Signified

Saussure (1959) proposed that a linguistic sign is a combination of signifier and signified, as shown in Figure 3. 1.

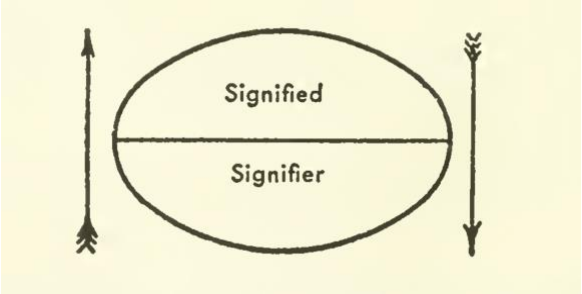


Figure 3. 1 The Saussure's linguistic sign, taken from Saussure （1959, P114）

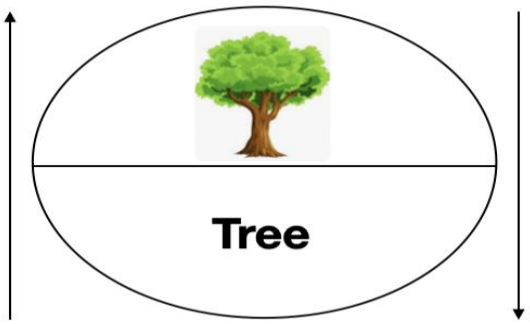


Figure 3. 2 A signifier consisting of a concept and a sound-image, sourced from Saussure (1959, P67)

The signifier refers to the perceived and tangible symbols, such as words, images, and so on, while the signified is the concept that this symbol refers to. This concept is not a physical entity but a psychological imprint—a sound-image (Figure 3. 2) that comes to mind when speakers encounter a signifier. For example, the linguistic sign "tree" consists of the word "tree" and the concept it refers to: A plant with an elongated stem, or trunk, supporting branches and leaves. When a speaker says the word "tree," the listener receives this sound and connects it to the corresponding image of the plant in their brains.

The relationship between the signifier and the signified is arbitrary, based on social conventions within a linguistic community. In addition, a signifier and a signified hold a fixed

associative bond. They form a linguistic sign, like two sides of a sheet of paper, with the front being the signified and the back the signifier. They are reciprocally independent but of equal status (Saussure, 1959, p. 113).

Signifier and signified directly informs Dowling's concept of domains of practice, which analyze pedagogic messages through expression (the signifier) and content (the signified) dimensions. Lacan broke the fixed associative bond between a signifier and a signified emphasised by Saussure, developing his chain of signifying and formation of subjectivity. These two concepts are integrated into Dowling's structural level within SAM to analyze acquirers' subjectivity.

3.1.3 Lacan's Signifying Chain and Formation of the Subject

Lacan's concepts of signifying chain and subject were influenced by Saussure's notions of signifier and the signified (Lacan, 2001). Saussure emphasised the fixed correspondence and inseparability between the signifier and signified. However, Lacan argued that signifiers independently operate of any fixed signified. In Lacan's model, the relationship between the signifiers and the signified is shown in Figure 3. 3. From the Figure we can see that, firstly, Lacan reversed the position of the signifiers and the signified, marking them as capital S and lower-case *s*. He elevated the position of the signifiers, arguing that the signifiers take precedence and produces the signified. Without signifiers, signified would be meaningless objects or vague concepts, things of nothingness.

$$\frac{S}{s}$$

Figure 3. 3 Lacan's signifier and signified, taken from Lacan (2001)

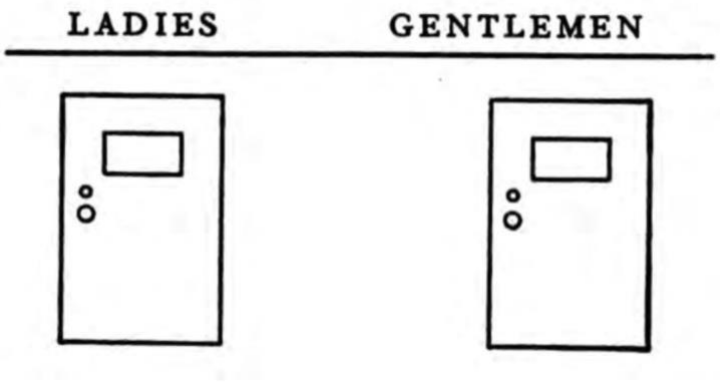


Figure 3. 4 Lacan's example of the doors, taken from Lacan (2001, P162)

Lacan demonstrated the priority of signifiers through illustrating this with twin doors labelled "Ladies" and "Gentlemen" (See Figure 3. 4). It is these two signifiers that differentiate the doors, but not themselves, as they are common in terms of the signified. Furthermore, these two reciprocally opposite signifiers also symbolize gender segregation. By contrast, if the signifiers are changed into the same "Unisex", then they give the same significance to the two doors, which implies the gender equality. Therefore, objects, or the signified hold no inherent significance. They represent differential concepts when they are designated differential signifiers, as well as implying distinct social regulations and ideologies. Therefore, the signifiers take precedence over the signified, giving significance to the signified.

Additionally, Lacan removed the Saussure's circle of a linguistic sign consisting of a signifier and a signified with a fixedly associative bond. Lacan rejected the notion of a fixed correspondence between a signifier and a signified. Instead, he proposed that signifiers and signified form their distinct networks that do not overlap. Lacan's "—" in Figure 3. 3 functions as an insulation or boundary, emphasizing that signifiers operate independently without crossing into the domain of the signified. Consequently, a series of signifiers are interconnected and structured and form signifying chain. Furthermore, Lacan articulated the ways of how signifiers are assembled together to create a new way of significance. They are metaphor and metonymy.

3.1.4 Metaphor and Metonymy

Metaphor and metonymy are two fundamental approaches in connecting signifiers in linguistic devices (Jakobson, 1956). Thereinto, metaphor is based on a perceived similarity or analogy, emphasising common features in different objects or concepts (e.g., "the moon is like a plate" for roundness). A metaphorical deficit impairs the ability to select precise words. However, the person's actions of selection continue, resulting in stacked words that hinder syntactic structure (Barthes, 1974). Metonymy is based on contiguity, emphasising logical, spatial or temporal associations (e.g., Lacan's example (2001) "thirty sails" referring to thirty ships demonstrates metonymy through part-whole inclusion). A metonymic deficit impairs the ability to substitute words, affecting associative connections. Normal speech operates both metaphorically and metonymically, enabling topic shifts through similarity (metaphor) or contiguity (metonymy). In classrooms, for instance, teachers generally use metaphoric and metonymic ways to structure classroom tasks, which are the indicators of Dowling's discursive strategies in pedagogic messages transmission.

In Lacan's work(2001), metaphor and metonymy not only refer to the methods of connecting signifiers but also signify the level of abstraction of these methods and their positions on the chain of signifying, which correspond to the positions occupied by the receivers of these signifiers. For Lacan, metaphor means that the signifiers break through the boundary into the domain of the signified, that it, breaking into physical contexts. "The moon is like a plate" is that the signifier "moon" is related to a physical plate. Entering a concrete context represents that the signifier can be more easily understood. In contrast, Lacan' metonymy refers that a horizontal shift from one signifier to another within signifying chain without penetrating the domain of signified. "Thirty sails" refer to "thirty ships". "Sails" and "ships" are all signifiers rather two signified in terms of physical object, they constantly function within the chain of signifying, representing an abstract and complex degree in understating.

In addition, metaphor and metonymy extend beyond linguistic devices, functioning in cognitive processes (Jakobson, 1956; Lakoff & Johnson, 2008). In cognitive science, understanding of two cognitive domains can be facilitated by introducing one from the other based on their similarities, i.e., the metaphorical approach. It must be stressed; however, this similarity is usually based on identification, i.e. the explanation of one concept using another concept that is already familiar. For example, there is a metaphorical relationship between school mathematics and mathematicians' mathematics. Mathematics is highly abstract and hard to understand, so in many school mathematics tasks teachers use familiar daily experiences such as supermarket shopping to access abstract mathematics. This metaphorical

process can also be understood as "recontextualization" in Bernstein's work. On the other hand, it is also possible to move from one cognitive domain to the other based on the relationship such as proximity, continuity, inclusion between them, i.e., metonymy. For example, "thirty sails" (referring to a boat) demonstrates metonymy through part-whole inclusion. In mathematics classrooms, teachers often use metonymic approaches to connect new concepts with previously learned knowledge, creating a pathway for advanced understanding. For example, when teachers introduce the concept and properties of a circle, they often use the concept of the radius (a part) to calculate the area of the circle (the whole). Overall, in cognitive processes, the connection of familiar and new cognitive domains through metaphoric and metonymic approaches facilitates the development of cognitive abilities.

Furthermore, Lacan's theory posits that dreams are structured like language, utilizing metaphorical and metonymic relationship of signifiers. He drew parallels between Freud's (2009) concepts of "condensation" analogous to metaphor) and "displacement" (analogous to metonymy). Condensation refers to the compression of multiple ideas, emotions, figures, etc. of a dreamer into a single symbol in the dreamer's dream, much like metaphor, where multiple signifiers converge to convey meaning. This convergence is based on similarity or association with reality, making the metaphor relatively easier to comprehend. On the other hand, displacement substitutes meaning from one object to another associative object, similar to metonymy, where a signifier refers to another based on associativity or contiguity. This substitution continues indefinitely within the signifying chain.

Lacan's concepts of metaphor and metonymy, along with Freud's notions of condensation and displacement, are illustrated here to facilitate understanding the two different methods teachers use in connecting teaching tasks. These concepts also help illustrate the hierarchical positions teachers place their students through use of these methods.

3.2 Classification and Framing

3.2.1 Power and Control

Classification and framing are instrumental concepts defined by Bernstein (2000), as translations of power relations and principles of control, to understand and analyze how power and control operate from the macro social structures to micro practical levels.

In Bernstein's work, power relations and principles of control are the most crucial concepts. Power relations "create boundaries, legitimize boundaries, and reproduce boundaries between different categories of groups, gender, class, race, different categories of discourse, different categories of agents" (Bernstein, 2000, p. 5). The inequalities in the distribution of power between and within social groups create class relations (Bernstein, 1981), i.e., the relationships of exploitation and being exploited. The upper class seeks to perpetuate these dominant and subordinate relationships and so forms of consciousness to maintain their power hierarchy. This perpetuation of class relations is realized through the conduct of principles of control, which "generate, distribute, reproduce, and legitimate distinctive forms of communication, which transmit dominating and dominated codes" (Bernstein, 1981). Subjects are socialized into these differential communication forms and internalize these codes carrying power relations. Consequently, they are differentially positioned by these codes in the process of their acquisition, constructing their respective class consciousness. As a result, class relations achieve their transformation and legitimation, transmitting power hierarchy invisibly.

3.2.2 Classification

Bernstein introduced the expression $C_{ie}^{+/-}$, $F_{ie}^{+/-}$ elucidate the concepts of classification and framing. Classification pertains to the degree of insulation, which denotes the maintenance of boundaries either between categories or between agents within a category, as dictated by power relations. Classification encompasses both external and internal values, represented by "i" and "e" in the expression.

External classification refers to the insulation between distinct categories shaped by social divisions of labour within a given social structure, such as professions (e.g., doctors and mathematicians) and their related fields (e.g., surgery and mathematics). Internal classification, on the other hand, refers to the insulation between agents within the same category in a specific communicative context, such as the relationship between teachers and students in a school setting. The strength of classification is denoted by the values +/-. When the classification is strong (C^{+}), the insulation is robust, meaning the boundaries between categories or agents clearly marked. Conversely, when the classification is weak (C^{-}), the insulation is minimal, representing blurred boundaries.

The distinction between external and internal values of classification is critical. According to Bernstein (2003), external classification is often invisible. For example, hierarchical power relations inherent in different social groups, based on the social division of

labour, such as various professions and disciplines, have specific statuses that are not overtly apparent. These power relations are masked or hidden. In contrast, internal classification, which involves hierarchical distinctions between agents within a category, is visible through their communication relationship, such as the teacher-student relationship. These classifications can be observed in classroom organization and task arrangements.

3.2.3 Framing

Framing, translated from the principles of control, plays a critical role in maintaining classifications by transmitting and legitimizing messages and symbols within communication between categories. Categories with differential power relations exert varying degrees of control over each other. Specifically, higher-status categories strive to preserve their insulation from lower-status categories by employing different strengths of framing. This concept extends to agents within a single category as well.

Framing operates by transmitting and legitimizing messages and symbols in communication between categories to maintain classification. Framing also encompasses two values: external and internal. The external value pertains to the degree of control over communication between different categories. For instance, in pedagogic institutions, strong external framing is evident when the state controls curriculum arrangements within schools, marked as F^+. Conversely, weak external framing occurs when schools have greater autonomy over curriculum organization and textbook selection, marked as F^-. In pedagogic practices, strong external framing is seen when teachers' classroom management and task arrangement are highly restricted by school administrators, colleagues, or parents (Hoadley, 2003).

The internal value of framing concerns the degree of control within a category. In micro pedagogic practice, "framing refers to the degree of control teachers and students possess over the selection, sequencing, pacing, and evaluation of knowledge transmitted and received in the pedagogical relationship" (Bernstein, 2003a, p. 80). Strong framing refers to teachers dominating classroom interactions, while weak framing signify that students predominate the instructional rhythms and task selections.

The strengths of framing reflect the hierarchical principles of classification, i.e., power relations. During the transmission process of various strengths of framing, these hierarchical relations are legitimized and reproduced. Thus, framing not only supports the maintenance of classifications but also reinforces existing power structures through the differential control of communication and pedagogic practices.

3.3 Pedagogic Discourse

Pedagogic discourse acts as a recontextualizing principle that "selectively appropriates, relocates, refocuses, and relates other discourses to constitute its own order" (Bernstein, 2000, p. 47). Bernstein developed this theory to illustrate how macro social rules govern micro classroom pedagogy to realize their transmission. Pedagogic discourse not only elucidates what (knowledge and competence) is transmitted and how it is transmitted but also presents how it is legitimized.

Pedagogic discourse consists of rules embedded in two interrelated discourses: instructional discourse and regulative discourse. Instructional discourse pertains to the transmission and acquisition of competence, skills, and knowledge, as well as their interrelations. Regulative discourse, on the other hand, is concerned with social order, "creating criteria which give rises to character, manner, conduct, posture, and etc" (Bernstein, 2000, p. 48). Instructional discourse is embedded within and dominated by regulative discourse, which governs the transmission of competence and knowledge, thereby creating internal order within instructional discourse.

Specifically, instructional discourse includes rules regarding the selection, sequencing, pacing of knowledge, and evaluative criteria. Regulative discourse encompasses rules of social order, such as those pertaining to race, social class, gender, and other social constructs. These social rules achieve their transmission and legitimation by controlling the rules within instructional discourse. Bernstein used the concept of the strengths of framing as an analytical tool to examine various degrees of control over instructional discursive rules, set out as (Bernstein, 2000, p. 46):

$$\text{framing} = \frac{\text{instructional discourse}}{\text{regulative discourse}} \quad \frac{ID}{RD}$$

Thereinto, the strengths of framing for discursive rules can be accessed through observation and measurement. However, the strengths of classification in categories, such as between disciplines, agents, spaces, and discourses can only be accessed through the analysis of framing, as they are dialectically linked.

The following sections will elucidate these discursive rules and the significance of their strengths of framing and classification. To align with the research objectives and data types, this theoretical framework will focus specifically on sequencing, pacing, and evaluative criteria within instructional discourse, hierarchical rules within regulative discourse, and the classification strength of space. Since the selection is dominated by the ORA in this context, it will not be addressed in this study.

3.3.1 Sequencing

Sequencing refers to "the principles and signs of the progression of the transmission. They regulate the temporal ordering of the content such that initial stages are concerned with the concrete and the learning of rote operations and relationships, and later stages are concerned with the abstract and the learning of principles" (Bernstein, 1981). Furthermore, every pedagogic practice must follow sequence rules, which organize the transmission of pedagogic messages in a structured manner, determining what is taught first and what follows.

At the macro level of pedagogic institutions, sequencing structures the progression of increasingly abstract mathematical knowledge according to grade levels. At the micro level, within a single mathematics lesson, sequencing is conveyed through the progression of knowledge from surface to deep structures, embedded in continuous teaching tasks. This progression creates sequence rules in terms of abstract knowledge (Bernstein, 2000, p. 99). In Bernstein's terms, sequence rules involve the transition from horizontal knowledge, which is context-dependent, everyday, and concrete, to vertical knowledge, which is context-independent and abstract. The boundary between these two types of knowledge reflects the social divisions of labour between manual and intellectual work (Bernstein, 1981). In addition, although Bernstein does not explicitly state this, the progression can theoretically occur within a specific task as well.

Dowling's concept of the domains of practice (1998) offers a more detailed perspective on sequence rules within a single teaching task by measuring the degree of abstraction along two dimensions: the mathematical symbols used and the context in which these symbols are embedded. This concept establishes a bridging stage between fully context-dependent and fully context-independent levels within sequence, which informs the analytical framework of sequence rules within a specific task. Dowling's concept will be further elaborated in his respective section.

The strengths of framing of sequencing refer to the degree of control over the organization of pedagogic content to be transmitted. In a strong framing of sequencing, the transmitter determines the order in which messages are presented. Conversely, in a weak framing, the receiver controls the organization of the content. Thus, sequencing rules also imply the rules of pacing.

3.3.2 Pacing

Pacing refers to the "rate of expected acquisition of the sequence rules" (Bernstein, 1981), representing the rhythm of the transmission-acquisition process. At the classroom level, pacing refers to the speed at which students acquire sequence rules through completing all teaching tasks under the teacher's guidance. Within a specific task, pacing reflects the expected rate of acquisition at which students' progress from context-dependent messages to abstract mathematical concepts, moving from horizontal to vertical knowledge.

Strong framing in pacing indicates significant teacher control over the acquisition speed of pedagogic messages. Teachers typically dominate the pace at which sequence rules are acquired based on their expectations, which are often informed by official curriculum requirements or their perceptions of students' cognitive abilities. According to Bernstein, these perceptions are actually based on students' social class. Therefore, within a strong framing of pacing, variations in the pace of delivering pedagogic content also potentially reflect underlying social hierarchies. In contrast, weak framing in pacing occurs when students control the acquisition speed of pedagogic content. Students determine the rhythm of acquisition based on their understanding and learning pace, which facilitates more teacher-student interactions and possible student engagement. In this context, teachers act as facilitators, guiding students to construct their understanding.

Overall, the strengths of framing in pacing and variations in pace within a strong framing context suggest class relations. Shifts in pacing indicate changes in the dominant subjects of communication, reflecting shifts in principles of classification. Furthermore, variations in pace mirror teachers' perceptions of students' abilities, which are translated from students' social class positions.

3.3.3 Evaluative Criteria

Evaluation refers to the rules transmitted alongside knowledge and competence within instructional discourse. It is an approach to bridging the gap between the knowledge students have already mastered and the knowledge required by their schools. The only purpose of evaluation is "to transmit criteria" (Bernstein, 2000, p. 28). According to Bernstein, (2003b, p. 58), "there are criteria which the acquirer is expected to take over and to apply to his/her own practices and those of others". He explains that these criteria are essential for students to understand what constitutes legitimate communication, social relations, and positions. The comprehension of evaluation criteria significantly influences students' ability to produce legitimate texts, thereby impacting their differential achievements (Morais & Miranda, 1996).

Additionally, evaluation can test the criteria of the knowledge previously mastered by students. It is important to note that criteria are not directly conveyed but are embedded within the continuous feedback provided by teachers to students. This embedded feedback informs the analysis object of the third recontextualized pathway.

Different social groups acquire varying evaluation criteria and produce texts that align with these criteria, functioning as mechanisms for selection and exclusion in the labour market. For teachers', their transmission of evaluation criteria involves both the content (what criteria are transmitted) and the approaches (how they are transmitted). Evaluation criteria for the content encompass the assessment of both instructional discourse and regulative discourse in pedagogic practices. The methods refer to the varying strengths of framing in transmitting the criteria for these two types of discourse. Bernstein defines the framing of evaluation criteria as the extent to which they are made available to all students. That is, when criteria can be recognised by all students, framing is strong. On the contrary, when criteria can be only available to certain social groups, framing is weak.

3.3.3.1 Evaluative Criteria for Instructional Discourse

In instructional discourse, evaluation specifically involves criteria related to knowledge, cognitive competencies, and scientific processes. Bernstein (2000) categorizes these criteria into two models based on their evaluation orientations: the competence model and the performance model, within each embedded different strengths of framing.

The competence model focuses on what students' responses present, aiming at prompting students to discuss, argue and negotiate. For example, a teacher might ask, "tell me

how you arrived at this answer?" to encourage students to reiterate strategies they employed for developing their long-term mathematics competence. The method of this model presents a weak framing, noted as F^-, featuring implicit and diffuse criteria, presenting a low level of explicitness. These implicitly conveyed criteria help students grasp higher-order knowledge and skills. However, generally, only students with an elaborated code orientation can recognize these implicit criteria.

The performance model, in contrast, focuses on what is absent in students' product, emphasizing "a specific output of the acquirer, the specific texts the acquirer is expected to construct, and the specialized skills necessary for the production of these specific outputs, texts, or products" (Bernstein, 2000, p. 44). The framing of evaluation criteria in the performance model is typical strong, noted as F^+. Teachers' assessment on what is missing or incorrect in a student's answer generally appear in an explicit way, aiming to improve task completion or to make the steps of their task completion clearer and more organized. This could involve critiquing a student for omitting a step in problem-solving or advising on clearer organization of steps. This explicitness helps students immediately understand their errors and produce legitimate texts, reflecting a present, exam-oriented evaluative approach. For instance, teachers might require students to write "to prove" or "similarly" or writing some essential conditions together rather than dispersing them, aims to enhance task clarity and simplicity. This kind of evaluative criteria is not intended to promote understanding; rather, they aim to ensure that students' procedures are refined and clear, allowing examiners to quickly check the steps and assign scores. If students miss some details or steps in their written problem-solving process, they may lose points, or if they write them in a scattered and messy order, making the examiners hard to find them within a short time, then students may also lose their points. Therefore, these strong framing evaluative criteria for completing tasks are exam-oriented and aim to cultivate students' short-term mathematical performance. Furthermore, these criteria are generally informed directly by teachers rather than being discovered or deduced by students themselves. This transmission method reflects a higher hierarchical position of teachers.

Evaluative criteria for instructional discourse correspond to differentiated criteria for regulative discourse, reflecting hierarchical relationship between teachers and students in classroom interactions. In the competence model, evaluation criteria emphasize cultivating students' long-term competence. Teachers prefer to employ more open-ended questions to prompt thinking, thereby transforming their relationship with students from a dynamic of transmitter and passive receivers to that of facilitator and active participants. This shift represents a move towards weaker hierarchical rules (Bernstein, 2000). Thus, students have

more freedom and autonomy to discuss their ideas and are given ample time to describe their viewpoints and strategies. As a result, forms of classroom interactions tend to be more individualized mode. However, as Bernstein (2000, p. 60) emphasizes, "This is not to say that positional and imperative control modes will not occur, only that these are not favoured modes".

In the performance model, evaluation criteria serve to legitimize macro social rules by emphasizing short-term student products. Teachers often use closed-ended questions to inform students what is missing in their response, reflecting teachers' authority in the classroom. Communication typically occurs collectively or in groups. The type of evaluative criteria stems from teachers' perceptions of students' lower cognitive abilities, leading them to view individualized interactions—which rely on extensive communication—as impractical and costly. Thus, forms of communication in the performance model predominantly involve the teacher addressing the entire class or groups of students, although individual interactions do occur, albeit to a lesser extent.

3.3.3.2 Evaluative Criteria for Regulative Discourse

In pedagogic practices, evaluative criteria for regulative discourse conveyed by teachers primarily consist of social dispositions—attitudes, values, rules of conduct, and principles of social morality—rather than classroom tasks or abstract mathematical knowledge. These evaluations are explicit and specific, identified as a strong framing (F^+), acting as extensions of macro social structures within micro-classrooms. Consequently, students might be excluded from the pedagogic content and vertical discourse. For instance, teachers might enforce rules like "raising your hands" before answering or praise students with comments like "your voice is very clear." These criteria focus on regulating behaviour rather than understanding mathematical content, reinforcing a strong hierarchical relationship where the teacher acts as a judge.

Conversely, the evaluative criteria for regulative discourse, which involve less explicit evaluation of student behavior and attitudes, are identified as weak framing (F-). Such a weak framing promotes a supportive classroom atmosphere, enhancing students' active participation and reflective thinking (Bernstein, 2003b; Morais, 2002; Morais & Miranda, 1996).

3.3.4 Hierarchical Rules

Hierarchical rules within regulative discourse pertain to the authoritative positions occupied by subjects during the transmission and acquisition of messages, as embodied by pedagogic relationships. In classroom settings, hierarchical rules delineate the degree of openness in communication between teachers and students, as well as among students themselves. A strong framing of hierarchical rules indicates that teachers dominate classroom communication. This dominance results in less open and more imperative communication, where teachers control the transmission process and the rules of instructional discourse, including the selection, sequencing, and pacing of knowledge, as well as the evaluation criteria used in pedagogic practices. Therefore, hierarchical positions are clear, with teachers holding greater authority. The classroom environment becomes teacher-centred, characterized by a unidirectional flow of knowledge from teachers to students, who have limited options to respond to the teacher's control. In this context, student performance is more easily objectified, as grades can be assessed based on the extent to which students have mastered the content delivered by their teachers. Teachers are viewed as primary knowers and specialized transmitters of knowledge, while students are seen as passive and industrious receivers. A strong framing of hierarchical rules among students suggests that one or a few students dominate the communication process. For instance, in a small group interaction, one student might determine the strategies for solving a task, the pace, and the order of activities, while the other students comply, execute tasks, or remain silent.

Conversely, a weak framing of hierarchical rules represents a more open communication relationship. Despite teachers in any society or culture inherently occupying authoritative roles and implicitly or explicitly controlling instructional discourse, a weak framing of hierarchical rules and open communication device obscure power relations to some extent. Authority is partially transferred to students, allowing them greater control over instructional discourse in the classroom, which is in terms that relate to the form of communication (Morais & Neves, 2018). In a weak framing context, evaluative criteria are more likely to be made explicit, as students have more autonomy to intervene discussions based on their understanding. They are encouraged to question, discuss, negotiate, and express their views and confusion during communication, which helps clarify the criteria for producing legitimate texts in educational settings. Additionally, teachers' feedback can make students feel that their views are valued, thereby facilitating their behavioural and emotional engagement in classroom activities. This weak framing of hierarchical rules corresponds to a weak pacing,

allowing students to take control of classroom time to understand and construct knowledge at their own pace. On the other hand, teachers' identity transits from the primary knowers and the transmitters of knowledge to facilitators in interactions. Consequently, students are perceived as interactive, creative, constructive, self-regulating, and autonomous (Bernstein, 2000). The transmission of knowledge is bidirectional, resulting in a hidden of the identities of transmitters and acquirers. As a result, students' achievements are therefore more difficult to be objectified and to be measured, given that the competencies developed by students through open communication are challenging to be assessed in a short time frame. Furthermore, a weak framing of hierarchical rules among students means that the equitable authority among peers and that all students can contribute to classroom interactions. Each student has the time, space and opportunity to express their view equally.

3.3.5 Space

Insulation in space includes both symbolic and social life dimensions (Bourdieu, 1989). Symbolic spatial segregation refers to the control that dominant classes exert over the spatial consciousnesses of the general public. In terms of spatial insulation in social life, this study focuses on the perceived environments experienced in practice. Dominant classes achieve insulation in physical space through insulation in symbolic space, and conversely, insulation in physical space can reflect insulation in symbolic space. Specifically, different social groups create distinct spatial impressions based on their positions on hierarchical power relations, which ultimately manifest in their physical spaces. For example, individuals from different social groups develop respective spatial consciousness, which is ultimately reflected in their living spaces. This study focuses on spatial insulation in pedagogic practices, where symbolic space denotes the insulation of hierarchical authority between teachers and students. The insulation is manifested in their physical positions within the classroom, encompassing aspects such as location, use of materials, and movement. Conversely, the insulation of physical space in the classroom can also reveal the underlying dynamics of symbolic space, reflecting the power relations at play.

A strong classification of space in a classroom is characterized by a clear but invisible boundary between the physical positions of teachers and students, which remains unbreached. Typically, teachers stand at the front, using specialized teaching materials such as computers, projectors, and remote-control devices. They deliver instruction from the podium without crossing into students' areas. Students, on the other hand, are confined to their seats, using their

own textbooks and materials, and are treated as isolated individuals. They listen passively to their teachers' instruction and respond briefly to questions. Their movement, communication, and exchange of materials among students are strictly constrained. This strong classification of physical space reflects a strong classification of symbolic space, indicating the teacher's strong authority over students. Teachers dominate the classroom, and students are submissive, with a strong framing of hierarchical relationship.

A weak classification of physical space in a classroom allows greater freedom of movement and exchange of materials between teachers and students and among students. Teachers typically move around the classroom to provide individual support to students. The invisible boundary is broken, symbolizing the breakdown of hierarchical authority or power relations in symbolic space. Although hierarchical relations still exist in the classroom since teachers are always the dominators in classroom, they are not as extreme as in a strongly classified physical segregation. The roles of teachers and students become more equal. When the roles of transmitter and receiver are indistinguishable in terms of symbolic space, insulation in physical space is entirely eliminated. This type of spatial insulation also applies to interactions among peers. Peers can move and communicate freely, reflecting physical space as a representation of broader social rules. Society becomes freer and more equal, with less control exerted by authorities.

Insulation in physical space reflects underlying power relations and the differentiated spatial awareness and spatial marking abilities of the individuals involved. A strong classification of space grid has clear boundaries set in each small space, which is easily recognised by students. Whereas in a weak classification of space grid, all practices, materials and communication are mixed, requiring students to recognise and establish boundaries themselves. However, students from different social classes have varying abilities to navigate and establish these spaces.

Bernstein and Adlam's food sorting experiment (Bernstein, 2003) highlights the difference in marking space. When asked to "group food pictures in any way you like", working-class students categorized them based on their everyday experiences. For example, "this is what my mother usually cooks", and "this is what I always eat for breakfast". They identified a weak classification question as a weak classification, and therefore gave a weak classification response (a weak insulation between daily context and professional answer). For them things are inherently separated, they just need to leave the space as it is.

While middle-class students used professional categories like dairy products or cereals. They quickly identified this weak classification question as a specialized context. Accordingly,

they gave these answers with a strong classification, i.e., professional knowledge independent from external contexts. As the rules for middle-class are "everything is put together", they need and are encouraged to recognise and make their own marks in their daily life (Bernstein, 2003, p70).

By contrast, their working-class counterparts lack this ability and consciousness to mark a space on their own. According to Bernstein, these children are not trained to decontextualize and recontextualize knowledge, as their interactions at home are simpler and context bound. Consequently, these students struggle to recognize and construct spatial networks in pedagogic practices with weak spatial framing.

Hasan (2002) supports this view from a linguistic perspective, arguing that the type of verbal interactions between students and their mothers plays a significant role. Working-class mothers typically convey clear, context-specific meanings and do not expect extensive responses from their children. Hence, their children are not expected to decontextualize and use these words in a variety of ways, leading them to be restricted in everyday contexts. These mothers provide "a set space", giving less space and opportunity for their children to develop the consciousness and ability to construct their own marks (Bernstein, 2003b, p. 70).

Middle-class mothers, on the other hand, use implicit meanings and encourage their children to apply words in various contexts and give positive feedback, fostering a capacity for abstract thinking and ability in marking space. Thus, students from middle-class backgrounds are better equipped to handle weakly framed spatial classifications in educational settings, while working-class students may find these environments challenging due to their limited exposure to such cognitive demands at home.

3.4 Visible and Invisible Pedagogy

The formulation of different strengths of classification and framing can generate distinct pedagogic practices (Bernstein, 2000). Generally, a strong classification aligns with a strong framing, generating a transmission modality of pedagogy. In this pedagogic modality, pedagogic practices are highly visible, characterized by explicit teacher control over selection, sequencing, pacing, and evaluative criteria within instructional discourse, as well as clear teacher authority within regulative discourse. This visible pedagogy emphasizes students' performance, focusing on specific outputs, including particular texts and specialized skills. Learning relies heavily on teachers' transmission of knowledge, with students seen as receptive, industrious, and passive participants lacking autonomy. Due to the focus on short-term,

immediate student performance, visible pedagogy has a present-oriented time preference. This necessitates strong framing of classroom pacing, enabling teachers to deliver mandated content within a set timeframe. The hierarchical relationship is evident in the physical positioning within classroom: teachers maintain an invisible boundary by staying at the podium, while students remain in their seats, indicating a strong classification of space between teacher and students, as well as among peers. The cost of visible pedagogic practices is relatively low, as the investment in visible, segmental space and time is short-term and easily measurable.

In contrast, weak classification corresponds to weak framing, generating an acquisition modality of pedagogy. In this model, pedagogic practices are invisible, granting students more control over the communication process and promoting interaction with teachers and peers. The framing of instructional and hierarchical rules is weak, making it difficult to identify the primary transmitter of knowledge and blurring power relations. This pedagogy focuses on developing students' competence, viewing them as active, constructive, interactive, and creative individuals with high autonomy. Learning occurs through exploration and discussion, with minimal facilitation from teachers (Reeves, 2005). Consequently, there is weak control over pacing, allowing students to acquire knowledge at their own pace, fostering long-term competence. The time preference of invisible pedagogy is future-oriented, requiring substantial long-term time and money to train more high-quality teacher training and the establishment of a weak classification of space in classroom. Thus, the cost of invisible pedagogy is high, often affordable only by schools serving middle-class students. The distinctions between visible and invisible pedagogic practices are summarized in Table 3. 1.

Table 3. 1 Distinctions of each dimension in visible and invisible pedagogic practices

	Visible	Invisible
Subjects	Passive	Active
Focus/Concern	Performance	Competence
Evaluation orientation	Absences	Presences
Space	Strongly classified	Weakly classified
Time preference	Present	Future
pacing	Strong framing	Weak framing
Autonomy	Low	High
Hierarchical rules	Explicit	Implicit
Cost	Low	High

3.5 Dowling's Social Activity Method

This section introduces Social Activity Method (SAM), a framework designed to analyze hierarchical differences in pedagogic messages and distributive strategies utilized by teachers during transmission (Dowling, 1998). The presentation of SAM will be structured in the following three parts. Firstly, the structural level of SAM will be delineated. This includes an exploration of its development and the foundational concepts of domains of practice and positions. Dowling's SAM synthesizes multiple theoretical works, including Eco's distinctions between the expression and content of symbols. Secondly, the textual level will be examined, focusing on the hierarchy of transmitted messages and the strategies of their transmission. This section will build on previous discussions of Lacan's theories of the signifying chain, and metaphor and metonymy. Lacan's concepts will be integrated with Dowling's discourse strategies to better align with the data under analysis and to enhance comprehension. The signifying chain, representing the symbolic order, will act as a quilting point to unify the various components into a coherent study. Finally, the resource level of SAM will be presented as an auxiliary tool for data analysis.

Dowling's SAM (1998, p. 125) is "directly indebted to Bernstein's work". Bernstein introduces the concept of an external language of description, referring a translation mechanism for associating an internal language of description, i.e., esoteric theory or syntax to empirical data (Bernstein, 2000; Moore & Muller, 2002). "Bernstein is concerned to give space for the voice of the researched to announce the specificity of its text, enabling the internal language to develop empirically" (Dowling, 1998, p. 125). While Dowling shares this intention in his development of SAM. Dowling emphasises that his SAM can potentially be applied to a variety of settings. He has applied it to the field of education to analyze the social class-regulated differences in mathematics textbooks (Dowling, 2013).

SAM, as an external language of description, provides a space to conduct empirical analysis. Dowling adopts the term "activity" because, in his view, an activity is generated by the division of social labour and is governed by ideology. In turn, activity serves as the contextual basis for all social practice. Here, ideology is equated with Bernstein's internal language, and social practice, akin to Bernstein's empirical situations. While activity, as a connection, provides a space for the analysis of social practices to explore ideology. Additionally, the relationship between practice and ideology is analogous to Saussure's relationship between speech and language: speech is the communication form in everyday life, but it is dominated by the syntactical rules of the language of the period (Saussure, 1959)

(Saussure, 1959). Similarly, practices are also dominated by the ideology of the society in which they take place. However, direct access to ideology is impossible. Hence, Dowling' Activity provides a means of to explore ideology through social practices.

3.5.1 The Structural Level of Activity

In Dowling's concept, any activity has its underlying ideological structure. In societies, any activities are articulated through signs, what Dowling refers as the global semiotic universe, drawn from Eco (Dowling, 1998). Generally, signs are identical to Saussure's signifiers, which assembly to form a symbolic order, embodying particular social rules and cultural expectations. Moreover, this symbolic order is shared across different subjects (Hoedemaekers, 2007). Accordingly, an activity articulated by signs regulates subjects of its signs as well as the content of the signs. That is, an activity regulates who says/does what. Dowling defines these two dimensions of an activity as the practice and positions. The relationship between the two is that activity constructs positions via the distribution of practices to a range of positions. Moreover, they two are inseparable and articulated as relational totalities to constitute an activity.

Dowling applies his SAM into a specialized activity, school mathematics, which contains not only specialized practices (mathematical and pedagogic knowledge) but also array of specialized positions with potentially hierarchy (e.g. teachers and students with differentiated levels of authority). The knowledge and positions of teachers and students are interdependent. Dowling take this as a specific and empirically specialized activity to illustrate his most widely cited concept, the domains of practice and positions.

3.5.1.1 Domains of Practice

Dowling deconstructs the practice of school mathematics, i.e., mathematical knowledge, into expression and content dimensions. His deconstructive approach draws from Eco's approach to the deconstruction of signs, which can be traced back to Saussure's signifiers and signified. Saussure (Saussure, 1959)defines a linguistic sign as a whole associating the signifier (sound-image) with the signified (content or concept). The Danish linguist and semiotician Hjelmslev (1963) then appropriates Saussure's notion of signifiers and signified and terms them as sign-expression and sign-content, respectively. In addition, he also follows Saussure's relationship between language and speech, where the syntactic rules of language are realized through speech, and then proposes his concept of the sign function. Hjelmslev argues that a sign is not

a simple mark or gesture, but what functions within a given context. Just like the function between a class and its components, the function of a sign also bases on its components: expression and content (Taverniers, 2008). The two propositions of Hjelmslev later significantly influences the Italian philosopher Eco. Eco (1976) considers that the whole universe is constituted by signs. Further, taking a hermeneutic perspective and incorporating Peirce's notion of "unlimited semiosis.", Eco derives that the significance of linguistic signs is subject to infinite interpretation (Eco, 1987). This insight implies that signs must contain particularly cultural messages in the process of interpretation (Lewis, 1985). In other words, then, the process of interpretation, namely, the realization of the function of the sign, is necessarily situated in a particular social and cultural context. Thus, in Eco's work of expression and content extracted from Hjelmslev, the meaning of his content becomes particular social or cultural setting.

Inspired by Eco's notion of expression and content, Dowling divides pedagogic messages transmitted in classrooms as a practice into content and expression forms. He simultaneously incorporates Bernstein's concept of strengths of classification into each form and then builds his matrix of four domains, termed as domain of practice, see in Figure 3. 5 below (Dowling, 1998; Hoadley, 2005; Koustourakis & Zacharos, 2011; Straehler-Pohl & Gellert, 2013). Specifically, the expression of pedagogic messages is the mathematical symbols, as well as the content is settings in which mathematical symbols are presented.

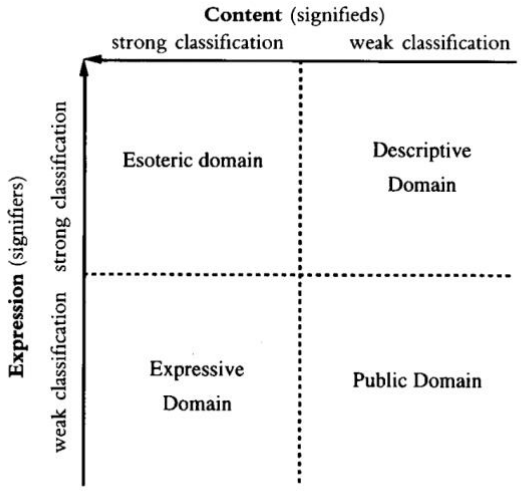
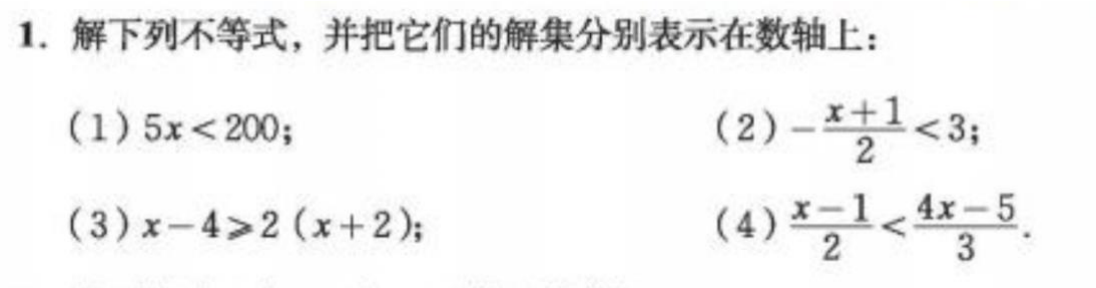


Figure 3. 5 Domains of practice, taken from Dowling (1998, p. 135)

Esoteric Domain

When the expression and content are strong classifications, distinguishing it strongly from other activities. This domain is defined as esoteric domain. In esoteric domain of school mathematics, these practices normally consist of specialized mathematical topics, including geometry, arithmetic, probability theory and statistics, etc. and mathematical symbols. For example: Extract 1 from BNU, 8th, 2, P4 (Textbook of Beijing Normal University (BNU), Grade 8, The second semester, P47. All the following are abbreviated in this format: (book version, grade, semester, page).

EXTRACT 1



1. 解下列不等式，并把它们的解集分别表示在数轴上：

(1) $5x<200$;　　(2) $-\frac{x+1}{2}<3$;

(3) $x-4\geqslant 2(x+2)$;　　(4) $\frac{x-1}{2}<\frac{4x-5}{3}$.

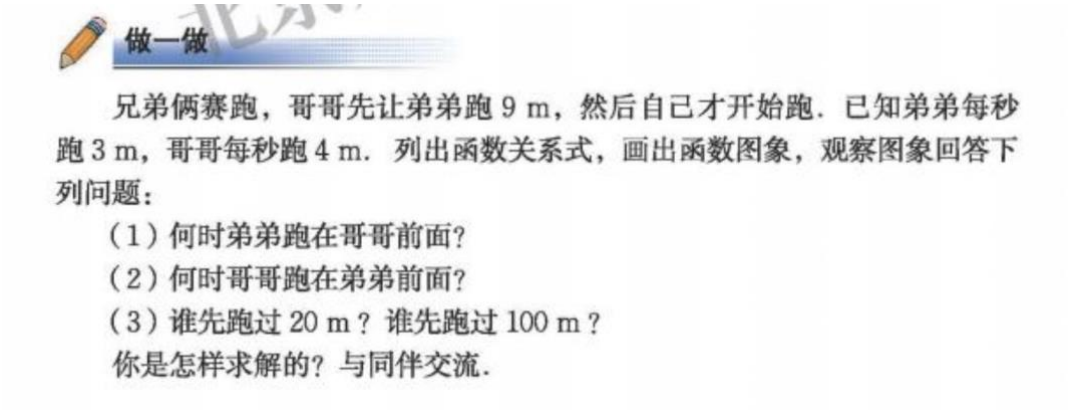
Notes: Solve the inequalities and mark each of their solution sets on a number line.

In this extract, the content is entirely in the field of algebra, and its symbols presented are entirely mathematical, like unknowns, inequality sign, fractions, etc. “Solve” is also a mathematical command of strong classification. In this domain: "ambiguity is minimized in the esoteric domain, specialized denotations and connotations are always prioritized. ", "only within this domain that the principles which regulate the practices of the activity can attain their full expression" (Dowling, 1998, p. 135). However, normally, in school mathematics, in order to enable students to access these esoteric domains, mathematical knowledge is often recontextualized. That is, its content and expression are transformed to accommodate students of different ages and abilities to facilitate their participation in mathematical tasks. In general, the esoteric domain is recontextualized in its content and expression respectively and then form the following three domains:

Descriptive Domain

When the expression form of an esoteric domain is maintained but the content is transformed into a weak classification. That is, mathematical symbols with strong classification are presented in a non-mathematical setting. This domain is defined as the descriptive domain. For example, in Extract 2 (BNU, 8th, 2, P50)

EXTRACT 2



做一做

兄弟俩赛跑，哥哥先让弟弟跑 9 m，然后自己才开始跑．已知弟弟每秒跑 3 m，哥哥每秒跑 4 m．列出函数关系式，画出函数图象，观察图象回答下列问题：

（1）何时弟弟跑在哥哥前面？

（2）何时哥哥跑在弟弟前面？

（3）谁先跑过 20 m？谁先跑过 100 m？

你是怎样求解的？与同伴交流．

Note:

Try to do: Two brothers run a race. The older brother asks the younger brother to run 9 metres before he starts. The younger brother is known to run 3 metres per second and the older brother runs 4 metres per second. List the equation for the functional relationship and draw the graph of it. Observe the graph and answer the following questions:

1. When does the younger brother run ahead of the older?

2. When does the older brother run ahead of the younger?

3. Who will run 20 metres first? Who will run 100 metres first?

How do you solve this? Discuss with your peers.

This extract presents mathematical symbols with strong classification, “equation for the functional relationship”, “graph of a function”. But these symbols are recontextualized into a non-mathematical everyday setting, presenting a weak classification mathematical content. This type of practice is identified as a descriptive domain.

Expressive Domain

The classification of the expression form of the esoteric domain is transformed by weakening the mathematical expressions, while the content dimension remains the strong classification. Namely, in contrast to the descriptive domain, the expressive domain refers to non-

mathematical symbols embedding in specialized mathematical content. As a result, "regulative principles of the esoteric domain cannot be fully expressed within this domain (Dowling, 1998, p. 136) ". For example, in Extract 3 (BNU, 7th, 2, P96)

EXTRACT 3

In this extract, a specialized mathematical content, congruent figure, is presented through an everyday object, a kite, a non-mathematical expression.


5. 一个风筝如图所示，请在风筝图中找出3对全等三角形，并指出它们的对应边和对应角（可以在图中标注字母）.

（第5题）

Notes: A kite is shown in the diagram. Find three pairs of congruent triangles in the kite and mark their corresponding sides and corresponding angles.

Public domain

The forms of expression and content of the esoteric domain are simultaneously recontextualized to a weak classification to build a domain, defined as the public domain. In public domain, both the symbols and the context in which they are embedded are non-mathematical. For example, Extract 4 (BNU, 7th, 2, P44)

EXTRACT 4

Notes: Do you know how physical education teachers measure the distance of long jump ?

In public domain, symbols and content are ambiguously mathematical. Hence, learners cannot quickly distinguish it from other everyday contexts. However, practice in the public domain is different from the real everyday activities because it exists to provide a portal for learners to enter the esoteric domain (Dowling, 1998; Straehler-Pohl & Gellert, 2013) . The public domain is still regulated by the principles of the esoteric domain, working as a projection of mathematical principles into the non-mathematical domain. Additionally, the contexts in the public domain are rarely used outside the classrooms. As Dowling says, "the mathematical gaze generates a virtual reality, a mythical domesticity within which all is rational and all is calculable" (Dowling, 1998, p. 33).

Dowling's domains of practice offer a very useful means to deconstruct practices. He himself employ this tool to analyse the forms of expression and content in different mathematics textbooks and then found that there are stratified differences across schools of different social classes. Specifically, textbooks employed in middle-class schools have more pedagogic tasks selected from esoteric domains and involve more strong classification mathematical expressions. By contrast, textbooks adopted by working-class schools offer little or without messages on the esoteric domain and remain primarily in the public domain. These differences are also evident in the covers of the textbooks, with middle-class textbooks featuring abstract altitude lines while working-class textbooks using everyday objects like clocks.

In addition to these, even when all tasks are selected from the public domain, there are stratified differences in the way mathematical tasks are described in textbooks adopted in

different social class schools. First, the textbooks adopted by middle-class and working-class schools provide their respective students with intellectual and manual practices, "in consistent with the recruitment of social class" (Dowling, 1998, p. 267). Secondly, middle-class textbooks present fewer domestic settings such as cooking, and generally weaken background information but rather prioritise mathematical principles. Moreover, middle-class textbooks tend to utilize the same objects in a variety of tasks. On the contrary, working-class textbooks describe plethora of contexts. Even in the same context, such as an economic activity, there are strong distinctions in tasks adopted or ways described in different textbooks. For instance, in the same setting of calculating taxes, in the middle-class textbooks, the income tax is described in terms of annual salaries, a term used for intellectual occupations. In contrast, in working-class textbooks they use the term "weekly wage" which is clearly for manual occupations. Even doctors, a well-known high-earning occupation, is described as a "monthly wage" (Dowling, 1998, p. 262).

In summary, the expression and content of pedagogic messages transmitted in textbooks are regulated by the principle of social class, i.e., the principle of division of labour. Textbooks selected from the middle-class schools access more esoteric domains, while those from the working-class schools mainly reside on the public domain. Even within the public domain, middle-class textbooks utilize more professional terms and tasks related to intellectual occupations, whereas working-class textbooks use more descriptions and contexts related to manual labour.

3.5.1.2 Positions and Subjectivity

Positions are constructed based on the distribution of pedagogic practices. Meanwhile, activity "regulates 'who' can say or do or mean 'what'" (Dowling, 1998, p. 140). In other words, any specialized activity, such as pedagogic activity, will construct different hierarchical positions that shape human subjectivity. This results in roles such as transmitters and acquirers, as "human subjectivities are interpreted as the articulation of multiple positions" (Dowling, 1998, p. 131). This viewpoint of Dowling is identical to Lacan's subjectivity. In Lacan's work, subjectivity is formed through a stack and moving of signifiers. Subjectivity is constantly changing by constantly acquiring new signifiers. In Dowling's study, textbooks act as the authoritative transmitter, which is unidirectional monologues that establish hierarchical positions for subordinate acquirers. On the other hand, in the category of acquirers, their

positions are identified according to the extent to which they can realize the regulative principles of the esoteric domain, which are also extent of their subjectivity produced.

To be specific, first, for those subjects who are allowed access to the esoteric domain in pedagogic practice, that is, to prepare to produce subjectivity, this is referred to as "apprenticeship". In Dowling's middle-class textbooks, for example, students are given a range of abstract, metonymically linked mathematical tasks from the esoteric domain. These tasks involve a strong classification of mathematical expressions and content. Hence, students who are presented these tasks can access the regulative principles of the esoteric domain. This is analogous that these textbooks as adepts pass on all their esoteric knowledge to these novices, enabling novice to potentially become skilled adepts. Accordingly, these students' position is designated as "apprenticed".

Secondly, some subordinate acquirers are denied access to the regulative principles of the esoteric domain. This is defined by Dowling as a position of "dependent". The possible reason could be pedagogic actions. In pedagogic practices, teachers as agent or interpreter do not transmit the teaching tasks from the esoteric domain in links of metonymy. Alternatively, they recontextualize the expressions or contents of the esoteric domain so that the regulative principles of the esoteric domain become ambiguous. These pedagogic actions result in an interruption of the process to access to the complexity of the overall mathematical system for students. As a result, students can only develop a limited degree of subjectivity. Consequently, students' final positions are interpellated by these pedagogic actions as being "dependent."

Finally, for acquirers in the public domain, they are constructed as participants of activities in the everyday setting rather than as describers. For example, some tasks selected from public domain provide a closer description of daily life rather than emphasising mathematical esoteric principles. Students are presupposed as shoppers in a domestic setting rather than as solvers outside of the task. Within this domain, the subjectivity of students is zero, which has completely not been produced. Accordingly, Dowling (1998, p. 141) claims the subjects in this context as being completely "objectified".

To sum up, at the structural level of SAM, specialized activities regulate their practices and positions. The former is also categorised into four different domains according to the strengths of their classification in terms of content and expression dimensions. Meanwhile, subjects in practice are also assigned into different hierarchical positions according to the extent to which they enter the regulative principles of esoteric domain. All of these are summarised in the Figure 3. 6 below.

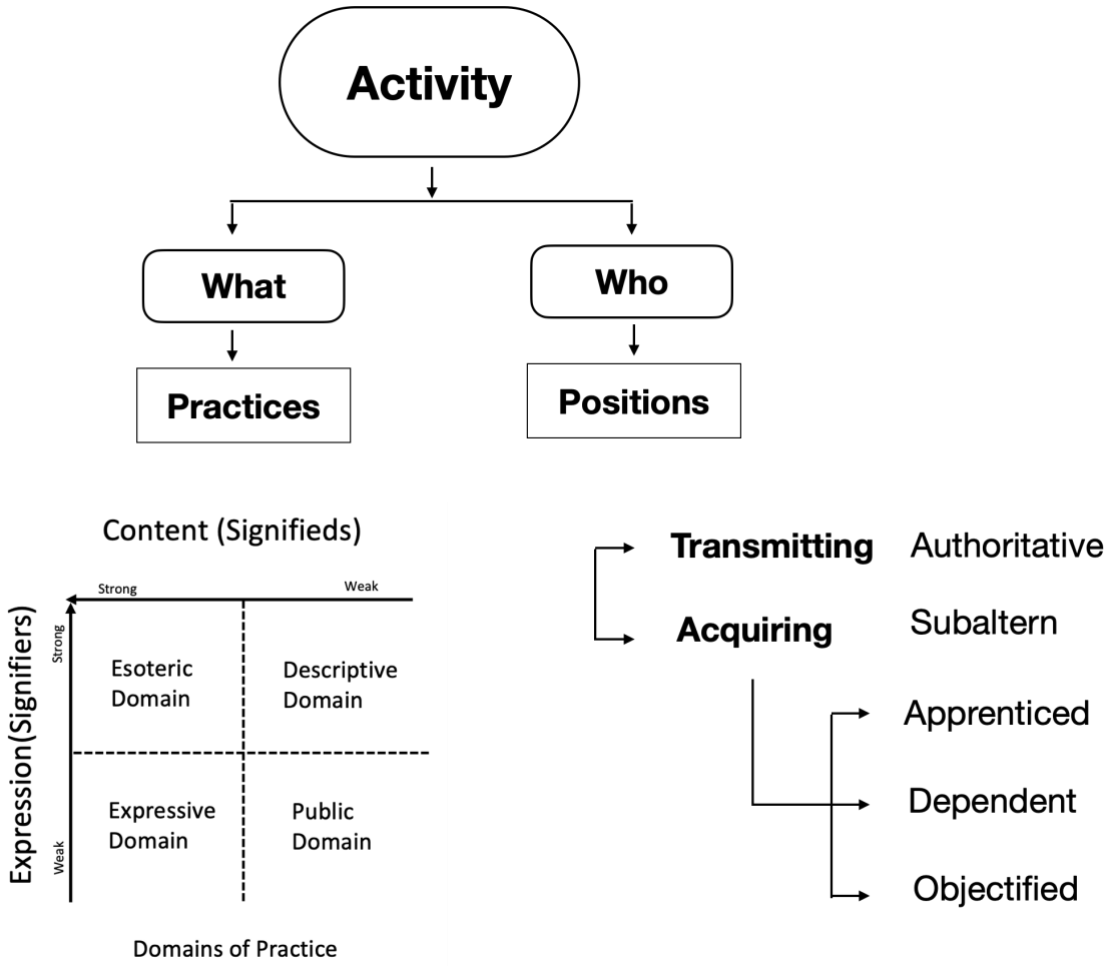


Figure 3. 6 Dowling's structure of activity

3.5.2 The Textual Level of Activity

Dowling's practice and the positions described above are the underlying structure of their specialized activity, which is invisible. As is the case with linguistics, language can only be access through speech. Dowling's structural level of SAM can only be through analysing the manifest event, the text. According to Dowling, "text as a material instance of activity is the empirical object of the study" (Dowling, 1998, p. 132). Practice and positions at the structural level are realized in texts. In addition, Dowling asserts that relationship between textual level and structural level is dialectical: the structure is accessed through the analysis of the texts, and, in turn, the texts are regulated by the structure. This kind of dialectical relationship exists in the work of many other structuralist and post-structuralist scholars, for example: Saussure enters his syntactical rules of a language by analysing the composition of words, "Being unable to seize the concrete entities or units of language directly, we shall work with words" (Saussure,

1959, p. 113) ; Vygotsky (1962) analyses the development of children's conception levels through the study of their speech; Hjelmslev analyses the schema of language through the usage of it (Taverniers, 2008); Freud (2009) accesses a dreamer's latent consciousness through a textual description of dreams, etc.. These are summarised in the following Table 3. 2.

Table 3. 2 An overview of analyse objects and their underlying regulative structure selected from some scholars

Scholars	Analyse Objects	Underlying structure
Saussure	Words	Syntactical language
Hjelmslev	Usage (text)	Scheme of a language
Dowling	Texts	Structure
Freud	Texts of interpretation dreams	Latent consciousness
Vygotsky	Speech	Thought

Dowling makes it clear that his object of analysis is texts. "Texts as a material instance of activity is the empirical object of the study" (Dowling, 1998, p. 132). A text is an utterance (linguistic and/or non-linguistic) or set or sequence of utterances made within the context of one or more activities. According to Bakhtin (1986, p. 103), "the text is the unmediated reality (reality of thought and experience), the only one from which these disciplines and this thought can emerge. Where there is no text, there is no object of study, and no object of thought either". That is, both thought and experience must be grounded in the text. Derrida (1976, p. 158) also writes that "there is nothing outside the text". All things including discourse, ideology, etc. are (re)produced by the text, and all objects are understood only through the meaning of the text. Back to Dowling's SAM, all practices in reality (text-as-work) can be translated into an external language of description (text-as-text) and then potentially access to internal language of description i.e., the esoteric theory, through induction or deduction, i.e., the purely theoretical/esoteric part. In this study, as discussed in the previous chapter, all these texts are signs, signifiers. That is the relative relationship of the different signifiers in signifying chain makes them significant. Meanwhile their position in signifying chain also constructs the symbolic order. All practices are an assembly of signifiers in different positions, which constantly move to construct order. In other words, symbolic order is realized in the structure of signifiers. The transmission of signifiers transmits the hierarchical symbolic order. Consequently, subjects acquiring different signifiers are assigned in hierarchical positions.

At the textual level, messages are the direct product of textual analysis. They are distributed and transmitted across the different subjects of practice. These distribution and

transmission are actually based on specific strategies, which are extracted from Eco's textual strategies and specialized them to specific pedagogic text by Dowling.

3.5.2.1 Textual Strategies

Dowling's textual strategies draw on Eco's definition. According to Eco, all presented texts have an author, model readers and messages. In order to make the texts communicative to the readers, authors usually address texts to be consistent with the code (like ages and educational background) of the model readers (Eco, 1981). For instance, in academic papers, authors presuppose their readers to be reviewers, researchers in the same field, etc. and thus they generally use more specialized vocabulary, structured language as well as often providing no basic concepts or background information. Whereas in generally scientific articles, authors normally assume that their readers are people without any background knowledge, so they tend to avoid using too many technical terms and prefer to use more understandable expressions and more examples from everyday life. The approaches that authors transmit different messages to their model readers are defined by Eco as textual strategies.

Dowling (1998, p. 143) claims that "a pedagogic text is a weaving of textual strategies". He defines "a pedagogic text is an utterance within the context of a pedagogic relationship" (Dowling, 1998, p. 122). By default, teachers are considered as transmitters and students as acquirers during a pedagogic relationship. To make mathematical knowledge more accessible and comprehensible for students, teachers transform the esoteric domain of knowledge according to their preconceptions of students' abilities, ages, family backgrounds, etc. Then they allocate the corresponding pedagogic texts to their model students. This is teachers' textual strategies in pedagogic activity.

Additionally, Dowling identifies two dimensions of teachers' pedagogic textual strategies based on Eco's work. The first dimension is the processing of the range of messages of the esoteric domain. Dowling proposes the concept of discursive saturation as an indicator for measurement the amount. Since any activity is articulated through text, i.e., symbols, then it necessarily consists of different amounts of expression or symbols from the esoteric domain. Thus, high discursive saturation activities (DS+) refer to activities with large scale of esoteric, abstract, generalising, context-independent messages. In contrast, low discursive saturation activities deliver large scale of public, concrete, localising, context-dependent messages. However, only in DS+ activities can the regulative principles of esoteric domain be explicitly expressed. Moreover, these differences in discursive saturation of messages also reflect

positions of these subjects within the social divisions of labour, that is, within the symbolic order. These differences in the discursive saturation of messages also reflect the positions of these subjects within the divisions of labour, that is, within the symbolic order. In pedagogic action, teachers extract various signifiers from the symbolic order to form their utterances, aligning them with students' codes, such as ability and age. Different students acquire differentiated signifiers and are simultaneously quilted into the symbolic order, which, in this study, represents hierarchical power relations.

Dowling then defines his textual strategies in accordance with this. In pedagogic practice, when teachers expand or broaden messages from the esoteric domain to the acquirers, the regulative principles of the esoteric domain can be more explicitly realized. This approach of message distribution is an expanding strategy. Conversely, if transmitters narrow or directly exclude messages from the esoteric domains, making practices with low discursive saturation. This is a limiting strategy. In practices of limiting strategies, the regulative principles of the esoteric domain are very implicit.

As direct products of text analysis, different messages are allocated to differentiated voices. The expanding strategy transmits abstract, decontextualized, generalising messages, corresponding to intellectual division of labour, associating with authoritative or apprenticed voices, indicating an adept to teach a novice to become a potential adept by transmitting these decontextualized messages. However, the limiting strategy constrains the messages to concrete, contextualized, particular range, corresponding to manual division of labour, associating with subordinately dependant voices. Or a complete exclusion of messages from the esoteric domains will produce an alienated voice.

3.5.2.2 Discursive Strategies

The second dimension is termed as discursive strategies by Dowling, referring to the means of connection between different topics or tasks. The discursive strategies include abstracting and particularizing, which indicators are metonymy and metaphor, respectively. Generally, in pedagogic practice, teachers connect different topics or tasks necessarily through metaphoric and metonymic links. This is because the messages transmitted by teachers are given by the symbolic order: teachers select different signifiers from the chain of signifying which are metaphorically or metonymically connected in language structure (Lacan et al., 2001) and then transmit them to their students, thus entering their students into the symbolic order. The

allocation of hierarchical positions in the symbolic order of these students is accomplished by acquiring signifiers of different positions and connected in different ways.

For abstracting discursive strategy, in mathematics pedagogic practices, if teachers connect different topics or tasks in a metonymic way, that is to say, teachers connect topics or tasks based on their contiguity, such as a whole-part relationship or a logical connection between two tasks. Therefore, messages can be transmitted metonymically from one task to a new one. Hence, the metonymical connection between them is abstract, complex, and implicit. In this study, I regard different tasks or concepts as different signifiers. Then, teachers are using metonymic relations between different signifiers in the esoteric domain of mathematics. Such relations between signifiers are complex and abstract. For instance, a teacher introduces the mathematical concept of mean through connecting to the concepts of mode and median in the data of this study. In this example, mean, mode and median are all measures of central tendency of a probability distribution, which implies the connection between them are not explicit. Each of them is a signifier, holding a part-whole relationship with the signifier of central tendency. Thereby, the connection between the properties of them is implicit and complex. However, the teacher's use their metronomic relation to introduce, without a reduction of the complexity. Instead, the teacher keeps messages in the esoteric domain, maintaining a high discursive saturation throughout the instruction. All these esoteric signifiers, including the exemplars or concepts presented by teachers, are context-independent, generalising and metaphorically connected to each other. They constantly refer to each other in the signifying chain but do not enter the real, local signified network. Thus, the teacher's discursive strategies are abstract. Accordingly, when these students access these esoteric signifiers which locate in the vertical chain of signifying, they thereby enter into the corresponding hierarchical power relations.

However, the particularizing strategy means that teachers use a metaphorical approach. Namely, they connect tasks or topics by their similarity, i.e., using acquired knowledge to access another new knowledge, which is relatively concrete, simple, and explicit. For instance, a teacher utilizes a picture of a swing to illustrate the rotation of a figure by extracting the similarity of the rotation points and rotation angles of the two. This teacher intends to use a comparatively simple or context-dependent example to access a relatively abstract mathematical concept. However, the two or multiple tasks already have a constrained meaning in terms of their similarity, alternatively the intrinsic property of a particular signifier. This particular signifier is analogous to the master-signifier, or quilting point proposed by Lacan, "everything radiates out from and is organized around this signifier. It's the point of

convergence that enables everything that happens in this discourse to be situated" (Lacan, 1993, p. 268). To put it simply, the master-signifier regulates different signifiers and in turn is articulated, characterised by them. Additionally, in the metaphorical process, these various signifiers break into the domain of the signified, that is, into the context-dependent reality. The Freudian concept of condensation, which we discussed in the previous section, can also help in understanding this process. In Freud's condensation dream, one condensed image in a dream is the master-signifier to multiple scenes or thoughts with a similarity in reality which are condensed together. When interpreting a dream, a psychoanalyst needs to explore the similarity of these multiple scenes or thoughts in a dreamer's reality to find his or her latent consciousness. Likewise, this property of the master-signifier is identical to a similarity discussed. In pedagogic actions, teachers use several tasks to articulate the similarity, i.e. proceduralising of esoteric mathematics knowledge, thereby making it more comprehensible. This action not only reduces the complexity of esoteric knowledge through the metaphoric connections between tasks. Moreover, the access to the domain of signified implies the use of more context-dependent examples, which also results in low discursive saturation. For instance, teachers illustrate the concept of quadratic equations, a signifier of esoteric domain, by using different settings such as supermarket shopping, buying museum tickets, calculating progress for a project. In this example, this esoteric mathematical concept is deconstructed into multiple tasks and thereby its complexity is reduced procedurally. This signifier from esoteric domain is metaphorically recontextualized into different settings in public domain, including domestic, school and work settings, entering the signified network and having become context-dependent, particular and localised. On the contrary, for students, the process of acquiring these signifiers is based on specific contexts of the signified network. In other words, the knowledge these students acquired is recontextualized, which does not completely realize the regulative principles of the esoteric domain. Consequently, these students do not access the vertical chain of signifying, i.e., the hierarchical power relations.

Dowling combines these two dimensions: the degree of discursive saturation of the messages transmitted (expanding and limiting) and the means of connection (metonymy and metaphor), and then establishes his four instructional strategies, as illustrated in Figure 3. 7 below, to measure the forms of knowledge, i.e., the amount of signifiers of mathematical esoteric domain students acquire. The four instructional strategies are: generalising is a combination of expanding messages strategy and abstract discourse strategy. Two possibilities are entailed in this space: one is that teachers transmit messages of esoteric domains through the whole process and that the relationships between different topics or tasks are metonymic.

This means that the mathematical knowledge moves in a chain of signifying and the relationship between them is metonymic. However, the other one may be that the knowledge transmitted by teachers is entered from the public domain, but this public domain has a specialized signifying function, which is still possible to realize the regulative principle of the esoteric domain. In other words, the signified in the public domain actually signifies signifiers in the esoteric domain, and the positions represented by the signified can be fully realized. Specializing refers to a limited amount of messages being metonymically connected. That is, the public domain contains messages from esoteric domains. In this strategic space the subject might be considered apprenticed. Fragmenting refers that teachers expand messages from esoteric domain, but use particularizing discourse strategy, or metaphorically link different topics. Thus, messages transmitted have entered the signified network. It is a master signifier that is decontextualized into various settings. Hence only part of the esoteric domain messages can be transmitted. In other words, it is the signifiers of the esoteric domain that enter the public domain. Localising is a gradual elaboration of messages from the public domain. Further, the relationship between different topics is metaphorical, i.e., similar and accessible. These messages remain in the network of signified, namely, the reality, without entering the network of signifiers. Therefore, it does not contain any messages from the esoteric domain, i.e., it does not realize its regulative principle.

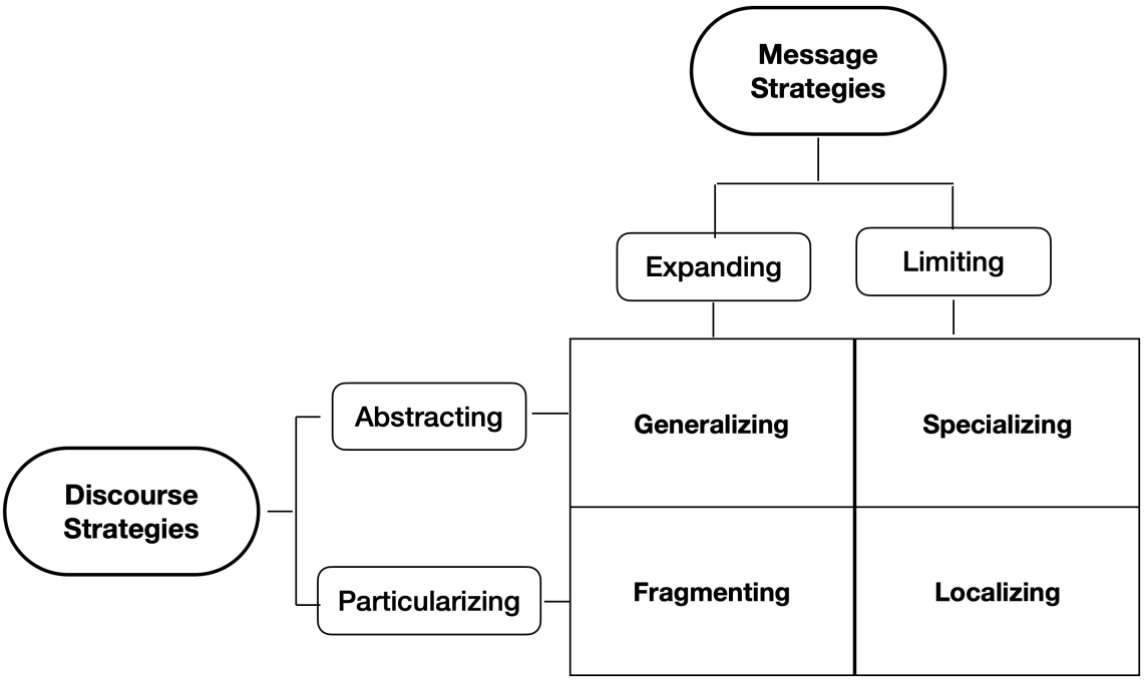


Figure 3. 7 Instructional strategies

3.5.3 The Resources Level

Dowling proposes a new level to analyse text in his SAM, which he terms the resource level. Dowling draws from Peirce's three categories of sign in the practice of signifying: icon, index and symbol, according to their different ways of representation.

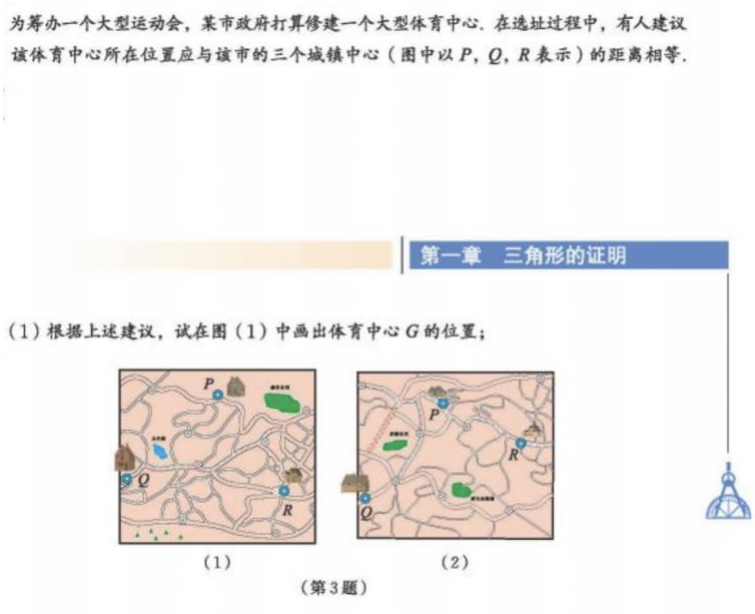
However, Dowling emphasises that his application of these signs is quite different from Peirce's. He stresses that he does not focus on the textual fragments of the signs (icon, index and symbol), but the signifying practice. He proposed signifying modes, which is "a form of the relationship between expression and content that is implicated in sign production." (Dowling, 1998, p. 151). He is concerned with whether the presentation of these three categories of signs in pedagogic texts provides readers with the senses of presence or changes their spatial locations. However, in fact, Dowling's concern is still similar to Peirce's three categories of phenomenon.

Peirce (1960) proposes his most basic philosophical science, phenomenology, discussing not only experience but also all other things that can be experienced or conceivably be experienced (CP.1.37). They have "three modes of being. I hold that we can directly observe them in elements of whatever is at any time before the mid in any way. They are the being of positive qualitative possibility, the being of actual fact, and the being of law that will govern facts in the future" (Peirce, 1960, p. 7) (CP.1.23). Accordingly, Peirce divides any universal element of experience into three categories: "Firstness", "Secondness", and "Thirdness". Firstness, this mode of being physically exists in subjects, "involving no reference to, or comparison with any other phenomena" (Midtgarden, 2020). They do not exist by means of the existence of other things. The property of the Firstness is initial, spontaneous, free, with nothing else behind it to dominate it. The Secondness, which is the Secondness compared to the Firstness, has no relation to anything else. "It is in willing that the Secondness comes out most strongly" (Peirce, 1960, p. 281) (CP.1.532). "It is the kind of phenomenon that forcibly manifests itself by imposing itself on people despite peoples' own willing" (Zhang, 2015). Secondness is constraint, without a mediation, and people can only accept its invasion passively. Thirdness is a relation, a law. It is a mediation that connects Firstness and Secondness. However, Dowling's textual resources realize the process of signification in exactly the similar way as Peirce's three phenomenological categorises. This also reflects the three types of textual resources that fulfil their respective role precisely through the property of these three phenomenological categories.

3.5.3.1 Iconic Modes

Dowling's iconic modes focus not on identifying iconic signs of apparent similarity in pedagogic texts, but on exploring the purposes these texts are intended to achieve through identifying these signs. Textbooks often present tasks in contexts similar to that shown in Figure 3. 8, where students are asked to locate a sports centre (G) on a cartoon map featuring a house, lake, and forest. These visual icons easily enable students to be unconsciously positioned in a virtual world when they engage in this task: it is as if students are in a city, looking for a location to build a gymnasium between the house, the lake, and the forest with the same distance. These kinds of visual images are often utilized as a supplement to some mathematical tasks. Yet, the detailed visual icons force students to be unconsciously located in the scenes. Instead of being readers of the text, they seem to be spectators of the scene at present. These icons change the spatial location of students, making them feel as if they are in a virtual physical scene. Clearly, indeed, unlike Peirce's icons, which suggest similarity to real scenes, Dowling's icons evoke Peirce's concept of Secondness. They impose an immediate and unmediated experience on the observer, effectively compelling their involvement in the constructed scenario.

However, Dowling's iconic code in pedagogic texts must be consistent with the code constructed in the reader's perception. Readers cannot be forced into an unfamiliar iconic code. In this example, the comic map resembling a real city's layout in turn indicates that Dowling's icons are highly context-dependent and strongly related to reality. This strong claim to reality limits the transmission of esoteric domain messages. This occurs often in the public domain, with using localising strategy, where the overuse of non-mathematical signs in pedagogic texts contextualizes the esoteric domain. Consequently, this very specific or limited transmission of messages normally falls into Dowling's public domain.


为筹办一个大型运动会，某市政府打算修建一个大型体育中心．在选址过程中，有人建议该体育中心所在位置应与该市的三个城镇中心（图中以 P，Q，R 表示）的距离相等．

第一章　三角形的证明

（1）根据上述建议，试在图（1）中画出体育中心 G 的位置；

（第3题）

Figure 3. 8 An extract of iconic modes (BNU, 8th, 2, p27)

3.5.3.2 Index Modes

Dowling's index modes refer to signs representing some mathematical objects, like diagrams. Although index modes provide visual coding, they do not create an immersive experience. Instead, they merely serve an explanatory function, facilitating students' engagement with mathematical tasks. This aligns with Peirce's Thirdness, which is a mediation, connecting Firstness and Secondness. For instance, a task involving the calculation of a bottle's volume using a geometric figure (as shown in Figure 3. 9) employs index modes. These mathematical visual symbols do not create a virtual physical space where students might imagine pouring water from the bottle into others. In contrast, iconic modes might depict a child with a large bottle and smaller ones, illustrating the pouring action and placing students in a virtual scene. Index modes, however, only provides students with a means of access to the mathematical domain but without altering the students' spatial perception. Typically, these index modes are found in the expressive and descriptive domains.

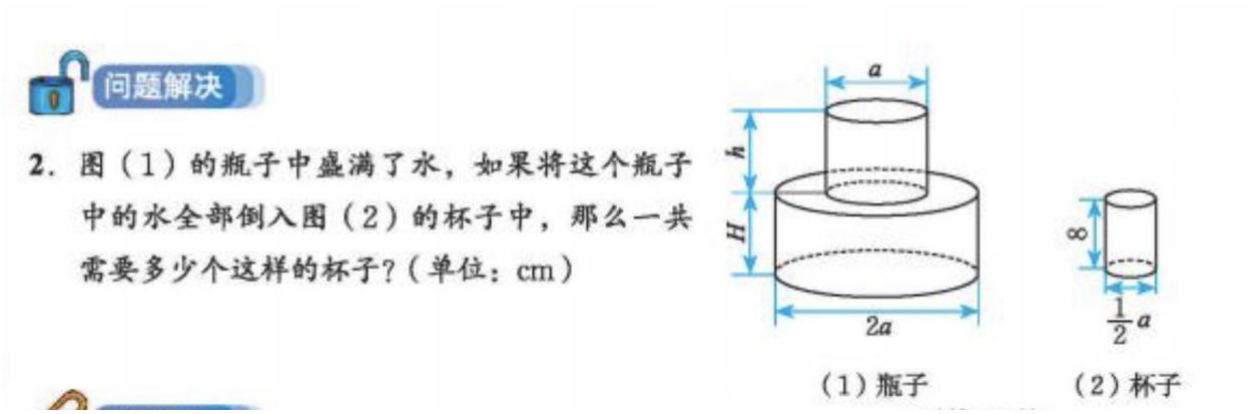


Figure 3. 9 An extract of index modes (BNU, 7th, 2, P32)

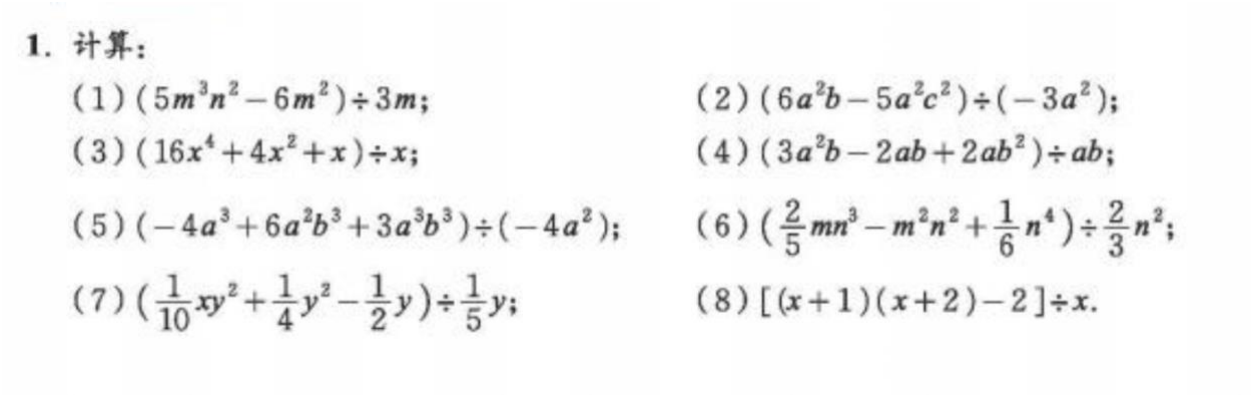


Figure 3. 10 An extract of symbolic modes (BNU, 7th, 2, P31)

3.5.3.2 Symbolic Modes

Dowling's symbolic modes do not provide any means of changing the spatial perception for students. This aligns with Peirce's Firstness, where readers are completely free. These symbols convey mathematical concepts as they are. Dowling's symbols in his pedagogic texts transmit the mathematical symbols of the esoteric domain themselves. They definitely fall into the esoteric domain, as the Figure 3. 10 shown.

Index and symbolic modes do not offer students a sense of participation in the signs to alter their spatial locations. Rather, they extricate students from tasks, making them onlooker to identify the messages contained in pedagogic texts. These modes alienate students from reality by separating the knowledge from reality. They can transmit high discursive saturation knowledge of esoteric domains of mathematics, instead of having to recontextualize mathematical knowledge into non-mathematical settings to enhance students' engagement.

3.6 Conclusion

This chapter examines comprehensively the Bernstein's theories including concepts of classification and framing, theory of pedagogic discourse, and articulates a set of rules in pedagogic discourse, as well as Dowling's SAM. Bernstein's theoretical framework informs the first and third parts of this study, which seek to delve into the class differences in the arrangement of interactional forms, expected rate of knowledge acquisition, and evaluative criteria conveyed in pedagogic communications across schools of different streams. Dowling's SAM underpins the second part of the study, focusing on class distinctions in pedagogic messages and their transmission methods within classrooms of different social streams. These theoretical concepts are intertwined in the process of empirical analysis to fit for the data type and for a better address of the research questions. Additional relevant concepts, like interactional quality employed in answering the first research question, will be simply presented in the Methodology chapter.

Chapter 4 Methodology

Introduction

In the preceding chapters, I elucidated the research aim of this study and deconstructed it into three specific research questions. The theoretical resources needed to address these three questions have also been framed. Therefore, in this chapter, the research methodology is developed and presented to interconnect the extracted theories and integrate them with the data collected in this study.

The chapter comprises the following main sections: sections 1 and 2 describe the context in which this research took place and the sample of three streams of schools that were selected, respectively. The standards and methods for the selection of the sample are also detailed. Next, section 3 elucidates the data sources and collection. Meanwhile, translation issues about data and ethical considerations are discussed in this section. Section 4 thoroughly presents data analysis for each research question, encompassing its own unit of analysis, data measurements, and the procedure of analysis, etc.

Finally, the last two sections describe the validity and summarise the research methodology for each specific question and provide an overview table of analytical approaches for visualising the overall methodological structure, respectively.

4.1 Context

This study is situated within the context of mathematics education in Xi'an city, China, which stands as the most economically developed and populous city in the Northwest region. With a population exceeding 12 million, Xi'an serves as a representative city, showcasing diverse characteristics in schools, migrant populations, and urban-rural disparities.

The focus of this study is on secondary schools, given that China adheres to a nine-year compulsory education system comprising six years of primary school and three years of secondary school. The culmination of this period is marked by a province-wide high school entrance examination at the end of the ninth grade. Successful candidates proceed to high school, where they have the opportunity to take the college entrance examination and pursue university education. Conversely, those who do not pass may opt for vocational schools or, in certain instances, enter the labour market directly. Thus, the secondary school is the first divide in the sequence of China's pedagogic device. Moreover, empirical investigations, such as those

conducted by Gruijters (2022) and Huang (2017), indicate that class segmentation and educational inequality are most pronounced during the transition from secondary school to high school in Chinese educational framework.

All schools across a province (excluding international schools) follow a standardized curriculum and apply uniform assessment criteria to students. Specifically, schools, both private or public in the same region, adopt the same textbooks (as displayed in the chapter of Theoretical Framework), teaching syllabus, and curriculum arrangement. Students undergo standardised tests at the district or municipal level at the middle and end of each semester. Additionally, in contrast to teachers in European countries and the United States who teach more than one subject, teachers in China typically specialize in one specific subject they are certified in. For example, a secondary mathematics teacher is eligible to teach mathematics after achieving a mathematics teacher qualification certificate above the secondary level. However, it is common for them to teach more than one classes.

4.2 Sample

This study selected a total of 59 mathematics classrooms from three distinct school streams in Xi'an. First, school choices generally shaped by students' family background. Therefore, schools from different streams were taken as the pool where the sample located in to show insulations created by social class. The general school streams were categorized based on the Hukou status of the students they admit, a system explained in detail in the introduction chapter. Specific to this study, the streams were stratified as follows:

4.2.1 Upper-stream Schools

The upper-stream schools are top five schools or their branches in the city. Three of them are university-affiliated secondary schools serving the children of permanent university staff, such as professors, administrative staff, etc. For staff on temporary contracts, for example, even doctorate students, their children are not eligible for admission to these affiliated schools. One school serves the children of Railway Bureau employees with "Bianzhi", which refers to the authorized number of personnel in government and public sectors, such as schools and state-owned enterprises (Brodsgaard, 2006). These employees typically hold permanent positions and receive state salaries and benefits. The last is located in the High-Tech Industrial Development Zone (Gaoxin), serving highly educated and high-income families. These schools

have the "Provincial Exemplary School" designation and charge high tuition fees, reflecting their elite status.

These five sample schools, excluding their branches, are centrally located in the city, surrounded by amenities, convenient public transportation, and high housing prices. Additionally, these schools charge higher tuition fees, with the registration fee for each semester (two semesters per year) amounting to around 8,000 Yuan. According to the Xi'an Survey Team of the National Bureau of Statistics, the disposable income per capita in the first half of 2022 is 20,432 Yuan, equating to a monthly disposable income of 3,405 Yuan (Shaanxi Provincial Development and Reform Commission, 2022).

The branches of these top five schools are located in various districts across Xi'an. These branches operate in collaboration with different real estate agents: schools are authorized to establish branches within residential estates, and in return, the agents offer the schools' teachers discounted property prices. Estate agents leverage the qualification for school admission as a selling point for these properties, known as school district housing (Xueweifang). This arrangement implies that purchasing an apartment secures admission to the associated school. Families with more than one child must acquire a corresponding number of houses, register their Hukou at the designated location, and subsequently become eligible for school admission. Typically, the cost of school district housing surpasses that of neighbouring properties, making it predominantly accessible to children from affluent families.

Furthermore, all these schools have their high schools located together, as high school is not compulsory in China due to the nine years of the compulsory education system. These high schools consistently rank at the top across the province in terms of college entrance rates, particularly for admission to the top four universities in China. Moreover, due to their university affiliations, these schools have access to various university resources, such as indoor and outdoor sports courts, libraries, and laboratory facilities, which are not open to the general public.

4.2.2 Middle-stream Schools

This category was selected from public middle schools without honorary titles granted by the Educational Department or other relevant authorities. The majority of the sample falls under the colloquial term "numerical middle schools," denoting schools identified solely by a numerical designation, such as Xi'an 32nd Middle School. This designation is colloquially used by local residents and may carry a discriminatory connotation. The second majority is

factory-affiliated schools. These schools primarily established for the children of their factory workers. However, with the close of factories, they admit more children of rural migrants. The stream of schools is characterized by smaller sizes, outdated facilities, and a lower percentage of highly qualified teachers.

4.2.3 Bottom-stream Schools

Rural secondary schools represent the bottom stream, primarily enrolling students with rural Hukou. These students, often left-behind children, are at the lowest social hierarchy in China. Raised by grandparents while their parents work in cities, these students lack economic, social, and cultural capital, as well as adequate communication with their parents, leading to potential psychological and safety issues.

4.3 Data Collection

4.3.1 Videotapes

The videos of the 59 sampled classrooms were stratifiedly extracted from three distinct school streams. These videos were sourced from the "One Excellent Teacher, One Excellent Class" database, an online platform established by the Ministry of Education. This platform allows teachers to share their teaching videos and materials, providing a medium for nationwide peer feedback, thereby enhancing instructional and classroom management skills. All selected videos were from mathematics classrooms conducted in Mandarin. The rationale for utilizing video data in this study extends beyond accessibility during the pandemic; videos capture observable interactions, dialogues, facial expressions, movements, positions, and behaviours during silent classroom moments (Toerien, 2014).

The extraction of these videos was aligned with the progression of the research, tailored to address specific research questions:

1. **First Research Question**: 34 classroom videos were randomly selected, distributed as follows: upper stream (N=12), middle stream (N=14), and bottom stream (N=8). The selection of 34 videos was based on the following considerations: As an individual statistical study, the sample size was necessarily limited. However, to ensure the validity of the statistical test, an effort was made to maintain a minimum of 10 samples per stream. Data for this part were collected in 2021, over a year earlier than the subsequent two parts.

At that time, only 8 videos meeting the criteria for the bottom stream, with approximately 40 minutes in duration and sufficient video and audio quality for analysis, could be obtained.

2. **Second Research Question**: a total of 33 videos were collected, with 7 of these retained from the first set. These 7 videos were kept because they included the specific study object to be explored in the second research question. The remaining 25 videos were selected based on their alignment with the study's objects and the criteria for analysis. This selection ensured that the 33 videos were evenly distributed across the three school streams, upper stream (N=11), middle stream (N=11), and bottom stream (N=11), providing a balanced representation for analysis.
3. **Third Research Question**: A more focused selection for exploratory analysis involved choosing nine classrooms from the 32 videos used in the second research question. Three classrooms were randomly selected from each school stream to allow for an in-depth investigation into pedagogic texts.

The overall mean class size of the samples was M=42, SD=10.5. Class sizes for each school type were as follows: upper stream (M=44.36, SD=9.5), middle stream (M=41.7, SD=8.8), and bottom stream (M=38.4, SD=14.3). An independent t-test showed no significant difference between school types concerning class size.

4.3.2 Teaching Syllabus

The syllabi uploaded by the teachers were extracted as part of the data source, primarily for the second research question. These syllabi typically included the teaching objectives of lessons, classroom tasks, exercises, and various teaching strategies devised by individual teachers, serving as textual material for analyzing the videos.

4.3.3 Translation Issues

The dialogues between teachers and students in the classroom, as well as the texts of tasks presented on slides or blackboards and those supplemented in the syllabus, are translated from Chinese to English. In this translation process, I have endeavoured to adhere to the literal meaning of the Chinese text, avoiding reinterpretation or adaptation to implied meanings, in order to preserve the original intent of the text. This approach is taken despite the potential for unclearness when translated into English.

In the context of Chinese classrooms, even imprecise language is often understood intuitively by both teachers and students. Additionally, there is significant inconsistency in the translation of many mathematical terms from Chinese. This study aims to present the usage within the Chinese context as accurately as possible to ensure that the original meaning of the text is not altered. This effort is made to faithfully reproduce the real classroom communications and the transmission of messages.

4.3.4 Ethical Considerations

The videos and teaching materials used in this study were sourced from a public platform where all data are openly accessible to the public. The data employed in this study are derived from transcriptions of the videos and the teaching materials uploaded by the teachers. Consequently, this study does not involve any personal information, such as family background or other privacy-related details. This structured and detailed approach ensures that the data collection aligns with the research objectives, providing a robust foundation for subsequent analysis.

4.4 Data Analysis

This study employed both qualitative and quantitative methodologies. For the first research question, a quantitative approach was used. This involved standardized video analysis to statistically examine the correlation between interactional forms and interactional quality, as well as the effects of different school streams on these variables. This statistical analysis facilitated generalizations about class differences within the studied region. However, it is essential to acknowledge that these statistical findings primarily indicate surface-level class differences, rather than delving into the deeper, recontextualized mechanisms underpinning social class distinctions.

Hence, in the subsequent research questions, a qualitative analytical approach was employed, specifically through interpretive video analysis (Knoblauch et al., 2014). This involves textual and dialogue analysis of classroom tasks and transcripts of teacher-student interactions. The qualitative methods aim to explore how class differences recontextualize in mathematics classroom pedagogy. The specific analytical methods and procedures are detailed below.

4.4.1 Forms of Communication in Classroom as A Recontextualized Means

This research question investigates whether class differences exist in pedagogic communication and, if so, how these differences are recontextualized to maintain social reproduction. Bernstein's concept of strengths of framing is used to categorize pedagogic communication into different forms. Meanwhile, interactional quality is taken as a mediator to measure the ways how forms of communication shape stratified school achievements. This stems from crucial role of interactional quality in impacting students' school achievements (Rimm-Kaufman et al., 2015). Additionally, interactional quality is influenced by various communication forms (Guedes et al., 2020). According to these, this research question is proceduralised into the following sub-questions:

1. Do forms of communication correlate interactional quality in classrooms?
2. Are forms of communication and interactional quality in teaching processes regulated by social class principles?
3. If forms of communication and interaction quality are both regulated by social class principles, do variations in duration of forms of communication amplify or mitigate differences in interaction quality between schools of different streams, thereby reproducing educational stratification?

Unit of Analysis

The unit of analysis is an around full 40-minute lesson. Each videotaped class is observed and coded into form of communication with different strengths of framing and rated for interactional quality using appropriate measurement instruments.

Measure

Forms of Communication

To measure communication forms, the four-point scale drawn from Morais and Neves, 2018 is used initially, gauging framing strength from very strong to very weak (C^{++}, C^{+}, C^{-}, C^{--}; F^{++},

F^{+}, F^{-}, F^{--}). The strength of F^{0}, as defined by Hoadley, is also incorporated to align with the data type analyzed in this study (Hoadley, 2003), see below.

The indicator for defining and coding different communication forms is students' speaking time. This choice is motivated by two primary reasons. First, students' speaking time serves as an indicator of their authority in the classroom. The allocation of classroom time to different communication forms structures a lesson and reflects the hierarchical relationship between teachers and students, as different strengths of framing of communication convey different hierarchical rules. Typically, teachers, as authoritative knowledge transmitters, dominate time to accomplish teaching tasks and manage student behaviours. If teachers transfer this dominance over time to students, it indicates a shift of their role to a facilitator, helping students construct knowledge themselves. Students, therefore, need more time for participation, discussion, and interaction. The extent to which students dominate time reflects their autonomy in classroom interaction and their position in the hierarchical power structure.

Second, time itself has inherent social dimensions. Contrary to its apparent objectivity, time functions as an instrument of power and its reproduction (Foucault, 1995). In Chinese secondary school classrooms, where each student is allocated 40 minutes of teaching time, the ostensibly objective nature of time conceals its role as a carrier of power relations. According to Durkheim, social time is constructed through social relations and activities, dominated by social structures. In different social divisions of labour, the density of power within the same timeframe varies. For instance, middle-class parents arrange social activities that carry more power messages than their working-class counterparts. Consequently, social time dynamically shapes social relations and activities. Changes in the allocation or arrangement of social time in practical activities lead to shifts in their significance. In the classroom, the temporal dimension is inherently social. The extent of time dominated by students signifies transformations in their identity and authority in the classroom.

This study initially codes five forms of communication based on different strengths of framing, denoted as $F^{+/-}$. This scale is used for coding the collected videos.

- **F^{++}:** When teachers communicate with the whole class, they prefer "monologue", reflecting strong framing and classification, noted as F^{++} and C^{++}. As authoritative primary knowers, teachers transmit knowledge to students, passive receivers, who listen, without an opportunity to negotiate for interactions (Hoadley, 2005; Nassaji & Wells, 2000; Scott et al., 2006). Teachers also control the content, pace, etc., for the purpose of maintaining their boundary with students and professional identity. On the contrary,

students have no speaking time to voice their own thinking (Hoadley, 2005; Molinari & Mameli, 2013).

- **F^{+}:** The form of communication between a teacher and an individual student (TI), noted as F^{+}. This form is typical in classrooms worldwide, generally in an Initiate-Respond-Feedback/Evaluate (IRF/IRE) format with close-ended questions.

- **F^{-}:** Teacher-small group communication is widely accepted as an effective way to promote students' behaviour engagement through richer vocabulary and open-ended questions (Cabell et al., 2013; Turnbull et al., 2009).

- **F^{--}:** Peer interaction (PI) where students dominate tasks or activities. Students have more opportunity and autonomy to initiate discussion, propose arguments, and cooperate in groups, leading to more active participation and viewpoints exchange (Sedláček & Šeďova, 2020; Slot & Bleses, 2018). The authority of teachers is repressed, power is segmentally transferred from teachers to students, so the hierarchical positions are hidden. This represents a very weak framing, noted as F^{--}.

- **F^{0}:** Moments without observable interaction, such as individual student exercises. Doing exercise by students themselves is common in classrooms, especially in science, technology, engineering, and mathematics (STEM) courses, because students need their alone time to understand, calculate, and solve problems. In this setting, teachers usually prepare for the next task for higher transitional efficiency or walk around classrooms to check students' progress/process/support individual support. Apparent communication is unobservable, noted as F^{0} (Hoadley, 2006).

Subsequently, three pilot videos from each stream of schools were randomly selected for the initial round of coding. The results showed a general alignment between the assumed five forms of communication and the actual forms observed in the classroom. However, a notable finding was the limited occurrence of teacher-small group interaction, replaced by a blend of teacher-multiple individuals communications. This form of communication is a common form observed in the first round of coding, involving teachers asking a student to answer questions. The teacher then invites another student or the entire class to comment on the answers. Alternatively, students may question the feedback given by their teachers to questions asked

by another student. This form, involving more than two agents and extending speaking time for students, is indicative of a relatively weak strength of framing (F^-) compared to teacher-whole class and IRF. Therefore, F^- is used for coding communication between Teacher-Multiple students (TM). Detailed actions taken by teachers are presented in Table 4. 1.

Table 4. 1 An overview of detailed actions in each form of communication

TW (Teacher-Whole class)	TI (Teacher-Individual student)	TM (Teacher- Multiple students)	PI (Peers Interaction)	ST (Students-Tasks)
F^{++}	F^+	F^-	F^{--}	F^0
Frontal Teaching: teachers introduce new concepts, explain tasks, declare rules or steps, etc. Students listen to teachers.	Teachers question a single student (normally are close-end questions), the student answers, then teachers give evaluations. Students have a short time to voice.	Teachers ask a student to answer questions or write answers on the blackboard and then invite another or the whole class to comment on the answers. Alternatively, a student questioned the feedback given by the teacher to questions asked by another student. More than two agents were involved in this pattern, leading to an exchange of different viewpoints.	Students initiate an activity. They communicate, discuss and cooperate with their seatmates or neighbours. Teachers provide scaffolding or remind them of the progress.	Students do exercise individually without talking to teachers or classmates. Like reading questions or definitions on textbooks, solving equations on draft papers. No apparent verbal communication between agents can be observable.

The video recording and analysis software, Vosaic, was utilized to code all the data. Five tags based on these five forms of communication were created to record each form's starting and ending time. Meanwhile, special events, body language, and moments were marked and commented simultaneously. After marking, the coder created and exported an analysis report for each video, including total times of communication, total duration, and breakdown of each code.

Interactional quality

Extensive research on classroom interaction has demonstrated that the quality of interaction significantly predicts students' reading and language skills (Leyva et al., 2015; Virtanen et al., 2018), behavioural engagement (Ponitz et al., 2009; Virtanen et al., 2015), and academic achievement (Cadima et al., 2014; Downer et al., 2010), even after accounting for students' individual characteristics. Students reported higher levels of emotional, behavioural, and cognitive engagement in classrooms characterized by greater cognitive stimulation and emotional support within a well-organized environment (Gamlem, 2019; Leyva et al., 2015; Virtanen et al., 2015; Wang et al., 2020). These three dimensions of engagement align with the three domains used to measure interaction quality: emotional support, classroom organization, and instructional support. These domains are structured and then developed into the Classroom Assessment Scoring System (CLASS), which rates interaction quality at the classroom level.

Grounded in self-determination theory and attachment theory, CLASS is a comprehensive tool for assessing global interaction quality, integrating the psychological and academic needs of students with the classroom environment (Allen et al., 2013; Allen et al., 2011; Hamre et al., 2013). Emotional support involves teachers' sensitivity to individual differences and affective learning needs, fostering a warm and positive learning atmosphere and a close teacher-student relationship to encourage student participation. Classroom organization refers to a well-ordered and organized environment, essential for high interaction quality. This includes teachers' clear communication of classroom rules, high expectations for student behaviour, maximisation of learning time, effective intervention and redirection of off-task behaviours, efficient transitions between teaching activities, and varied and novel instructional formats. Effective instruction involves scaffolding student participation to develop higher-order thinking, using abundant terms for concept development and language learning, reviewing prior knowledge and real-world examples to make content more accessible and constructive, responding immediately and precisely, and providing challenging tasks to enhance cognitive performance and problem-solving skills (Hamre et al., 2013; Rimm-Kaufman et al., 2015; Taut & Rakoczy, 2016). High-quality instruction engages students more actively in teaching activities (Rimm-Kaufman et al., 2015). Accordingly, these three domains are divided into 11 specific dimensions: emotional support (positive climate, negative climate, teacher sensitivity, regard for student perspective), classroom organization (behaviour management, productivity, instructional learning formats), instructional support (concept development, analysis and inquiry, quality of feedback), and student engagement. These dimensions serve as indicators for measuring overall interaction quality. All domains and dimensions are interrelated and reciprocally influenced, collectively shaping overall interaction

quality. Positive emotional support contributes to higher quality in classroom organization and instruction (Curby et al., 2013; Virtanen et al., 2015). Therefore, CLASS provides a comprehensive framework for researchers to examine both global interaction quality and its specific dimensions.

A seven-point Likert scale is used to score each dimension, from low (1, 2) to middle (3, 4, 5) to high (6, 7), following the detailed instructions and examples in the CLASS-S Manual (Allen et al., 2013; Pianta et al., 2012; Westergård et al., 2019). The dimension "Negative Climate" was excluded from this study due to its rare occurrence. Observations began at the start of each class when the teacher began instructing and ended with the teacher's closing remarks, "class is over." All lessons lasted approximately 40 minutes, with each being scored for the 10 dimensions.

Analysis procedure

The analytical process includes descriptive statistics, correlation examination, the establishment of regression models, and the analysis of mediation effect.

First, this study employed SPSS version 26 for descriptive statistics of proportions of time allocated to different interactional forms and interactional quality and Pearson's correlations between them. The mean values of classroom quality and time allocated to each form of interaction across three streams of schools were then examined and ANOVA was used to estimate variances between streams of them in these two variables for answering the first two questions.

Secondly, for answering the third sub-question, a mediation model was hypothesised. Streams of schools were taken as the independent variable, the duration of each interactional form as the mediating variable and the interactional quality as the dependent variable, to explore the relationship between these three. For achieving this mediation model, two regression models were established first to examine the effect of streams of schools on interaction quality and its domains, which has showed a significant variance between streams (path C). As categorical variables, streams of schools were set as dummy variables with upper-stream schools as the reference group. This means that the mean quality of upper-stream schools is the constant while the other two streams of schools entered the models are predictors. The coefficient equates to the total effect size, which would not be analysed for mediating effect further, if it is insignificant (Wen & Ye, 2014; Zhao et al., 2010). Mediating regression analysis was performed by SPSS Process 3.4.1 (Preacher & Hayes, 2020) by examining the

effect of school streams on time spent on interactional forms, the mediator (path a), and the effect of the mediator on interaction quality and domains, outcome variables (path b). Additionally, only duration of interactional form with significant variance across school streams was examined. The indirect effect is a*b or C-C'. Finally, for the test the reliability of the mediating effect, the confidence intervals of the indirect effects and significance were tested through the bootstrap resampling method. The strength of the estimated mediating effect is shown through the ratio of the indirect effect to the total (Shrout & Bolger, 2002), which is more accurate than a presentation of a full or partial mediating effect. This mediating effect mode is shown in Figure 4. 1.

In the interpretation of quantitative analysis, details regarding the strengths of classification on space and other observable elements from the videos were incorporated into the results. This integration serves as a supplement for clarifying the strengths of classification of various elements of communication principles.

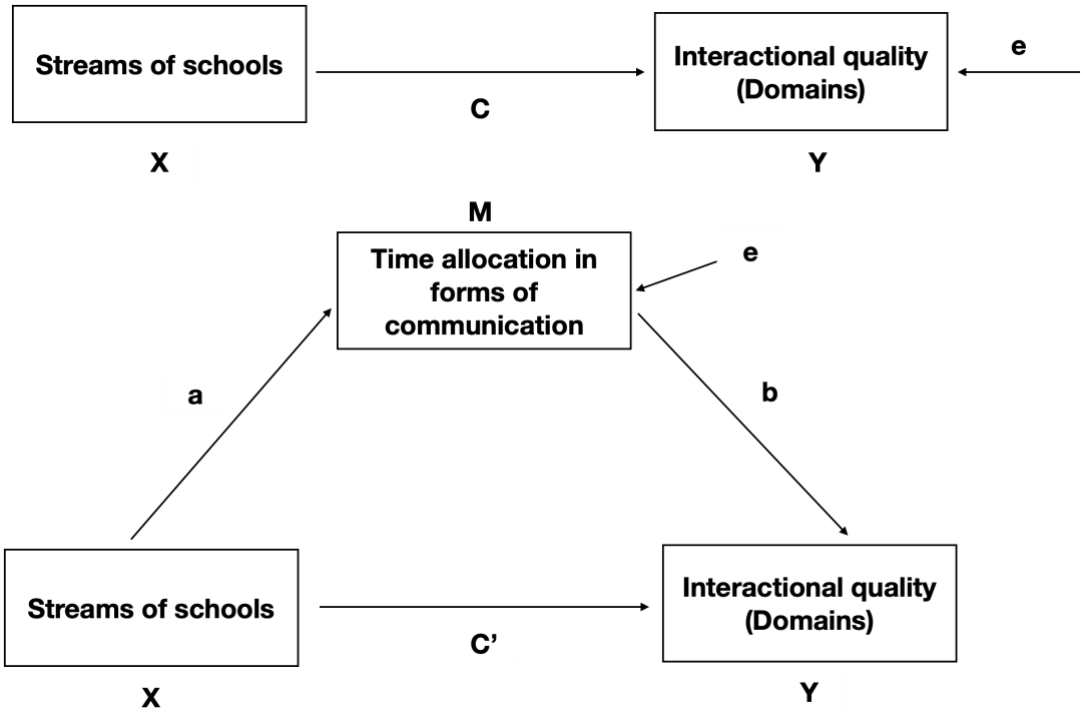


Figure 4. 1 Mediating effect model

Note: X= Predictor, Y= Outcome, M= Mediator, C= Total Effect, C'= Effect Direct, b= Mediating Effect

Validity and Reliability Issues

Following the CLASS protocol, Cronbach's alpha for these three domains and all 10 dimensions were computed to be $\alpha = 0.826$ and $\alpha = 0.913$, respectively, indicating high internal consistency for each of the CLASS domains and indicators.

4.4.2 Pedagogic Texts as A Recontextualized Means

The second research question aims to explore how class differences are recontextualized into pedagogic messages to implicitly convey social relations. This is achieved by addressing three sub-questions:

1. Are there class differences in the pedagogic messages transmitted by teachers from schools of different streams?
2. Are there class differences in the ways pedagogic messages are transmitted by teachers from schools of different streams?
3. Are there class differences in the use of content, specifically the use of pedagogic tasks selected from the public domain in the stage of preparation by teachers from schools of different streams?

To address research questions in this section as well as in the next, qualitative analytical methods were employed to delve into the underlying operational mechanisms of the principle of social classes within mathematics pedagogy. This was achieved by conducting an interpretive video analysis (Knoblauch et al., 2014). Specifically, this section utilizes Dowling's framework for textual analysis for transcripts of teacher-student conversations and classroom tasks.

Unit of Analysis

The unit of analysis of this part encompasses the entire process of teachers' preparation to presentation of a new mathematics content. The preparation and presentation are stages drawn from Herbartian five formal steps of a lesson (Vadohej et al., 2015). This teaching approach structures a lesson into five stages, consisting of preparation, presentation, association, generalization, and application. Preparation refers a preparatory stage provided by teachers to

increase students' interest and engagement in a new content. Teachers can make use of relating material, even telling a story, playing a game, showing examples from daily life, or questions associated with content learned to spark interest among students, making students ready for the new topic. Accordingly, the step of preparation acts as a portal for students to access abstract mathematical knowledge. In the stage of presentation, new mathematics topics are presented to students. In Chinese classrooms, Herbartian subsequent three steps are typically replaced by two steps: exercise and summary, where the main task of teachers is conducting many exercises for getting familiar with the new content and making a summary for generalization (Xu, 2010).

In this study, "new" topic is defined as mathematical content that a teacher officially introduces to the entire class for the first time, providing detailed information that has not been previously covered. Due to the increasing prevalence of the internet, the popularity of extracurricular tutoring classes and private tutors, and common practices of pre-class preparation, many students may have already encountered the mathematical content in their textbooks beforehand. Therefore, in this context, "new" content refers specifically to the material that the teacher formally presents to the entire class during the lesson. The introduction of new mathematical content involves more than simply stating the name of a topic, such as writing the name of a mathematical concept on a blackboard or a slide. It necessarily includes a comprehensive explanation, including definitions and properties of the topic.

Entering the exercise and summary phases indicates that no new mathematical concepts will be introduced. Instead, these steps focus on reinforcing and familiarizing students with the knowledge covered in the previous steps. Consequently, if students have not received new mathematical knowledge from preparation to presentation, they will not encounter it in subsequent steps. Accordingly, this study extracts this process from preparation to presentation as the unit of analysis to investigate how pedagogic texts are transmitted to perpetuate social stratification.

In line with this approach, the samples extracted for analysis consist of lessons introducing new mathematics concepts. Consequently, the samples largely resemble those of the first research question, but the lessons specialized for review were removed. The new samples for this research question were selected to complement those removed, maintaining consistency in their type.

Data Sources

For the classroom tasks in preparation, a text analysis method was used. These texts of classroom tasks were mainly extracted from videos. The texts presented in the teacher-written syllabus were used as an auxiliary to ensure that the transcription of the texts from videos was correct. The reasons why the teacher-written textual syllabus was not used as the primary data source are, firstly, because some teachers do not provide details of the exercises in their syllabuses, or they modify the classroom tasks during their teaching. Analysis of teacher-student conversations: the texts of teacher-student dialogues were transcribed sentence by sentence.

Analysis Procedure

First, the respective scope of preparation and presentation should be delineated. Typically, this involves identifying a clear transitional sentence spoken by the teacher to shift from the preparation stage to the presentation stage. The specifics of this transition depend on the particular task in each classroom. Then the transcripts would be analysed at the three levels framed in SAM, detailed as following.

The Structural Level

The first classroom task is extracted from the preparation stage identified, relying on texts transcribed from the videos. Teachers' lesson plans are taken as a supplementary verification due to a relatively poor quality of audios, pictures, etc. Dowling's concept of domains of practice was adopted as an analytical framework to examine the strengths of the classification in terms of the content and expression dimensions of the pedagogic messages in the first task. According to the results, a domain that a teacher initiates a class can be identified. In practice, certainly, some teachers may use multiple tasks for preparation to present a new mathematics topic, this study only focuses on the first task which marks the domain of practices where a teacher initiates a lesson. Afterwards, according to the domains teachers select for preparation can determine the positions that they prepared for their students to reach in power relations.

The Textual Level

Message strategies: examining that messages from the esoteric domain introduced by teachers in the process of moving from preparation to presentation which are expanded or limited. In

addition, whether the pedagogic messages have been restricted to the public domain, or the high degree of context-dependency of the classroom tasks, are also criteria for determining whether the message strategy is expanding or limiting.

Discourse strategies: the relationships between each classroom task are analysed to access the discourse strategy, especially the relationship between the tasks bridging preparation and presentation. Whether the tasks are metaphoric and metonymic assembled are the indicator for assessing whether the discourse strategy is particularizing or abstracting. Furthermore, whether teachers use multiple tasks for deconstructing the complexity of the mathematical system, or the teachers organise tasks in a stepwise manner, from easy to complex, remaining the whole process in esoteric mathematical domain. These also serve as a criterion for helping to identify the discourse level. Throughout the analysis, Lacan's notions of symbolic order, the master signifier, and Freud's notions of compression and displacement are used as a subsidiary explanation to facilitate understanding, which is also intended to align with the theoretical resources on the notions of signifier and signified.

Instructional strategies: Based on the combination of identified message and discourse strategies to determine the instructional strategy teachers employ in their classes. The instructional strategy then is used to assess the positions of power relations that students can ultimately enter into. The whole analysis is based on Dowling's SAM, specific paths are shown in Figure 4. 2.

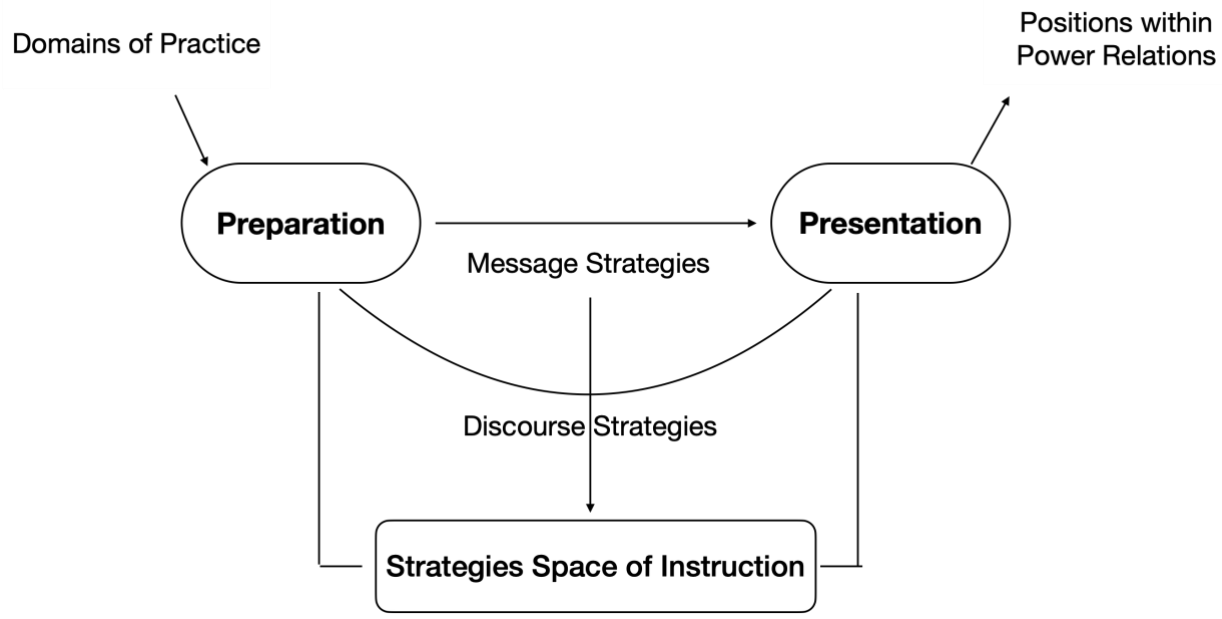


Figure 4. 2 The process of preparation to presentation

The Resource Level

This level aims to analyze the textual resources of the tasks provided in each unit of analysis. Building on the theoretical framework, this analysis examines whether these textual resources can change students' the senses of spatial location of the students, specifically whether they position students as readers or active participants in the tasks. Analysis at this level is used as an auxiliary measure to understand whether the students are able to access esoteric mathematical knowledge and hierarchical power relations through these tasks.

Analysis on Using of Tasks Selected from the Public Domain

Teachers across streams of schools who initiate their classes from the public domain were selected to examine whether there were class differences in teachers' selection on tasks and their ways of using them. Two situations were chosen and compared, one when all teachers used non-everyday content as the context of a task, and the other when teachers all used tasks from everyday settings. These two situations will be compared to explore whether the two exhibit class differences, and if so, what the differences are.

4.4.3 Feedback as A Recontextualized Means

This part of the study aims to investigate whether classroom feedback provided by teachers in pedagogic practices functions as a recontextualized pathway of social class. Specifically, it examines what is transmitted through feedback and how it is transmitted, potentially legitimizing social stratification. Grounded in Bernstein's theory of pedagogic discourse, the objective of this section is to address the following questions:

1. Are there any class differences in the content conveyed through feedback provided by teachers across schools of different streams?
2. Are there any class differences in the ways feedback is transmitted?

In this part, Bernstein's instrumental concepts of classification and framing are used again to analyze these questions. Text analysis is employed to examine whether these three discursive rules exhibit class differences, thereby revealing the underlying regulative principle of social class.

Unit of Analysis

This analysis focuses on the stages from the preparation to the end of the exercises, excluding the review and summary phases of a lesson. As according to Hattie, Gan, & Brooks (2017), feedback should occur before the summary of the learning process to provide students with opportunities for improvement. Feedback given after the conclusion of the learning cycle is often too late and rarely transferred to new learning contexts. Therefore, this study concentrates on the process from the preparatory stage to the completion of exercises.

The specific unit of analysis is every teaching task within this stage. A teaching task begins with the teacher initiating a question or asking students to complete an exercise and ends with the beginning of the next teaching task. The feedback provided by teachers within each teaching task is analyzed, including simple confirmations or evaluations of students' responses (e.g., "correct" or "well done"). Extended sequence of feedback, which involve two or more three-part instructional sequence are also analysed since teachers often respond to students' answers with new questions, leading to further dialogue. In extended sequence, the teacher might question other individual students, small groups (this is rare in Chinese classrooms), or the entire class. Thus, each teaching task is taken as a unit of analysis, and all feedback utterances provided by the teacher within the task are analyzed.

Additionally, similar exercises completed simultaneously are considered as a single task, as students complete them within a fixed time and receive unified feedback from the teacher. For example, the task, "complete the following three factorization exercises" is treated as one.

Data Source

This part is exploratory and employs textual analysis, making a small sample size more suitable. Therefore, three classrooms from each stream are randomly selected from the participants in the second part of study. All teaching tasks from the preparation to the end of exercises in these nine teachers' classes are transcribed.

Analysis Procedure

Based on the research questions and theoretical framework, the analysis is divided into three sections:

Evaluation Criteria

This section focuses on whether evaluation criteria conveyed by teachers in each teaching task exhibit class distinctions. The analysis encompasses two aspects: instructional discourse and regulative discourse. For instructional discourse, this study examines whether feedback emphasizes the content present in students' answers (F-) or on the missing and incorrect parts of students' product (F+). It also identifies teachers' favoured communication modes—individualised and free or whole class and imperative—which reflect the strength of framing of the hierarchical rules. For regulative discourse, teaching tasks with clear evaluative criteria are marked as strong framing (F+), while those without such criteria are marked as weak framing (F-). Indicators for identifying the strength of framing in evaluation criteria according to teachers' emphasis on instructional discourse and regulative discourse are summarized in Table 4. 2. Since a weak framing of evaluative criteria for regulative discourse lacks clear indicators in teachers' words, these will not be included in the Table.

Table 4. 2 Overview of indicators of identifying strengths of framing both of instructional and regulative discourse

	Instructional Discourse （ID）		Regulative Discourse （RD）
	F^-	F^+	F^+
Indicators	1. Mastery of abstract mathematical symbols 2. Development of problem-solving skills 3. Constructive connections with previously learned knowledge	1. Write solution steps more completely 2. Write solution steps concisely 3. Follow traditional conventions in writing solutions, such as placing positive signs before and negative signs after 4. Writing multiple conditions together for better clarity and structure	1. Listen attentively/focus during lectures 2. Raise hand before answering questions 3. Stand up when answering questions 4. Actively participate in classroom activities 5. Study hard

The Course of Feedback Level

The indicators sequence rules and pacing are taken as dimension for investigating the ways of transmitting feedback. The progression of feedback levels within a task corresponds sequence rules, as feedback provided by teachers for students' responses within a task theoretically

follows a sequence that conveys increasingly abstract levels of knowledge. Structurally similar to Bernstein's sequencing, this progression within feedback can be categorized into three hierarchical levels based on its focus: task level, process level, and abstract level. Together, these three levels form a feedback course within a task, serving as a framework for analyzing sequence rules within a specific task.

- **Task Level:** Feedback at the task level focuses on confirming or disconfirming student responses to specific tasks, serving as an evaluative criterion for task completion. This type of feedback typically involves brief statements, such as "correct/incorrect" or "right/wrong," without elaborating on the student's response in detail. Task-level feedback confirms the student's performance on specific tasks and their current knowledge state but does not provide further information or strategies to guide additional learning (Butler & Winne, 1995). Furthermore, task-level feedback helps students establish a superficial understanding of messages and knowledge. If feedback remains solely at this level, it indicates that teachers do not intend for students to progress toward more complex and challenging goals or provide the support needed for students' engagement with more abstract mathematical knowledge, which corresponds to higher criteria of school success and cognitive levels.

- **Process Level:** When feedback focuses on the skills and strategies used in completing a task, it is categorised as process-level feedback. The evaluative criteria are set as students' mathematical problem-solving strategies and sense-making (Wright, 2020). Through process-level feedback, teachers identify the gap between students' current knowledge status and the clarified teaching goals (Sadler, 1989). They then could provide additional clues and methods to guide students toward learning goals and criteria of school success. Process level often takes the form of questions such as, "Can you describe the method you used?" or "Can you explain your strategy for solving this problem?". It prompts students to reflect on their current understanding, thereby reshaping and developing their responses (Straub, 1996). Process-level feedback acts as a bridge, providing constructive pathways to link the knowledge already acquired with the learning objectives, thus helping students move toward their goals. It also helps reduce students' cognitive load, making it easier for them to focus on understanding the concepts (Stovner & Klette, 2022) and preparing them for a deeper understanding and higher-order, abstract level, within the course of feedback.

- **Abstract Level:** The abstract level of feedback involves conveying context-independent mathematical concepts to enhance students' understanding of abstract mathematical knowledge. At this level, teachers act as facilitators, helping students establish connections between different mathematical concepts or generalize specific tasks to broader contexts. The goal is to cultivate students as self-constructive learners. For instance, teachers might ask questions like, "What can you infer from this by yourself?", "How would you solve this for a general polygon?", or "Can someone provide a general formula that applies to all situations?". Feedback at the abstract level serves the mastery of vertical knowledge and the development of self-constructed skills. According to Bernstein's work, this type of feedback is familiar to students with an elaborated code orientation and acts as a criterion for selection and exclusion in entering the division of intellectual labour.

Indicators for identifying these levels has been summarised in the Table 4. 3 below. This table delineates the progression from task-level feedback, through process-level feedback, to abstract-level feedback, highlighting the increasing complexity and abstraction involved at each stage.

Table 4. 3 The overview of indicators of different levels of feedback in sequencing

Feedback Level	Focus	Indicators
Task level	Confirmatory/Correction	1. Correct/Wrong. 2. Your answer is wrong, the correct answer should be… 3. Your answer is not complete, you need to add brackets. 4. Your calculation is wrong; you forgot the negative sign.
Process level	Focuses on strategies, skills, and crucial concepts, ideas employed by students in completing a task	1. What is the key concept for solving this task? 2. What strategy did you use to solve this exercise? 3. In completing this task, Student A has used… (specific skills)
Abstract level	Emphasises a mastery of abstract mathematics concepts, constructive connection with esoteric knowledge learned previously, and self-reflection of students	1. How would you apply the concept we learned today to another right triangle? 2. Why did you use … (a concept) here?

Pace

In general, due to limited instructional time, teachers often dominate the use of time to achieve teaching goals, thus constraining students' control over pacing. Consequently, most classrooms exhibit strong framing of pacing. Accordingly, if these samples exhibit a strong framing of pacing, this study will investigate variations in the pace at which feedback is provided, dominated by teachers. The variations reflect teachers' perceptions of their students' cognitive abilities, which are often shaped by the students' respective family backgrounds.

- **Fast Pace:** A fast pace implies that teachers expect rapid knowledge acquisition. This can be reflected in the feedback provided during a specific task, progressing efficiently from lower to higher levels—task, process, to abstract levels. Initially, teachers confirm or deny students' responses, then quickly move to the process level, assessing strategies or skills used in task completion, often prompting student self-evaluation. Subsequently, teachers advance to the abstract level, using direct instruction or facilitative questioning to guide students in solving general problems or connecting previously learned abstract concepts. In some tasks, teachers might end at a level and then introduce a new task, depending on the task's content. As long as there is upward movement from lower to higher levels, with students consistently gaining more mathematical content and symbols or increasing in abstraction without excessive repetition of the same content, the pace is identified as fast. Teachers' high expectations for knowledge acquisition often reflect their confidence in students' cognitive abilities and learning capabilities.

- **Slow Pace:** A slow pace is evident when teachers linger excessively at a particular feedback level, especially at the lower levels. For example, teachers might spend much time repeatedly confirming students' answers or asking for confirmation from other students with questions like, "Do you have the same answer as him?" or "Is her answer correct?". These repetitive questions slow down the acquisition process. Another form of slow pace occurs when teachers oscillate between different levels across the course of feedback, frequently moving from higher to lower levels. For instance, when a student provides a complete, abstract-level response, this indicates the student has understood the requirement of the task and produced the expected text legitimized by schools. However, a teacher might deconstruct this abstract response into simpler and more concrete steps, moving from the abstract level back to the process and task levels. This approach ensures students thoroughly understand the concepts but reflects the

teacher's low perceptions of the students' abilities. These practices might aim to emphasize crucial concepts but are often based on teachers' low expectations of students' capabilities. Lengthy, repetitive feedback at a particular level or deconstructing abstract responses into simpler levels indicates teachers' low expected rate of knowledge acquisition.

These three levels of feedback and the varying paces within a strong framing of pacing constitute the analytical framework for examining how feedback is conveyed within each pedagogic task. This study investigates whether class-based differences exist in these two dimensions across different school streams.

4.5 Summary

This study identifies three possible recontextualized means to explore whether they help class differences transform and legitimize into mathematics pedagogy. Both quantitative and qualitative methods were employed to examine the existence of class differences in the pedagogic communications and messages and explore their specific recontextualized processes in pedagogic practices. These three recontextualized dimensions were analysed to elucidate how class differences are implicitly legitimized in micro mathematics pedagogy and thus achieve social reproduction.

Finally, an overview of each of the specific research questions, methods, data sources, and units of analysis for this study is presented in the Table 4.4. A summary of scopes of analysis for each research question is illustrated in Figure 4. 3.

Table 4. 4 Overview of research questions, dimensions measured, analytical framework, unit of analysis for each part.

Research Questions	Dimensions measured	Theoretical framework	Unit of analysis	Data source
1. How class differences are recontextualized into pedagogic communication?	Forms of communication	Bernstein: Classification and framing	Time allocated to different forms of communication	Videotaped data
	Interactional quality	Pianta, et: CLASS-S	A whole lesson	

2. How class differences are recontextualized into pedagogic messages and their transmission?	Pedagogic messages and their transmission strategies	Dowling: SAM	Teachers' Preparation	Classroom tasks
			Preparation to Presentation of New Mathematics Content	Monologic and dialogic texts transcribed from videos. Texts from teaching syllabus written by teachers
3. How class differences are recontextualized into teachers' feedback?	1. Course of feedback levels 2. Pacing and pace 3. Evaluative criteria	Bernstein: 1.Classification and framing 2. rules of pedagogic discourse	Individual teaching task	Texts transcribed from teachers' feedback

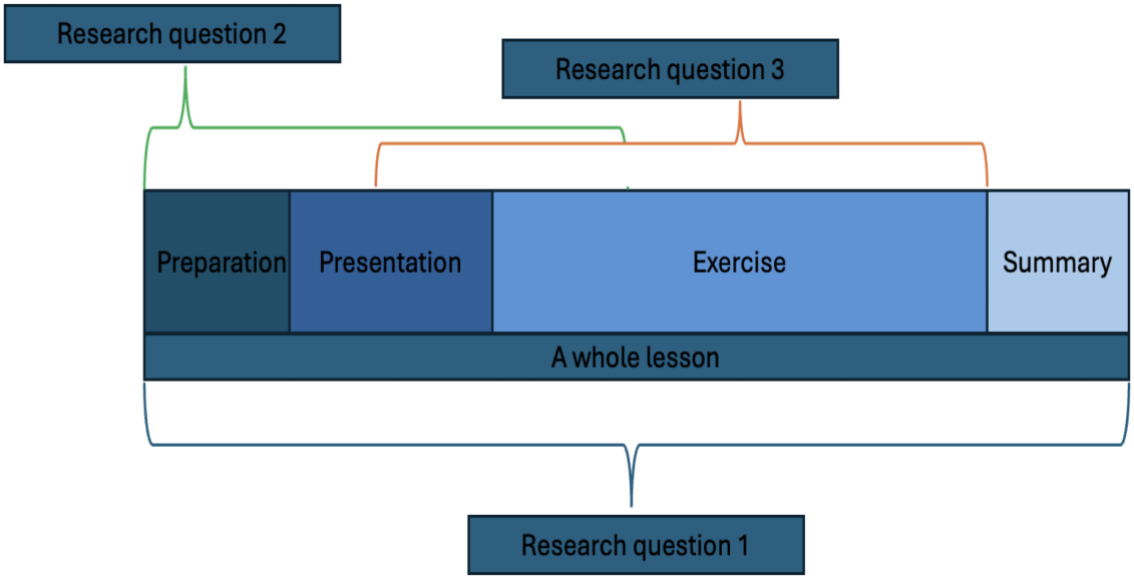


Figure 4. 3 A summary of analysis scopes for each research question

Chapter 5 Data Analysis on Class Differences in Forms of Communication

Introduction

In the previous two chapters, the theoretical framework and methodology for exploring three potential pathways of recontextualization have been separately constructed. In this and the following two chapters, each pathway will be examined to determine whether there are class-based differences. This chapter investigates whether the arrangement of communication forms functions as a recontextualization pathway for transmission of class differences.

This chapter presents observational data from 34 classrooms across different school streams to statistically compare various arrangements of forms of communication. Bernstein's concept of framing is utilized to identify five distinct forms of communication in Chinese secondary school classrooms. Interactional quality is used as a bridging variable linking communication forms to student school achievement, exploring whether differences in communication forms indirectly lead to disparities in academic outcomes. The analysis of whether communication forms serve as a recontextualization pathway for class-based differences will be presented through an examination of the correlation between communication forms and interaction quality, the presence of class-based differences in both variables, and the role communication forms play within different school streams and their associated interaction quality.

Before presenting the results of the correlation analysis between communication forms and interaction quality, this study first provides descriptive statistics of all variables to offer a general profile of the arrangement of communication forms and interactional quality in context where the research is situated.

5.1 Descriptive statistics

Table 5. 1 presents descriptive statistics, including the means (M), standard deviations (SD), minimum (Min) and maximum (Max) scores for each variable. The overall interaction quality in these mathematics classrooms fell within the middle level (M=4.32, SD=0.61) of the 7 points scale, with instructional support emerging as the strongest (M=4.62, SD=0.71) and emotional support as the weakest (M=3.61, SD=0.85). These results suggest that teachers provide moderately positive support for the academic needs but a comparatively weaker support for emotional needs for students. In terms of durations of various forms of communication, as

expected, a significant portion of classroom time is spent on communication with the whole class (F^{++}), characterised by a very strong framing (M=46.32, SD= 18.3). This indicates that teachers dominate the classroom activities in this context. Peer interactions, which are marked by the weakest framing (F^{--}), occupied the second-largest portion of classroom time, slightly higher than proportions devoted to teachers' interaction with individual students (F^{+}) and student doing exercises (F^{0}).

Table 5. 1 Description of durations of each form of communication and interactional quality and its domains

Variables	M	SD	Min	Max
Quality	4.32	0.61	3	5.55
Emotion	3.61	0.85	2	5.33
Organization	4.3	0.51	3	5.33
Instruction	4.62	0.71	3.2	6
TW (F^{++})	46.32	18.3	11.86	77.73
TI (F^{+})	14.92	9.93	0.32	35.98
TM (F^{-})	7.16	5.97	0.37	22.21
PI (F^{--})	17.33	14.39	0	55.94
ST (F^{0})	14.21	9.56	1.55	36.27

Note: M= Mean, Min = minimum scores, Max = maximum scores, SD = standard deviation. TW= Teacher- Whole class, TI= Teacher- Individual student, TM= Teacher- Multiple students, PI= Peer Interaction, ST= Students-Tasks. The mean value (M) of each form of communication is the proportion of its duration during the classroom time.

5.2 Correlations Between Time Spent on Each Form of Communication and Quality of Interaction and Its Domains

In this section, the relationship between durations of various forms of communication and interactional quality, along with its three domains is presented. The results of Pearson product-moment correlations (N= 34) presented in Table 5. 2 reveal significant relationships between communication forms and interactional quality, as well as some of its specific domains. First, the data show that all domains of classroom quality are highly positively intercorrelated, indicating that in a highly structured classroom, elevated emotional support aligns with high teacher instructional quality. Conversely, the durations of each communication form are negatively correlated with one another, given their mutually exclusive as they collectively constitute an entire lesson.

Table 5. 2 Correlations between domains of interactional quality and durations of forms of communication

	Emotion	Organization	Instruction	TW	TI	TM	PI	ST
Emotion	—							
Organization	.59**	—						
Instruction	.80**	.74**	—					
TW	-.41*	-0.28	-.42*	—				
TI	-0.06	-0.14	0.002	-.39*	—			
TM	0.13	0.07	0.05	-.45**	-0.03	—		
PI	.54**	.40*	.54**	-.56**	-0.12	-0.06	—	
ST	-0.05	0.05	-0.06	-.38*	-0.11	.36*	-0.26	—

*Note: * $p < .05$ (two-tailed); ** $p < .01$ (two-tailed).*

Additionally, the analysis reveals that the allocation of time to distinct communication forms indeed correlates to interactional quality and its instructional dimension. Specifically, time assigned to whole-class interaction, primarily teachers' monologue, presents significantly negative relations with emotional and instructional support. This indicates that an extended period of strong framing brings in a lower psychological and academic quality in classroom. Teachers' monologue implies a strong framing of pacing, which represents teachers' control over the rate of acquisition of knowledge for students. Therefore, in this communication form, teachers dominate classroom time, conveying pedagogic messages according to the requirement of syllabus and their perceptions of students' abilities, rather than based on students' individual comprehension. This dominance restricts opportunities for students' inquiry and discussion, thereby reducing the frequency and quality of teacher feedback, which is a crucial component of effective instruction. Furthermore, during teachers' monologue, teachers hold a high level of authority, acting as the primary knower to unidirectionally transmit knowledge to the whole class, leaving no dialogic space for students, and paying less attention to students' emotional needs. This communication form is marked by a strong framing of hierarchical rules. Additionally, the strong framing aligns with a strong classification embodied in space, which indicates an invisible but clear boundary of the physical positions between teachers and students in classroom. Taken together, either the insulations on relationship or physical locations between classroom subjects can create a less positive and warm climate, as well as restricted movement. As a result, a higher percentage of classroom time use for whole-class communication correlates with a lower emotional quality.

In contrast, the duration of peer interaction, the form characterized by the weakest framing, shows noteworthy correlations with all domains of interactional quality. This indicates that weaker teacher control over communication is associated with higher interactional quality in the learning process. The possible reasons might be, during peer interaction, students predominate the classroom communication, controlling the proceeding of activities at their own pace. This potentially leads to a higher emotional and instructional quality. Specifically, these correlations indicate that when students' control pacing, they create a more open and participative environment, facilitating engagement in classroom discussion and cooperative learning. In this form, teachers' identity shifts to that of a facilitator, providing scaffolding, selecting tasks, offering suggestions and delivering individualized support or feedback to stimulate students' self-reflection. Teachers show less authority during classroom communication, representing a weak framing of hierarchical rules, foster a more relaxed classroom atmosphere and closer pedagogic relationships.

Additionally, during peer interactions, teachers typically walk around the classrooms, observing students' status and ready to be providing emotional and academic support as needed. Students, in turn, experience greater freedom of movement within the classroom, allowing them to interact and discuss with peers, as well as in exchanging material. This breaks down spatial insulation—the physical boundaries between teachers and students—signifying a weak classification of space.

The weakened hierarchical relationships and spatial boundaries create an emotionally supportive environment, which, in turn, reduces off-task behaviour and encourages student inquiry. Consequently, the qualities both of classroom organisation and teacher instruction are identified as high.

The results in this table shed light on the interplay between communication forms and various domains of interactional quality, suggesting that interactional quality may serve as a bridge between varying communication forms and the stratified school achievements. This paves the way for the further exploration in subsequent investigation.

5.3 Class Differences in Forms of Communication and Quality of Interaction

This section analyzes whether class differences manifest in the durations of various forms of communication and the quality of classroom interactions. The results presented in Table 5. 3 reveal significant class-based disparities in both the time allocated to different communication forms and the quality of interactions across schools from different streams.

Table 5. 3 Differences presented in durations of communication forms and qualities of overall interaction its three domains across three streams of schools

	Upper-stream		Middle-stream		Bottom-stream			
	Mean	SD	Mean	SD	Mean	SD	F	p
Communication Forms								
TW	45.09	12.08	41.52	20.86	54.9	20.13	1.51	0.24
TI	15.06	9.01	15.71	10.94	13.6	10.61	0.12	0.89
TM	4.61	3.54	9.68	6.2	6.94	7.21	2.46	0.1
PI	26.35	9.99	15.99	16.89	7.25	7.05	6.03	0.01
ST	8.89	7.09	17.11	9.61	17.1	10.22	3.25	0.052
Quality								
Overall	4.62	0.39	4.3	0.76	3.96	0.38	3.54	0.04
Emotional	3.81	0.59	3.79	1.08	3.11	0.58	2.35	0.11
Organizational	4.53	0.36	4.23	0.63	4.11	0.41	2.06	0.15
Instructional	5.07	0.43	4.54	0.82	4.15	0.53	5.55	0.01

Table 5. 3 first displays the mean values and standard deviations for the durations of five communication forms across three school streams. Notably, a significant difference emerges in the time allocated to peer interaction ($F = 6.03$, $p = 0.01$), with teachers in upper-stream schools dedicating a substantially larger portion of classroom time to peer communication ($M = 26.35$, $SD = 9.99$). This accounts for more than a quarter of the total classroom time and is significantly higher than the durations observed in middle-stream schools ($M = 15.99$, $SD = 16.89$), and nearly three times longer than in bottom-stream schools ($M = 7.25$, $SD = 7.05$). These disparities suggest that as the stream of schools increases, there is a corresponding increase in the duration of weak framing of communication forms, aligning with a weak framing of pacing. This implies that students in higher-stream schools have greater control over the transmission of pedagogic messages, allowing them to govern the rate of knowledge acquisition according to their own pace. This autonomy in learning may contribute to a deeper comprehension of esoteric knowledge, thereby laying an indirect foundation for their varied academic achievements. Moreover, the class differences exhibited in time allocated to peer interaction also suggest that teachers in higher-stream schools are less authoritative, fostering an environment with more equitable opportunities for student participation and discussion in classroom activities.

Noticeably, the form of communication between teachers and the whole class, which constitutes the majority of classroom time, shows no statistically significant differences across

school streams (F = 1.51, p = 0.24). This indicates that a teacher-centred mode of communication predominates in secondary school classrooms across social streams in China.

The lower half of Table 5. 3 reveals significant differences in the quality of classroom interaction and its instructional domain (F = 3.54, p = 0.04; F = 5.55, p = 0.01). Interaction quality and instructional effectiveness are highest in upper-stream schools (M = 4.62, SD = 0.39), followed by middle-stream schools (M = 4.3, SD = 0.76), and are lowest in bottom-stream schools (M = 3.96, SD = 0.38). These findings address the first two research questions of this study, demonstrating that in pedagogic practices, the allocation of time to different communication forms and the quality of overall interaction and instruction provided by teachers are regulated by the principle of social class.

5.4 Mediating Role of Duration of Communication Forms

The central research question of this chapter is to investigate how class differences are recontextualized into forms of communication that implicitly sustain social stratification. Interactional quality is used as the bridging variable to determine whether communication forms achieve this recontextualization by stratifying interactional quality across different school streams. To this end, two regression models (path c) were initially established to examine the total effect of school streams on interactional quality and instructional quality, respectively.

As shown in Table 5. 4, the effect of middle-stream schools on interactional quality is statistically insignificant, suggesting that there is no mediating relationship between middle-stream schools and their interactional quality. As a result, further analysis of mediating effects was only conducted on the three paths that exhibited significant coefficients.

Table 5. 4 Predictors of communicational and instructional quality across streams of schools.

	Model 1			Model 2		
	Interactional Quality			Instructional Quality		
	R^2	B	SE	R^2	B	SE
	0.186*			0.263**		
(Constant)		4.621**	163		5.067**	182
Middle-stream		-317	226		-0.528*	253
Bottom-stream		-0.661**	249		-0.911**	278

** p < .05 (two-tailed); ** p < .01 (two-tailed).*

Table 5. 5 presents the results of two mediation models, where upper-stream schools serve as the reference group, and middle-stream and bottom-stream schools are the predictors. The duration of peer interaction is treated as the mediator, while interactional quality and instructional quality are the outcome variables. The effects of the predictors on the mediator were the same across both models (path a) and are therefore presented only once in Model 1. Both the standardized coefficients (β) and standard errors (SE) for each "path a" and "path b" are reported, along with the unstandardized coefficients, which allow for substantive interpretation of the results (Zhao et al., 2010).

The analysis reveals that the coefficients for each path are significant, indicating that school stream significantly predicts the duration of peer interaction, symbolising the weakest framing in pedagogic communications. Upon the mediator entering the models, its effect on the outcome variables becomes significant (path b). Conversely, the direct effects of the predictors on the outcome variables are no longer significant (path c'), suggesting that the influence of school streams on overall interactional quality and instructional support is achieved through the mediating role of duration of peer interaction.

Table 5. 5 Mediating analysis models.

		R^2	B	SE
Model 1:	Predictor			
PI		0.28**		
	MS (path a)		-10.36*	5.04
	BS (path a)		-19.10**	5.55
Quality		0.33**		
	MS (path c')		-0.12	0.22
	BS (path c')		-0.3	0.27
	PI (path b)		0.02**	0.01
Model 2				
IQ		0.33**		
	MS (path c')		-0.33	0.25
	BS (path c')		-0.55	0.31
	PI (path b)		0.02*	0.01

Note: PI= Peer Interaction, IQ= Instructional Quality, MS=Middle-stream, BS= Bottom-stream;

** p < .05 (two-tailed); ** p < .01 (two-tailed).*

As presented in Table 5. 6, taking upper-stream schools as the reference, the confidence interval for the indirect effect of middle-stream schools includes zero, indicating that the indirect effect is not significant. This suggests that the duration of peer interaction does not mediate instructional quality in middle-stream schools. In contrast, the confidence intervals for the mediating effects in bottom-stream schools, concerning both interactional and instructional quality, do not include zero, confirming the significance of these indirect effects. Specifically, when upper-stream schools are used as the reference group, the duration of peer interaction in bottom-stream schools—representing the weakest framing of communication—exerts a significant indirect effect on both overall interactional and instructional quality. Furthermore, the mediation effect explains 54.97% of the total effect on interactional quality and 39.37% on instructional quality. This finding underscores that the duration of peer interaction serves as a crucial mediator between bottom-stream schools and the quality of interaction and instruction referred to upper stream schools.

Table 5. 6 Summary of the mediated paths tested from bootstrap resampling method

Mediated path tested	Lower CI	Upper CI	Indirect effect (β)	total effect (β) (ab+c')	Proportion
BS schools to OIQ through PI	-1.1515	-0.2042	-0.6	-1.09	54.97%
MS schools to IQ through PI	-0.7235	38	-0.28	-0.74	
BS schools to IQ through PI	-0.9731	-0.0994	-0.5	-1.28	39.37%

Note: OIQ=Overall Interactional Quality, IQ= Instructional Quality, PI= Peer Interaction, MS=Middle-stream, BS= Bottom-stream;

5.5 Discussion

The primary aim of this study was to explore how class differences are recontextualized within pedagogic communication and to elucidate their role in perpetuating social stratification. By examining class differences across three school streams, this investigation focused on the duration of various interactional forms and the quality of classroom interactions. The empirical findings not only align with existing research on class disparities in pedagogic practices but also reveal a more nuanced recontextualization of social class at the micro-level of classroom

dynamics. This study thus provides a deeper understanding of how pedagogic practices can legitimize social hierarchies.

5.5.1 Durations of Communication Forms

Class disparities in the duration of peer interaction underscore that social class, as an underlying principle of control, regulates time spent to peer communication characterised by a weak framing. To be specific, teachers in schools of a higher stream allocate more time to peer interaction, signifying a longer period of weak framing of hierarchical rules in pedagogic communication. This suggests that in higher stream schools, teachers tend to transfer more control over classroom processes to students, thereby reducing their authoritative presence. This finding aligns with Hoadley's (2005) observations that teachers from higher social classes tend to exhibit less authority in classroom interactions.

From the students' perspective, they control over pacing of message acquisition, which facilitates student participation and discussion in classroom activities, thus deepening their understanding of pedagogic content (Alexander, 2018), which build a solid base for successful learning (Morais, 2002). This finding provides empirical support to the proposition that progressive pedagogy is characterised by weak framing, developed by new middle class who positioned within the field of symbolic control (Bernstein, 2000; Morais, 2002; Muller, 2004).

The class differences in the allocation of time to peer interaction may be attributed to the increased educational costs, both in economic terms and in the time investment required. First, weak framing pedagogy demands highly qualified teachers with a strong theoretical and practical foundation, which incurs substantial training costs. Higher stream schools, with greater financial resources and a strong reputation, are better equipped to attract such teachers and to provide ongoing in-service training. In contrast, lower stream schools, particularly those at the bottom, lack the capacity to offer such resources. Additionally, the time cost for teachers, who must carefully plan weak framing interactions in advance, is a crucial factor.

Another potential reason for the disparity is that students in lower stream schools may struggle to grasp the rules of access to valued knowledge, which are often constructed based on middle-class syntax. As a result, a longer duration of weak control by teachers signifies less guidance from them and more self-construction for students, resulting in more ineffective practices among these students, which further affects the time devoted to peer interaction.

It is important to note that the time allocated to whole-class communication constitutes the largest proportion of classroom time. For teachers, communication with whole class

enhances teaching efficiency and ensures fluent pedagogic practices (Chiang et al., 2021). In addition, this duration does not exhibit significant stratified differences across school streams, which could be attributed to the persistent teacher-centered teaching model in Chinese education, deeply rooted in Confucian traditions. Moreover, another possible reason might be the intense competition within the Chinese education system and labour market, exacerbated by the large population, which creates immense pressure on both students and teachers. The teacher-led instructional model, with its visibility and easily quantifiable outcomes, facilitates the clear allocation of responsibility (Bernstein, 2000). For teachers, this approach, which emphasizes short-term student performance, allows them to reflect on and adjust their teaching practices based on students' mastery of the content. For instance, if a teacher notices widespread errors in solving quadratic equations, they might increase practice opportunities or provide more contextually relevant examples to improve understanding.

Contrary to expectations, the duration of teacher-whole class communication does not show a significant correlation with classroom management, which was anticipated to exhibit a strong relationship. Bernstein's insights provide a possible explanation: classroom management, particularly in terms of student behaviour, often operates implicitly and may not be observable. This is because students have already mastered and adapted the syntax governing classroom processes within the given societal context. However, this does not mean that teacher control has disappeared. Once disruptions occur, teachers are likely to reassert apparent control for keeping order (Bernstein, 2003b).

5.5.2 Quality of Interaction and Instruction

The quality of interaction and instruction within classrooms exhibits significant hierarchical disparities. These findings challenge the conclusions of O'Brien & Pianta (2010), who argued that classroom processes do not significantly differ between private and public schools, despite the common perception of private schools as superior. Contrary to their assertion, this study reveals that schools with higher streams provide substantially better interactional and instructional quality, which are recognized as direct predictors of students' school success (Goble & Pianta, 2017; Howes et al., 2008; Pianta et al., 2016). The observed discrepancies between studies may be attributed to variations in cultural contexts and educational systems across different societies. Nevertheless, the findings align with Bernstein's argument, which posits that pedagogic practices are governed by underlying regulative rules, in this context, social class (Bernstein, 2000).

5.5.3 Mediating Effect of Peer Interaction

The mediating effect of peer interaction on the relationship between school stream and the quality of classroom interaction and teacher instruction offers empirical evidence for the invisible transmission of social class differences. Class distinctions are recontextualized into differential time allocations for peer interaction, a form of pedagogic communication characterized by weak framing. This process legitimizes social stratification at the micro-interactional level, contributing to the implicit perpetuation of social hierarchies.

Moreover, the mediating effect of peer interaction duration suggests a potential approach for improving the quality of classroom interaction by increasing duration of peer interaction. This approach could help narrow the achievement gap among students from different social streams. However, implementing such strategies would necessitate additional teacher training to equip educators with the skills to select and design tasks that are more conducive to student self-learning and discussion without diluting the esoteric degree of the mathematics content being taught.

These findings also provide statistical support for Bernstein' (2000) proposition that class relations establish distinct communication forms that carry hierarchical power relations. These forms appropriate individuals from different social streams for socialising them into their respective social positions. Additionally, the process has permeated to the level of students' consciousness, promising the internalization of class differences for individuals.

5.6 Conclusion

In conclusion, this study argues that class differences are recontextualized into the duration of weak framing of forms of communication, serving as a means for transmitting social relations. This study extends the application of Bernstein's theoretical concepts into the Chinese cultural context. Furthermore, the statistical findings highlight the pivotal role of teachers in organising pedagogic communication in perpetuation of social stratification. Yet, the allocation of time in peer interactions simultaneously provides a potential means to narrow achievement gap and educational inequities at the micro classroom level.

Chapter 6 Data Analysis on Class Differences in Pedagogic Messages and Their Ways of Transmission

Introduction

This chapter aims to explore how social class differences are recontextualized in the transmission of pedagogic messages, contributing to social reproduction. Utilizing Dowling's SAM as an analytical framework, the chapter investigates whether teachers in schools of different streams exhibit class-based distinctions in their selection of pedagogic messages and the strategies they employ to transmit these messages, from preparatory activities to the presentation of new mathematics content.

The chapter consists of three sections. The first section presents four analyzed cases to illustrate the differential selection of tasks with varying degrees of discursive saturation and the corresponding instructional strategies employed by teachers in different school streams. These variations conduct in pedagogic messages orient students towards different levels of esoteric domain knowledge constructed by power hierarchies. Each of the four cases is examined in detail at the structural, textual, and resource levels to demonstrate how class differences are transformed and legitimized. Given the dialectical relationship between structural and textual levels, their analyses are often intertwined, with additional insights provided by examining the resource level.

The second section focuses on the analysis of class differences in the use of public domain content during the preparatory activity. It further examines the selection and utilization of tasks embedded within everyday and non-everyday contexts by teachers, which serve to differentiate the consciousness of students across streams. The last section concludes with a statistical summary of the selection and strategies of all participants in transmitting pedagogic messages, from preparation to presentation, providing an overarching view of class differences in the recontextualization of pedagogic practices within the context of this study.

6.1 Data Analysis

In all Extracts, "T" refers to the teacher, "S" refers to an individual student answering a question, with the number indicating their order of response through the whole lesson; "SS" refers to the entire class of students.

6.1.1 Extract 1

1. T: Yesterday, I assigned you two hands-on tasks. First, let's look at the first question. Can you divide a triangle into four congruent triangles? Who would like to share your results? S1.
2. S1: Hmm, yesterday, I took the midpoints of the three sides of the triangle.
3. T: Took the midpoints of the three sides of the triangle?
4. S1: Yes, then I connected them and cut along the lines.
5. T: Connected them and then cut along the lines?
6. S1: Yes, then I found that the four triangles are congruent.
7. T: Hmm, how did you find that out?
8. S1: Hmm, we previously learned about an equilateral triangle. By taking the midpoints of its three sides and connecting them, we found four congruent equilateral triangles. So, I thought if I tried the same with this triangle, maybe there would be four congruent triangles.
9. T: Ah, after cutting, how did you check if they were congruent?
10. S1: I stacked them on top of each other and found they coincided perfectly.
11. T: Good. Please sit down, very well done. We often consider problems in a particular way. Are there any different ideas? S2, please share.
12. S2: I noticed it asked for dividing into four congruent triangles, so, hmm, since congruent triangles have equal sides, I…
13. T: Oh, congruent triangles must have equal sides?
14. S2: Yes, so I took the midpoints of the three sides of triangle ABC, tried it, and then cut along the lines and found they were congruent.
15. T: Good, please sit down. Very well done. You identified the clue about equal sides to solve the problem. Very good. Are there different methods of dividing? What if you didn't use those three lines? (No one responded) Everyone used the same method. Yesterday, the triangles we had were of various shapes and sizes. All these triangles can be divided into four congruent triangles using these three lines. It shows these lines are very special; they are another important type of line in a triangle. We call them the midsegments of a triangle. Today, let's study this.

(The teacher writes the topic on the blackboard: 6.3 Midsegments of a Triangle)

16. T: First, I'll ask a student to describe what a midsegment of a triangle is, based on the diagram. S3.
17. S3: Hmm, a line segment connecting the midpoints of any two sides of a triangle is called a midsegment of the triangle.
18. T: Good, please sit down. You captured the basic characteristics of a midsegment very accurately! We call a line segment connecting the midpoints of two sides of a triangle a midsegment of the triangle. (The teacher writes this sentence on the blackboard) Now, please draw a triangle and its midsegment.
    (Students start practicing individually)
19. T: Let's understand the definition further according to the diagram (illustrated on the Slide). According to the definition of a midsegment, if we know AD equals BD, and AE equals EC, we can conclude?
20. Ss: DE is a midsegment of triangle ABC.
21. T: Using symbolic language, because of AD=BD, AE=EC, then DE is a midsegment of △ ABC; Conversely, if we know, because DE is a midsegment of △ABC, we can conclude?
22. Ss: AD = BD, AE = EC.
23. (Teacher writes down the conclusion "because of AD=BD, AE=EC" on the blackboard)
24. T: In other words, because DE is a midsegment of triangle ABC, AD equals BD and AE equals EC. This is the dual meaning of the definition. First, it can be used to identify a midsegment. Second, it can be applied as a basic property of a midsegment. Let's look at the screen. How many midsegments does a triangle have according to the definition?
25. Ss: Three.
26. T: Three midsegments. When we previously saw midpoints, we often associated them with a triangle's?
27. Ss: Median.
28. T: So, what's the difference between a midsegment and a median? S4, please explain.
29. S4: The endpoints of a midsegment are the midpoints of two sides, while the endpoints of a median are a vertex and the midpoint of its opposite side.
30. T: Correct, the midsegment connects the midpoints of two sides, while the median connects a vertex to the midpoint of the opposite side. (The diagram is shown on the slide simultaneously)

Analysis

The first step in this analysis is to delineate the boundary between the teacher's preparatory stage and the presentation of new content, in order to clearly demarcate these two stages. Once this boundary is established, the pedagogic messages and the strategies employed for transmitting them during this process can be systematically investigated and analyzed. Based on the teacher's statement in line 15— "apparently, these three lines are very special; they are another important type of line in a triangle. We call them the midsegments of a triangle. Today, let's study this"—and the subsequent writing of the topic on the blackboard, "6.3 Midsegments of a Triangle," it is evident that the teacher is transitioning to the introduction of new content, specifically "midsegments of a triangle." Following this, the teacher asks a student to define a midsegment based on information received from the preparatory tasks. The teacher then validates and reiterates the student's response, using geometric symbols to describe the properties of midsegments, and then displaying on the blackboard. Subsequently, the teacher contrasts the midsegment with the previously learned definition of a median through student responses. Therefore, it is clear that the content presented before line 15 falls within the preparatory stage, while from line 15 onwards, the presentation of new mathematical content begins. In the subsequent analysis, I will examine these texts at three levels within the theoretical framework established in Chapter 3.

The Structural Level

The pedagogic messages in the initial task of preparation are coded in terms of both content and expression. Based on the strength of classification in these two dimensions, the domain of practice initiated by the teacher was identified. In terms of expression, the classification is strong, not only during the preparation phase but throughout the entire task. All mathematical symbols employed by the teacher belong to the esoteric domain, including terms such as congruent triangles, midpoints, equal sides, and triangle ABC, as well as the geometric figures and symbolic language displayed on the slides and blackboard: because of AD=BD, AE=EC, then DE is a midsegment of△ABC; because of DE is a midsegment of △ABC, then AD=BD, AE=EC. These are all esoteric mathematical symbols. Regarding content, the exercise in this extract is highly context-independent and mathematically strong. Although the task involves a hands-on activity (paper cutting), the content— "cutting out four congruent triangles"—exists solely within the context of a math class and is detached from any everyday context. Consequently, the strong mathematical classification in both content and expression identifies this extract as belonging to the esoteric domain, making it easily distinguishable from other

specialized activities. Within this extract, the mathematical regulative principle is fully expressed.

In teaching practices, students construct their positions and subjectivity by continually acquiring new, abstract symbols from the esoteric domain—a process of subject production. As outlined in the theoretical framework, the process of subject production is analogous to an apprenticeship, where individuals progress from incompetence to competence in a specialized field. For instance, Dowling (1998, p. 30) illustrates this with the example of Japanese pottery making, where a master potter guides an apprentice through the learning process. Similarly, Strahler-Pohl (2013) describes a master spray painter mentoring an apprentice, exemplifying this transformative pathway. In these contexts, accomplished individuals act as mentors, encouraging apprentices to experiment while providing guidance in specialized skills. The goal of these skilled practitioners is to mold learners into future experts in their respective fields. Analogously, in this extract, the teacher first reviews the previous task, invites students to share their methods, and uses questioning to help them articulate their strategies and thoughts. By evaluating and summarizing students' ideas, the teacher transitions into the introduction of new mathematical content, thereby moving into the esoteric mathematical domain. In this pedagogic relationship, the teacher functions as an adept, transmitting mathematical symbols selected from the esoteric domain to the "novice" students, with the aim of transforming them into potential experts. Through continuous questioning, the teacher maximizes the students' subjectivity within a strongly classified activity, positioning them as "apprentices." In terms of symbols and symbolic orders, students acquire the geometric symbols extracted by the teacher from the symbolic order, thereby entering the symbolic domain. In doing so, they are integrated into the vertical power relations where these mathematical symbols are situated. In conclusion, at the structural level, this teacher from the upper-stream school begins her lesson within the esoteric domain, guiding her students into vertical power relations through the acquisition of specialized knowledge.

The Textual Level

In this extract, the teacher's message strategy is identified as expanding, and the discourse strategy as abstracting. The teacher organizes the instructional tasks into four parts: asking two students to share their solutions to the task, respectively; presenting new mathematical content in detail; and prompting a student to compare the properties of midsegments and medians to enhance understanding. Throughout these tasks, the teacher gradually expands on the messages

from the esoteric domain. Initially, by revisiting the previous task, “How to divide a triangle into four congruent triangles,” and then summarizing the students’ responses to expand the mathematical messages such as "taking midpoints,” and "equal sides." Subsequently, she introduces the new content of midsegments and provides geometric and symbolic representations. Finally, the teacher revisits the concept of the median to reinforce understanding. Through this structured teaching process, the esoteric mathematical texts—comprising abstract terms and symbols—are progressively expanded. The mathematical signifiers introduced remain confined within the domain of signifiers, i.e., the esoteric domain, conveying meanings strictly within the realm of the signifiers themselves. These signifiers move along the signifying chain without crossing into the field of the signified; in other words, they do not enter into a concrete, localized reality.

The discourse strategy employed in this extract is abstracting, underpinned by the connective relationships between tasks. The four tasks in this extract are metonymically connected. Specifically, the first two tasks involve eliciting different solutions to the same problem, where both students rely on the same crucial concept of taking midpoints. However, from the teacher’s perspective, she is exploring different methods to solve the same problem. These different solutions represent distinct parts of a whole and are inherently parallel, thus metonymically related. Without intuition, students may struggle to draw connections between these two tasks. The teacher then generalises these specific tasks to an abstract level, explicating the properties of midsegments. In the subsequent task, the teacher enhances students’ comprehension by contrasting the previously learned concept of the median with the midsegment. Since both midsegments and medians are properties of triangles, this comparison also reflects a metonymic relationship. Therefore, these metonymically connected tasks make the discourse strategy in this extract abstracting.

When considered together, the expanding message strategy and abstracting discourse strategy place the teacher’s instructional strategy within the space of generalization. Overall, in this extract of pedagogic task, the messages conveyed by the teacher are classified as high saturation degree (DS+) (i.e., esoteric mathematical signifiers), distinguishing them from other specialized activities that students might engage in. These multiple signifiers, interconnected in an abstract and metonymic manner, are continuously moving along the signifying chain. As a result, students consistently acquire these esoteric signifiers, leading to the reinforcement and specialization of their voices. In Lacanian terms, this process can be understood as the sewing process of the symbolic order. Ultimately, students construct their subjectivity within the vertical symbolic order through the continuous accumulation of esoteric signifiers. In

Bernsteinian terms, this process signifies their access to hierarchical power relations through the acquisition of a valued form of mathematical knowledge.

The Resource Level

The use of resource modes, specifically the signifying process, aligns with different instructional strategies. In this extract, the teacher selectively employs textual resources, such as geometric figures and symbols, that function autonomously within the mathematical discourse without representing anything beyond their inherent properties. These mathematical symbols are explicitly presented to symbolise the properties of the midsegments of a triangle, devoid of any external referents. In this instructional practice, students are exposed solely to specialized mathematical symbols, without any alteration in their sense of spatial or conceptual positions. For the students, their role is confined to being readers of these texts, observers of the mathematical tasks, and solvers of the posed questions, thereby gaining access exclusively to the realm of pure mathematical symbols. Hence, the regulative rules of esoteric domain are realized. This result at the resource level is consistent with Dowling's argument that recruiting substantially from symbolic mode facilitates the generalizing strategies which are necessary in the production of DS+ practices and in the construction of positions of apprenticed.

In summary, the teacher in the upper-stream school initiates the lesson from the esoteric domain and consistently employs an expanding message strategy alongside an abstracting discourse strategy, thereby positioning her instruction within the generalizing space. The transmission of pedagogic messages orients students toward the acquisition of esoteric mathematical knowledge, positioning them within hierarchical power relations. The instructional strategies used by the teacher maintain students within the symbolic order constructed by the chain of mathematical signifiers.

However, a contrasting case exists: a teacher who begins a lesson outside the esoteric domain but, through the strategic use of messages and discourse strategies, still ultimately guides students toward accessing esoteric mathematical signifiers. This alternative approach, observed in another upper-stream school, will be discussed in the following section.

6.1.2 Extract 2

1. T: Please work in groups of four. Take out two squares with side length of 1 and scissors. Discuss seriously and then cut, and assemble to try to get a bigger square, OK?

2. Ss: Yes! (Students got started to engage in this activity)
3. T: After working together, each group has completed this task. Please show your own patchwork to the class.
4. (Several student were selected from each group to display their work to the teacher and students)
5. T: Now let's summarise what we have together done.
6. (Teacher summarised different approaches presented by these students used to make a bigger square. Then he asked the next question)
7. T: Let's think of another question. Assuming the side length of the bigger square is *a*, so what requirement should be met by *a*?
8. Ss: Because the sum of the area of the two small squares is equal to that of the bigger one, so, according to the formula of the area of a square, $a^2=2$. By $a^2=2$ can get a result that a should be 1.41421356….
9. T: What you said are reasonable. Previously, we have summarised the rational numbers including integers and fractions, then is *a* an integer? Or is *a* fraction? Please discuss in groups and then answer.
10. S1: Because $1^2=1$, $2^2=4$, $3^2=9$…, we can see that the squares of integers are getting bigger and bigger, so $1^2<a^2<2^2$, so $1<a<2$. So, *a* should be between 1 and 2, then it is not possible to be an integer.
11. S2: Because the product of two identical simplest fractions is still a simplest fraction, so *a* is unlikely to be a fraction.
12. T: After the discussion, we can see, in the equation $a^2=2$, *a* is neither an integer nor a fraction. So, a is not a rational number. However, in our real life, we do encounter numbers like "*a*". So, it seems the current set of numbers we have learnt is not sufficient anymore.
13. (Afterwards, the teacher displayed several tasks to orientate students to a conclusion that previously learnt categories of numbers can no longer be used in the new content.)
14. Task 2: (Figure 6. 1)

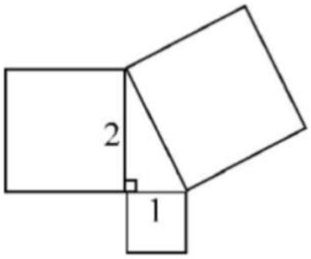


Figure 6. 1 Task 2

15. (1) In this figure, what is the area of the square sided by the hypotenuse of the right-angled triangle? (2) If the length of the side of this square is *b*, what conditions must *b* satisfy?
16. T: Who is going to give us an answer to this question? S3, come and answer it.
17. S3: This question can be answered a little by using the Pythagorean Theorem. Because in this right triangle, from the Pythagorean Theorem we get $a^2+b^2=c^2$, so $c^2=1+4$, so c equals square root of 5. Then the area of the square equals 5.
18. T: Good, very good, give S3 applause. In this question I want to study the length of the side of this square, then I suppose that the length of the side of this square is b. It is also the hypotenuse of the right-angled triangle. According to the Pythagorean theorem we can get the square of the hypotenuse, that is the area of the square. Then we get the same question: the area is 5, then we get the side length b^2, which equals 5. Okay, the same question, is b a rational number?
19. SS: No.
20. T: Who can explain it?
21. S4: Because 2^2 is equal to 4, 3^2 is equal to 9. So, 2^2 is less than b^2 is less than 3^2. So, 2 is less than b is less than 3. Therefore, b is not an integer.
22. T: Very good. But is b a fraction?
23. Ss: No.

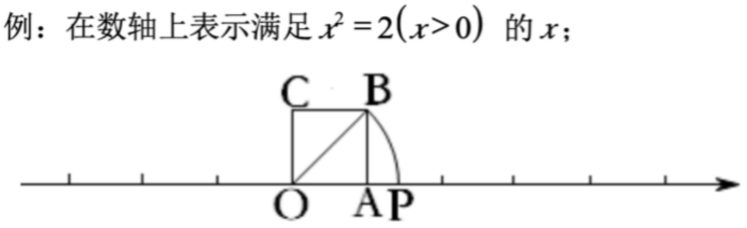


Figure 6. 2 Task 3

Note: mark a x which satisfy the equation, $\boldsymbol{x^2 = 2}$*, where x >0)*

24. T: The next task (Figure 6. 2), mark the number on the number line. Let's look at this question (on slide). Do you have an idea? We just said just rational numbers are not enough. But we can mark all the rational numbers on the number line. So, are all the numbers on the number line necessarily rational numbers?
25. Ss: Not necessarily.
26. T: Is there any way you can find an $x^2=2$ and $x > 0$ on the number line.
27. Ss: Only find out the approximate position, but not exact.
28. T: We just effectively used right triangles when we were working on the last two tasks, and?
29. Ss: The Pythagorean Theorem.
30. T: Very good. So, how about using right triangles in this question? (Ss: Yes!) How could we effectively deconstruct $x^2=2$ into a right triangle? S8.
31. S8: $x^2=2$ equals 1^2+1^2. This implies that the right-angle side of this right triangle is 1 and the hypotenuse is x.
32. T: So, let's illustrate this process: first, taking 1 unit as the length of a right-angled side on the number line, and then making the other right-angled side 1 unit vertically upwards. This forms a right-angled triangle of 1x1. As shown on the graph, the square of OB is 2. Then the length of OB is the irrational number that we are going to learn today. Well, I don't know how to say and write it, but I can show it. Now we can draw an arc with OB as the radius by using a circular ruler. The intersection P with the number line is the length of OB. So, does this number line also tell us that irrational numbers can be illustrated on the numerical axis as well?
33. Ss: Yes.

34. T: So, can I also mark on the intersection P but in the other direction? It means irrational number could be positive, and?
35. Ss: Negative.
36. T: But here is a condition. Should it be…?
37. Ss: x should bigger than 0.
38. T: Ok. Then, the next exercise: $x^2=5$. How to mark it on the number line and x should smaller than 0? Let's make a summary. What do we learn in this class today?
39. S9: Determination of irrational numbers. Whether a number is an irrational number. First determine if a number is an integer and if it is a fraction. Then you can tell if the number is a rational number.
40. T: Very good. Then this also teaches us a method when we determine a concept. We can use the branches of this concept to determine one by one, so as to make the final determination. So, there are cases in real life where a number is neither an integer nor a fraction, namely, it is not a rational number. Besides this, in our future learning, are concepts we have learnt previously our ultimate conclusion? So, we should also dare to criticise the authority, as well as to explore new questions.

Analysis

The preparatory stage of this lesson is a relatively long process, during which the teacher employs three mathematical tasks to introduce the concept of irrational numbers. Through these tasks, the teacher aimed to demonstrate to the students that the numbers they had previously learned were inadequate for solving problems in various contexts they encountered. This insufficiency highlighted the necessity of learning a new type of number. As the students engaged with these tasks, they gradually realized the existence of an unexplored realm of numbers beyond their current knowledge. In the third task, the teacher guided the students to independently derive the definition and properties of irrational numbers. The statement, "then the length of OB is the irrational number that we are going to learn today" (Line 32), marks the teacher's introduction of the specific properties associated with this new concept. Moreover, the teacher reinforced this content by questioning a student, further emphasizing its importance. Consequently, the presentation phase of the lesson is identified as beginning from Line 32, with the preceding content categorized as part of the preparation phase.

The Structural Level

Although multiple tasks are involved in the preparatory phase of this lesson, this study focuses on the initial task through which the teacher initiates pedagogic practice. The first pedagogic task, clearly emerging from the expressive domain, involves students using scissors and pieces of paper to create a larger square from two smaller squares. In terms of expression, the tools used—scissors and pieces of paper—do not employ abstract mathematical symbols, thus representing a weak classification. While this task is unconventional compared to standard textbook exercises, the requirement to "make a larger square from two square pieces of paper" aligns with mathematical practice, providing students with a mathematical intuition rather than a handcraft activity. Therefore, the content dimension is classified as strong. According to the strong classification in content but weak in expression, the domain of this practice is identified as the expressive domain. In contrast, the subsequent tasks in the preparatory stage are characterized by a strong classification in school mathematics content, including topics such as right triangles and the number line. These tasks utilize mathematical symbols like side lengths, rational numbers, right triangles, and ΔABC, thereby positioning them within the esoteric domain.

Typically, tasks from the expressive domain do not immediately engage students in strongly classified mathematical practices, which may limit their access to the esoteric domain and restrict their exposure to the hierarchical power relations embedded in esoteric mathematical signifiers. However, contexts within the non-esoteric domain are distinct from daily life and are confined to mathematics classrooms. The use of non-esoteric domains serves as a portal to the esoteric domain. Generally, content and symbols from the public, descriptive, and expressive domains are oriented towards the esoteric domain through a complementary signifying process employed by teachers.

In this extract, the teacher quickly extracted the mathematical messages and content presented in the first task: the side length of the large square. After the students complete the task, the teacher prompts them to determine the side length of the large square, with students estimating it to be approximately 1.41 based on the equation $a^2 = 2$ (Line 8). The teacher then questions whether this value, a, is an integer or a fraction, leading to student discussions and conclusions that a could be neither an integer (Line 10) nor a fraction (Line 11). Through a series of probing questions, the teacher introduces the concept of irrational numbers indirectly. Although the lesson begins in the expressive domain, the teacher's intent is to provide an accessible entry point for students, allowing them to discover the new concept themselves through guided inquiry. This approach maximizes student subjectivity, positioning them as potential future experts.

The teacher's continuous introduction of esoteric signifiers, such as irrational numbers, keeps students engaged in activities with strong classifications, thereby orienting their understanding towards the regulative principles of mathematical knowledge. Consequently, in this extract, students are interpellated as "apprentices," gradually assimilating into the esoteric domain through active exploration and guided inquiry.

The Textual Level

The analysis at the textual level reveals that this teacher employed both expanding message strategies and abstracting discourse strategies in their instructional approach. Initially, in terms of the message strategy, the teacher gradually introduced more esoteric messages in his instruction: texts of his first maths task are low discourse saturation (DS-) (piecing of square pieces of paper). Subsequently, the teacher's instruction incorporated more esoteric messages, including discussions on the area of squares, rational numbers, integers, fractions, and their application in geometric shapes and algebra. This transition to higher discourse saturation (DS+) indicates an expansion into more esoteric domains.

The discourse strategy used by the teacher is identified as abstracting, as evidenced by the metonymic relationships established between the tasks. These tasks, involving rational numbers, were designed to introduce the concept of irrational numbers. The relationship between irrational and rational numbers is metonymic, as both are subsets of the broader number system. The teacher used tasks related to rational numbers to gradually introduce irrational numbers, maintaining an abstract level of instruction. This approach is consistent with the teacher's statement on the abstract nature of the content (Line 40). Additionally, the relationships within the tasks also exhibit a metonymic nature. For example, geometric tasks involving triangles or quadrilaterals were used to demonstrate the existence of irrational numbers, thereby linking algebraic concepts with geometric content. The metonymic relationship between algebra and geometry—both branches of mathematics addressing similar concepts from different perspectives—further underscores the abstracting discourse strategy employed.

The integration of expanding message strategies and abstracting discourse strategies situates the teacher's overall instructional strategies within the realm of generalization. This approach enables students to access a range of esoteric signifiers. However, the primary focus of this analysis is to demonstrate that even when a teacher begins instruction in the non-esoteric domain, students can still gain access to esoteric domains, i.e., vertical power relations, if

teachers employ expanding message and abstracting discourse strategies make a turn through the whole signifying process of other non-esoteric domains. Initiating instruction from a non-esoteric domain serves as an accessible entry point, but the ultimate social positions and access to hierarchical power relations depend on the instructional strategies employed.

The Resource Level

In the first task, the teacher utilized the iconic mode, though it is important to note that these icons do not align perfectly with the theoretical framework since the task is hands-on rather than textual. According to Dowling, such practical tools (text-as-work) could be translated into a textual mode (text-as-text) for analytical purposes. Nevertheless, these practical tools create a spatial dislocation for students, more so than textual icons, as they resemble everyday tasks rather than mathematical ones. In subsequent tasks, the teacher used symbols and indices, such as right-angled triangles and number lines, which represent abstract mathematical concepts rather than concrete icons. This reliance on non-iconic modes aligns with a generalizing instructional strategy, consistent with the analysis results at the textual level.

Overall, the teacher's instructional strategy, beginning in the expressive domain and transitioning to more esoteric content, ultimately positions students within vertical power relations through generalizing instructional strategies. Conversely, there is a contrasting case where instruction starts from the esoteric domain but does not lead to access to vertical power relations. This case, observed in a middle-stream school, involves a teacher who employs particularizing discourse strategies, thereby confining students to horizontal power relations. The specifics of this contrasting case will be discussed further.

6.1.3 Extract 3

(*Note: In English, a fraction, where the numerator and denominator are both numbers, and a fraction, where the denominator contains letters, are the same word. However, in Chinese, they two are different terms, which are compiled in textbooks of different grades with different definitions. In this study, in order to differentiate, they are represented by their Chinese terms Fenshu (only numbers) and Fenshi (with letters), respectively*.)

1. (The teacher wrote down the pedagogic goal for today on the board: Addition and subtraction of Fenshi with the same denominator. Then he displayed a few exercises on a slide for reviewing those of Fenshu learnt previously: 1. $\frac{1}{5}+\frac{2}{5}=$ 2. $\frac{1}{5}-\frac{2}{5}$, =. Students rushed to answer, then the teacher named two and asked them their respective solving method.)

2. S1: There is one $\frac{1}{5}$ inside $\frac{1}{5}$, there are two $\frac{1}{5}$ inside $\frac{2}{5}$, one $\frac{1}{5}$ plus two $\frac{1}{5}$ equals three $\frac{1}{5}$ is $\frac{3}{5}$.

3. S2: There is one $\frac{1}{5}$ inside $\frac{1}{5}$, two $\frac{1}{5}$ inside $\frac{1}{5}$, one $\frac{1}{5}$ minus two $\frac{1}{5}$ equals to one negative $\frac{1}{5}$ which is - $\frac{1}{5}$.

4. (Teacher evaluated each by saying that the answers were very good and asking the class for clapping)
5. T: Well, after these two exercises we have clarified the operation of adding and subtracting of Fenshu with the same denominator. Well, who can summarise what is the law of adding and subtracting of Fenshu with the same denominator? Recall it and say it boldly.
6. S3: leave the common denominator, only subtract the numerators.
7. T: Right, very good. Read it together.
8. (Then the teacher showed this law on slide and the whole class read it collectively. Thereafter the teacher affirmed and repeated the law. Afterwards, he moved on to the next task by showing 2 new exercises on slide.)
9. Exercise 1. $\frac{1}{a}+\frac{2}{a}$ =; Exercise 2. $\frac{1}{a}$ - $\frac{2}{a}$ =

10. T: Please take out your exercise book. When you finish, talk about your ideas with your desk mate.

11. (Students started to do the exercises individually, while the teacher walked around the classroom. After back to the podium, he named a student to answer the first exercise.)
12. T: S4, you answer the first question.
13. S4: $\frac{1}{a}$ plus $\frac{2}{a}$ equals to $\frac{(1+2)}{a}$ which is equal to $\frac{3}{a}$.
14. T: Very good, can you tell us what did you think? What is your method?
15. S4: Because there is one $\frac{1}{a}$ in $\frac{1}{a}$ and two $\frac{1}{a}$ in $\frac{2}{a}$, one $\frac{1}{a}$ plus two $\frac{1}{a}$ equals three $\frac{1}{a}$, that is $\frac{3}{a}$.
16. T: Right? (The class answers right collectively.) Well, very good, applaud! You said it particularly good! Your language is very accurate, and you say it in a very standardised way. Who would like to answer the second question? S5, you try it, say it boldly.
17. S5: $\frac{1}{a}$ minus $\frac{2}{a}$ equals $\frac{1-2}{a}$ equals one negative $\frac{1}{a}$, that is negative $\frac{1}{a}$.

18. T: OK, can you explain your method of doing it?

19. S5: Yes. Because there is one $\frac{1}{a}$ in $\frac{1}{a}$ and two $\frac{1}{a}$ in $\frac{2}{a}$, one $\frac{1}{a}$ minuses two $\frac{1}{a}$ equals one negative $\frac{1}{a}$, namely negative $\frac{1}{a}$.

20. T: Very good, applaud him. So, through your exercise, we found we could solve the new questions by using the law of Fenshu with the same denominator that we have just reviewed. Right? (The class collectively answers yes.) Then look at these two equations, what is different from adding and subtracting Fenshu with the same denominator that we just learned?
21. SS: The denominators.
22. T: Right, what did their denominators change from numbers? (SS: letters). Right, when the denominator changes from a number to a letter, what does the Fenshu become? (SS: Fenshi.) Yes, it goes from a Fenshu to a Fenshi. We have already learnt the concept of Fenshi two days ago: an algebraic equation with a letter in the denominator is called Fenshi. Right! So, let's look at that. Now it's turned into Fenshi, so we've solved today's problem of adding and subtracting Fenshi with the same denominator using the same method we just used for Fenshu, right? Well, that's a great discovery. So, let's see, have you noticed anything during your calculations? What has changed? What has not changed? Who's going to say it? S6.
23. S6: The denominator doesn't change, the numerator changes.
24. T: Hey, the denominator doesn't change, the numerator changes. So, look: $\frac{1}{a}$ plus $\frac{2}{a}$ equals to $\frac{1+2}{a}$. It adds up the numerators, and $\frac{1}{a}$ minus $\frac{2}{a}$, equals to $\frac{1-2}{a}$. Does it add and subtract the numerators, and does the denominator change?

25. SS: No.
26. T: The denominator doesn't change. Then, think about it, according to the law of adding and subtracting Fenshu with the same denominator we just reviewed: addition and subtraction of Fenshu with the same denominator, the denominator remains the same, add and subtract the numerators. Right? Can you think about that then, and can someone tell us, what is the law of addition and subtraction of Fenshi with the same denominator? Based on the law of Fenshu, how should the law for addition and subtraction of Fenshi with the same denominator be recounted? (Selecting a student to answer)

27. S7: For addition and subtraction of Fenshi with the same denominator, keep the denominator the same, add and subtract the numerators.
28. T: Correct? (The class collectively answers "correct", and then the teacher asked for a round of applause to this student. The teacher displayed the texts of this law on a slide. He asked the students to read the law aloud with him. Simultaneously, the teacher wrote down the law on the blackboard. After this, he asked the students to read it again together. Then they move to the step of doing exercise.)

Analysis

To delineate the scopes of preparation and presentation in this extract, it is crucial to clarify their definitions again. As established in the Methodology chapter, the presentation of new mathematical content involves a detailed exposition that includes definitions, properties, and other relevant elements. A mere mention of a concept's name does not constitute an adequate introduction. In this context, the initial act of writing the topic title on the blackboard does not qualify as the presentation stage.

In contrast, the transition to the presentation phase is clearly marked by the teacher's statement: "Now it's turned into a Fenshi, so we've solved today's problem of adding and subtracting Fenshi with the same denominator using the same method we just used for Fenshu, right?" (Line 22). This sentence plays a pivotal role in transitioning between the preparatory and presentation phases. It bridges the prior exercise, where students worked on a new Fenshi problem without formally learning the operational methods, and the subsequent content where the teacher introduces the rules of addition and subtraction of Fenshi.

Prior to this statement, students engaged in solving an exercise using the rules for Fenshu addition and subtraction they had previously learned. The teacher's statement at Line 22 explicitly signals the shift to the presentation of new content by stating, "Now it's turned into a Fenshi," thus initiating the comparison of addition and subtraction operations for Fenshi with those previously learned for Fenshu. This comparison helps in presenting the rules for Fenshi, which is the new content of the lesson. This presentation is further reinforced by a student's response to a teacher's question (Line 27). While the boundary between preparation and presentation in this extract is not sharply defined, it is important to recognize that real pedagogic practice often involves iterative movement between different stages—preparation, presentation, exercise, and summary—rather than a strict linear progression. Consequently, the

boundaries between preparation and presentation in each extract were identified and adjusted according to the definitions outlined in the Methodology chapter.

The Structural Level

At the structural level, the initial focus is on identifying the domain of practice from which the teacher begins his instruction. In the extract, it is evident that the teacher initiates the lesson from the esoteric domain.

Firstly, in terms of content, the lesson is situated within the algebraic domain, which is characterized by a strong classification of mathematical activity. Specifically, the teacher identifies the focus of the lesson as the addition and subtraction of Fenshi with the same denominator (Line 1). This topic is inherently algebraic, reflecting a high level of abstraction. The teacher then proceeds to review previously learned knowledge by presenting two exercises, with both student responses and the teacher's evaluations situated firmly within the field of arithmetic. Secondly, regarding the dimension of expression, the use of algebraic symbols such as Fenshi and the negative sign denotes a strong mathematical classification. Therefore, this pedagogic practice at the stage of preparation is within the esoteric domain.

The domain of practice ultimately determines the position students access through the learning process. In this case, the pedagogic messages remain firmly within the esoteric domain, providing students with access to a range of mathematical signifiers along the signifying chain. This allows students to differentiate this specialized mathematical activity from other contexts, such as everyday life or other academic subjects, thus contributing to their construction as potential subjects in the domain of mathematics.

However, the relationship between the tasks is metaphorical, with clear similarities facilitating easier access to the tasks. Despite exposure to esoteric symbols, the procedural introduction of these symbols interrupts students' engagement with the full complexity of esoteric mathematical systems. As a result, the pedagogic approach produces only residual subjectivity. Consequently, the students' position in this lesson is characterized as "dependent," reflecting a limited engagement with the deeper complexities of the mathematical knowledge.

The Textual Level

The instructional strategies employed in this extract can be characterized by an expanding message strategy and a particularizing discourse strategy. The identification of the message

strategy involves examining whether the esoteric content conveyed by the teacher from the preparatory activities through the presentation of new mathematical concepts is broadened or restricted. As evidenced by the text, the teacher initiates the lesson with a task involving the calculation of Fenshu, prompting the class to recall operational rules. The teacher then introduces additional mathematical symbols, such as $\frac{1}{a}+\frac{2}{a}$ = and $\frac{1}{a}$ - $\frac{2}{a}$ =. This is followed by a review and a detailed demonstration of the concept of Fenshu via a slide presentation. Clearly, the esoteric content is continually expanded, thus establishing the message strategy as expanding.

In terms of discourse strategy, the teacher consistently employs metaphorical connections between tasks, which is indicative of a particularizing strategy. Throughout the lesson, from preparation to presentation, the teacher introduces four distinct tasks that share a common operational principle: maintaining the denominator while adding and subtracting the numerators. After the class completes these exercises, the teacher asks a student to articulate this operational law, which is subsequently presented on a slide and recited aloud by the entire class (Lines 5-7). The teacher then provides two additional exercises that follow the same structure and solution method. This pedagogical approach is effective in scaffolding new knowledge on the foundation of previously constructed understanding. Furthermore, after the second set of exercises, the teacher emphasizes that these new problems can be solved using the Fenshu principle just reviewed (Line 20), reinforcing the continuity between the preparatory and presentation stages.

Additionally, when the teacher solicits explanations from students regarding their approach to each exercise, their responses exhibit a striking uniformity. The first student provides an answer (Line 2), and the subsequent three students follow with nearly identical structures in their responses (Lines 3, 13, 15). The only differences lie in the specific mathematical symbols, which are replaced with the numbers and letters relevant to their respective tasks. Notably, Student 4 (Line 15) mirrors the response of the first student almost exactly, substituting $\frac{1}{5}$ with $\frac{1}{a}$ in her explanation. The teacher's positive feedback on her response (Line 16) serves to validate this imitation, either as a recognition of the correct application of previous methods or as an acknowledgment of the task similarities. This endorsement suggests that the teacher values the use of these metaphorical connections, which reduce the complexity to enter the regulative rules of mathematical system for students. Therefore, the discourse strategy in this pedagogical process is particularizing.

From a theoretical perspective, as framed in the SAM framework, these tasks can be viewed as diverse signifiers with a metaphorical relationship. These signifiers share a limited, overarching meaning, which can be termed the "master signifier"—in this context, the operational law of Fenshu. The teacher deconstructs this master signifier into various tasks, presenting them in a procedural manner to illustrate the underlying principle. Consequently, the complexity of entering the regulatory framework of this esoteric master signifier is reduced, making the discourse less abstract.

In conclusion, the combination of an expanding message strategy and a particularizing discourse strategy positions the teacher's instructional strategies within the domain of fragmenting. In this fragmenting approach, students gain access to esoteric mathematical knowledge, but it is delivered in a simplified, easily digestible form. As a result, students do not fully engage with the deeper, more abstract hierarchies of the mathematical system, which should be accessed through metonymic intuitions rather than procedural constructs. Consequently, the students' voices are specialized as "dependent."

The Resource Level

The textual resources employed in this extract are predominantly symbolic. At the structural level, the expression of these messages has been identified as esoteric, particularly through the use of arithmetic formulas in the exercises. These formulas serve as distinct symbols within the esoteric domain of mathematics, specifically transmitting the content of specialized algebraic topics. For the students, there is no shift in their sense of spatial or cognitive orientation, nor is there any confusion with other types of activities, reinforcing the specialized nature of these symbols.

However, it is important to note that the resource level serves as an auxiliary dimension in the overall analysis. The teacher's subsequent organization of these symbols, based on their relational proximity, was aimed at enhancing student comprehension. Yet, this approach does not culminate in a generalizing instructional strategy. Instead, it results in the transmission of fragmented knowledge within the esoteric domain.

It is also crucial to acknowledge the existence of scenarios where students fail to access esoteric domain messages throughout a lesson. In such cases, these students are deprived of engagement with hierarchical power relations inherent in the esoteric domain. An example of this was observed in a lower-stream classroom, where the teacher initiated the lesson within the public domain and consistently employed a particularizing discourse strategy.

6.1.4 Extract 4

1. The teacher displayed a task on a slide, “The Meaning of Average Depth of Water: Ming is a student in the eighth grade in our Chang’an District. There is a Pond with an average depth of 1.5 meters near his school. The height of Ming is 1.75 meters. During the summer vacation, he wants to go to this pond alone to learn swimming. So, what safety risks are associated with Ming’s idea?”
2. S1: The average depth of the pond is 1.5 metres. This means it may be deeper or shallower than 1.5 metres.
3. T: Yes, very good. The meaning of the average depth of a pond is that there are places that are deeper than 1.5 metres and places that are shallower than 1.5 metres. Some data is bigger than it, some data is smaller than it. So, is Ming’s height 1.75 meters at risk?
4. SS: Yes.
5. T: Is there any other else?
6. S2: Swimming in a pond and going alone to learn to swim are very dangerous.
7. T: Yes, these are not allowed. These are just some ideas, do not act these.
8. (The teacher showed the second example: observing three person’s shooting scores)
9. The graph below illustrates the shooting scores of three persons, A, B and C. Who has better and more consistent scores? How do you tell?
10. S3: B is more consistent and has a better score. Because his lowest and highest values are not too far apart. Unlike A, his highest value is 10 and his lowest value is 4. The difference is 6.
11. T: A’s difference is bigger. On the graph we can see that B and C’s scores are more consistent. A’s scores fluctuate too much. The data speak for themselves. We can even see the specifics of A, B and C. So how do you tell?
12. (Display the title of the new concept on slide： Analysing Data - The mean value)
13. T: In this chapter, Ming’s school achievement is in moderate level in our class. And I am shorter in height in our class. The members of team A are younger than the those in team B. All these are related to data. We can’t live without data. So, in this class we are going to learn about the analysis of data. With the progress of society, we have entered the era of big data. Then the analysis of data is becoming important. So, this lesson we will start from the most basic concept: the mean value. Here is a question: For example, the neighbour kid’s test scores are 87, 90, 93. so what is the mean score for this kid. Do you know how to solve it?

14. Ss: Yes. (The teacher named a student)
15. S4: The mean score is 90.
16. T: How did you calculate it?
17. S4: Add the three figures and divide them by 3.
18. T: Right, 87+90+93 and divide by?
19. Ss: 3.
20. T: In short, calculate the mean value is to find out their sum and then divide them by?
21. Ss: number of individuals.
22. T: Then we call such a mean value as the arithmetic mean. How is it calculated? We call the first value as x_1, the second value as x_2, the third as x_3. and so on up to x_n. Now we add up this set of values.
23. Ss: Sum the values x_1 through x_n, then divide their sum by n.
24. T: Divided by n, we write it as multiply 1/n. In maths we note the mean value as $\bar{x}$. Pay attention to how it is written. you should know how to write and read it.

(Afterwards, the teacher showed several exercises on calculating the arithmetic mean, including evaluating the stability of shooting according to their mean score, the mean height of the class, the average weekly physical exercise time of 50 middle school students. After conducting these exercises, the teacher introduced another new concept, the weighted arithmetic mean.)

Analysis

In this pedagogic practice, although the teacher displays the title "Analyzing Data – The Mean Value" on a slide (Line 12), she does not immediately transition into the specific details or properties of the mathematical concept. Therefore, this moment does not signal the start of introducing new mathematical content. Instead, the teacher begins with an exercise that asks students to calculate a child's average test score. By guiding the class through this problem, she elicits the rules for calculating the mean from the students' responses (Line 20). This marks the formal introduction of the mean value calculation. Consequently, the presentation phase begins at Line 20, when the teacher explicitly outlines the calculation rules, while the preparatory stage includes all activities prior to this, from Ming's swimming example up to the explanation of the calculation rules.

The Structural Level

The initial task in the preparation stage clearly falls within the public domain, as it is weakly classified both in terms of content and expression. Regarding content, the teacher situates the task within a highly context-dependent setting: "the neighbourhood school in Chang'an district" (Line 1). This localized setting restricts the scope of the task to a familiar environment, and the case itself—where a student named Ming, a common name, decides to swim in a pond—is closely tied to everyday experiences. Furthermore, the question posed, "What safety risks are associated with Ming's idea?" is open-ended and non-mathematical, further reinforcing its grounding in everyday concerns rather than academic inquiry. Absent the context of a mathematics classroom, students might struggle to distinguish this task from activities typical of a safety education course. In terms of mathematical expression, the task remains weakly classified. The only mathematical symbols used, 1.5 and 1.75, are embedded within the context of the pond's depth and Ming's height, respectively. This minimal use of mathematical symbols, coupled with the non-mathematical content, identifies the preparatory activity as operating within the public domain.

However, within the context of school mathematics, this public domain practice is recontextualized, assigning students the role of evaluators tasked with determining whether Ming's height is safe in a pond with an average depth of 1.5 meters. The detailed narrative and closed-ended nature of the evaluation task position the students as external observers rather than active participants. As evaluators, their role is fully objectified, with no room for the production of subjectivity. Consequently, within this classroom, the teacher initiates the lesson from the public domain and structurally positions the students as "objectified" participants, producing no subjectivity in the process.

The Textual Level

In this case, the teacher employs a limiting message strategy and a particularizing discourse strategy.

The transition from the preparation stage to the presentation stage demonstrates a limiting message strategy, as the teacher does not expand the quantity of messages from the esoteric domain. Both tasks presented are deeply embedded in non-mathematical, highly practical contexts, with an emphasis on detailed contextual information. This approach effectively backgrounds the esoteric mathematical content, preventing it from becoming the

focal point of instruction. By not introducing additional mathematical symbols or concepts as the lesson progresses after Line 24, the teacher limits the scope of mathematical knowledge being conveyed.

The discourse strategy is particularizing, identifiable by the metaphorical relationships established between the various tasks. The teacher begins by extracting the concept of the mean depth of a pond in the initial example and uses this as a basis for introducing subsequent cases. The similarity across these examples—the calculation of the mean value—acts as the master signifier in this context. The teacher deconstructs this master signifier into various practical examples, such as evaluating shooting stability based on mean scores, calculating the mean height of a class, and determining the average weekly physical exercise time of 50 middle school students.

This metaphorical linking dilutes the complexity of the mathematical concept, making it more accessible to the students. The structure parallels Freud's concept of the compressed dream as a supplement in Dowling' SAM, where a single image or scene in a dream serves as a master signifier, distilled from multiple real-world experiences. Similarly, in this extract, the teacher uses multiple real-world examples—such as the average depth of a pond, shooting scores, and test scores—to illustrate the concept of the arithmetic mean. This proceduralizing of the esoteric concept simplifies its understanding, making it easier for learners to grasp.

The combination of a limiting message strategy and a particularizing discourse strategy positions the teacher's instruction within the space of localising. By employing multiple practical examples, the teacher conveys messages primarily from the public domain, providing extensive background details in each case. Although a minimal amount of esoteric mathematical symbols is introduced, the overall discourse remains low in discourse saturation (DS-). As a result, students are unable to access the deeper regulative rules of the esoteric mathematical domain and remain within a horizontal hierarchy of power relations.

The Resource Level

In the teacher's first example involving a pond, the presentation was not delivered through visual code (iconic mode), such as pictures of ponds or students swimming, but rather through textual descriptions. Despite the absence of visual aids, the textual modes employed were highly specific and closely tied to the students' everyday experiences. Phrases like "our Chang'an district," "near the school," "summer vacation," "learning to swim in the pond," and "safety risks" are deeply context-dependent and geographically limited. These carefully chosen

textual resources effectively create a vivid virtual space, allowing students to easily imagine themselves within this scenario. The character Ming is portrayed in a manner that could make him seem like a friend or classmate, further reinforcing this sense of personal relevance. Students might even relate this scenario to real-life concerns, such as the well-documented safety risks of swimming in local bodies of water, particularly during summer vacations—a time when incidents of drowning are alarmingly frequent in the area.

This example, though implicitly, forces a spatial shift in the students' perception, placing them as if they were witnessing the event firsthand. The specific and relatable nature of the textual description anchors them in this constructed scenario, blurring the line between their real-world experiences and the classroom setting.

The subsequent examples provided by the teacher also relied on both visual and textual modes that conveyed specific and limiting information. This approach supports Dowling's assertion that iconic modes are frequently used in particularizing strategies (Dowling, 2003, p. 154). The use of detailed, concrete iconic resources tends to limit the potential for generalisation, thus fostering a localising instructional strategy. Such a strategy produces low discourse saturation (DS-) practices, which in turn construct a dependent or objectified student position.

The analysis of these four extracts demonstrates how the recontextualization of class differences plays out in the selection of domains of practice when initiating a lesson, as well as in the instructional strategies employed by teachers. These pedagogical selections ultimately place students from different streams into distinct hierarchical positions within power relations. The next section will explore whether this recontextualization of class differences persists even when teachers across different school streams begin their lessons within the public domain.

6.2 Class Differences in Using of the Public Domain

This section explores the utilization of the public domain within the content dimension of pedagogic practices. As Dowling posits, the public domain serves as a resource for recontextualization, enabling teachers across different social classes to craft pedagogic practices with varying degrees of discourse saturation. Through this process, teachers construct learners' positions within hierarchical power relations. Content embedded in the public domain typically falls into three categories: domestic settings (e.g., shopping), work settings (e.g., income), and school settings (e.g., ages of students, purchasing student tickets).

In this study, I have streamlined these categories into two broad settings: everyday settings and non-everyday settings. This simplification is due to the limited number of participants in the research. "Everyday settings" refer to contexts that are deeply embedded in students' daily lives, such as using the example of sharing a pizza to introduce the concept of fractions. Conversely, "non-everyday settings" encompass content that is distant from students' everyday experiences, such as fairy tales, historical events, or foreign contexts.

This section aims to illustrate how class differences manifest in the use of everyday and non-everyday settings within the public domain. By examining these distinctions, the study seeks to understand how class differences are recontextualized through the application of the public domain in pedagogic practices. Furthermore, this analysis attempts to investigate whether the patterns observed in the Chinese context align with Dowling's findings, which suggest that the use of the public domain in school mathematics is regulated by social class principles.

6.2.1 The Utilization of Non-everyday Setting in Public Domain

6.2.1.1 Extract 5

1. T: Our goal today is to design our own algorithms program. To accomplish this task, let's start by looking at a few examples. (Opened slide) Look at this picture. What is it? Let's take a look at a picture. What is it?
2. Ss: A black hole!
3. T: On April 10, 2019, the first photo of a black hole in human history was released. It is well known that a black hole is an object of great mass and gravity. Any object close to it will be absorbed in, even light. That's why it is called a black hole. So as a scientific and technical discipline, is there any phenomenon similar to a black hole in mathematics? Please do the task shown on the slide.
4. (The task revolves around Kaprekar's constant. Students are instructed to follow these steps: 1. Select any four-digit number, using at least two different digits (leading zeros are allowed); 2. Arrange the digits in descending and then ascending order to create two four-digit numbers, adding leading zeros if necessary; 3. Subtract the smaller number from the larger number; 4. Repeat steps 2 and 3. This iterative process always converges to the fixed point, 6174, known as Kaprekar's constant. Once 6174 is reached, subsequent iterations continue yielding 7641 – 1467 = 6174. Therefore, 6174 is also referred to as the black hole number.)

（Students do exercise）

5. T: (evaluated students' answers and asked their elaboration of procedures, then made a conclusion). Like the phenomenon of a black hole, 6174 is the four-digit black hole number, cause all the numbers to be looped around and absorbed into this black hole number. So, overall, the four-digit number has its own black hole number. Does anyone have any other ideas? (Then students started to find the three-digit and two digit-black hole number.)

(*Note: This sample is extracted from an upper-stream school, ranked in the top 3 in the city, according to student scores in examinations and school reputation. The classroom has 40 students, sitting in a clean and bright classroom equipped with advanced teaching facilities*.)

Analysis

The teacher begins the lesson with a non-daily life example, presenting an image of a black hole and offering a brief description. In the context of pedagogic task, this phase is characterized by weak classification in both the dimensions of expression and content, and thus the preparation stage is coded as operating within the public domain. The teacher's intention is evident: to engage students in the lesson by leveraging intriguing and novel materials. However, she swiftly transitions to the mathematics content by asking if there is any analogous phenomenon in mathematics to the black hole (Line 3). Consequently, the content prior to Line 3 represents the preparation stage, while the content following Line 3 marks the presentation of new mathematical concepts.

The teacher's use of a problematising approach at this juncture is particularly noteworthy. By posing a question that introduces the next topic, she employs a strategy known to enhance student engagement (Scott et al., 2006). Such questions are not designed to elicit answers from students but rather to set the stage for the tasks that follow. After this introductory phase, the teacher introduces a high discourse saturation (DS+) mathematics exercise. In providing feedback on this exercise, she effectively bridges the abstract concept of a black hole with the mathematical content. This teacher drew a parallel between the mathematical symbol "6174, a four-digit black hole number", and the nature of black holes highlights a similarity: all numbers, through specific operations, inevitably converge to 6174, just as all matter near a black hole is absorbed in and ends at a singularity. Both embody the idea of an inescapable endpoint, which serves as a central theme in the new content.

As the lesson progresses, the teacher broadens the discussion to include three-digit and two-digit numbers. Through this process, the students are constructed as potential subjects, positioned as “apprenticed” learners who are acquiring the specialized language and symbols of mathematics.

Importantly, this teacher devotes minimal time to describing the background context of the black hole example. By quickly extracting and repurposing the property of black holes in subsequent mathematical tasks, she effectively shifts the students’ attention from the background context to the mathematical principles at play—specifically, the concept that certain numbers will consistently reach a fixed point through a series of steps. This pedagogical approach aligns with Dowling’s observation that middle-class educational practices tend to minimize the emphasis on background details in pedagogic tasks.

6.2.1.2 Extract 6

In the bottom-stream classrooms there are also some teachers using non-domestic examples in the public domain, but in different ways of using. For example, in the preparatory activity extracted from a bottom-stream school, the teacher presents the epitaph of an ancient Greek philosopher on a slide in order to introduce the concept of linear equation:

1. T: So, the nature of "equation" we have reviewed, so here, Wang (Student’s name), read us this Diophantus.
2. S: (stood up and read the story) “Diophantus is an ancient Greek mathematician. Little is known about his life. Much of our knowledge of the life of Diophantus is derived from his epitaph: here lies Diophantus, the wonder behold. Through art algebraic, the stone tells how old: God gave him his boyhood one-sixth of his life, one twelfth more as youth while whiskers grew rife; And then yet one-seventh ere marriage begun; In five years there came a bouncing new son. Alas, the dear child of master and sage. After attaining half the measure of his father’s life chill fate took him. After consoling his fate by the science of numbers for four years, he ended his life.”
3. T: Ok, after reading this story, let us think about two questions: first, what is the key in solving practical problems with equations? What is the key point? (Paused and looked at the class) Who knows? (No one answered) Not sure? Can you find the

equivalence in this story and make an equation? (Pause, look at the class) Both of these questions are difficult, so for answering these questions, we should learn the lesson on Linear equations first. So let us read the goal of this class all together (showed on slide), "the goal for this lesson", ready? read!

4. Ss: learn the content of this lesson, experience the concept of inductive equations, understand the concept of quadratic equations, and master how to use quadratic equations to solve some simple practice problems.
5. T: OK, let's invite two students for a situational performance.
6. (Two students perform the situation of guessing each other's age in front of the class, so the pedagogic task moves on to the next. The philosopher's story is not mentioned in the subsequent lesson any more.)

Analysis

In this extract, the content and expression are characterized by mathematically weak classification, identifying it as part of the public domain. The narrative focuses on the life story of an ancient Greek mathematician rather than on specialized mathematical activity. For children in rural northwest China, this story is not rooted in their daily lives and is far removed from their individual experiences and circumstances. However, unlike the upper-stream teacher's use of the abstract black hole example—where the teacher simply presented an image of a black hole—this teacher provides an extensive amount of detail, emphasizing the life story of the philosopher while relegating the abstract mathematical content to the background.

The narrative not only summarizes the mathematician's life but also includes details about his marriage and children. This heavy focus on biographical elements renders the mathematical messages vague and difficult for students to discern. Consequently, students are more likely to concentrate on the life story rather than engage with the embedded mathematical content. This positions students as "objective" readers of the mathematician's life story rather than as active participants in a mathematical task.

Moreover, in contrast to the upper-stream teacher who repeatedly draws on the concept of black holes to reinforce mathematical principles, this teacher mentions the mathematician's story as a singular example without subsequent references to the story or its mathematical implications. The following examples she cites are contextually separate from one another and

bear no connection to the initial narrative. As a result, while this example does not draw from daily life, its use in the public domain primarily foregrounds the background story, while backgrounding the esoteric mathematical messages.

The divergent approaches to using non-domestic examples in the public domain by these two teachers from different school streams provide cross-cultural empirical support for Dowling's proposition. Dowling's analysis of mathematics textbooks across social classes reveals that middle-class textbooks often simplify contextual information within tasks, while working-class textbooks tend to offer diverse and detailed contexts, thereby diluting the esoteric domain messages. Additionally, middle-class textbooks typically reuse the same context across multiple tasks, enabling students to concentrate on the core mathematical content. In contrast, working-class textbooks frequently present different contexts for different tasks, which can detract from the focus on mathematical principles.

Even when teachers from different school streams utilize daily life settings within the public domain, class-based differences in pedagogic practices persist. This distinction is further exemplified in the following extracts.

6.2.2 The Utilization of Everyday Setting in the Public Domain

In this section, not only the settings are both in everyday life, but the new mathematics content introduced by these two teachers are the same, "rotation of shapes". They both chose to introduce this topic by showing daily life pictures. However, the specific examples they chose also reflect their class backgrounds.

6.2.2.1 Extract 7

T: Did you all go to Disneyland (located in the city of Shanghai, 1400km away from Xi'an) on your summer holidays? Have you all seen the Ferris wheel there?（Then displayed on slide） Let us look at this and think about its properties.

6.2.2.1 Extract 8

T: Today we are going to learn the “rotation of shapes”. Look at these pictures on the slide, which show the swings in the Kunming Lake Park near our school.

Analysis

This comparison of class differences in selecting examples from daily life aligns with Dowling’s (1998, p. 262)assertion that “social class identification is sometimes achieved more directly through the differential recruitment of settings”. The variations in examples reflect disparities in the real-life experiences of students across different school streams. Upper-stream students, who have greater financial resources, often engage in diverse and high-cost activities such as traveling to bustling cities, visiting museums, attending concerts, and participating in expensive sports. In contrast, students from lower streams typically access less costly and more local recreational activities, such as visiting parks or watching television.

These differences in daily life experiences and entertainment options are indicative of social divisions of labours. Intellectual workers, who generally have higher incomes, are more likely to afford a range of leisure activities and cultural experiences that signify higher social status. These activities often include access to symbols of cultural capital, such as classical music concerts, golf, museums, and opera houses. Such symbols help maintain their social position by creating distinct cultural and economic insulations from the working class.

Conversely, manual labourers, with their limited income, are restricted to more accessible and affordable leisure activities. Their lack of exposure to the symbols of the dominant class contributes to their subordinate social position. These class-based differences in experiences and symbols are subtly reproduced in pedagogic messages, reinforcing social stratification through pedagogic practices. Thus, students from different streams are tacitly placed into vertical and horizontal power relations, perpetuating social hierarchies within the educational context.

6.3 Site Notes

Additionally, the class differences are visually apparent in the educational videos sourced from China’s public education platform. These videos, recorded and uploaded by teachers from their respective schools, exhibit clear disparities in qualities of the images and filming of the videos. Upper-stream school videos typically feature well-equipped classrooms with bright lighting, modern teaching facilities, and professional-grade audiovisual equipment. These videos are

often professionally edited, with detailed credits and multiple camera angles capturing both teacher and student interactions.

In contrast, videos from middle-stream schools generally show average classroom settings with standard equipment as mandated by state requirements. These videos are less polished and may include fewer camera angles and less sophisticated editing.

Bottom-stream school videos starkly contrast with those of higher streams, revealing notable differences in classroom equipment and recording quality. These classrooms are usually equipped with outdated or minimal technology, such as basic projectors and computers. The videos are often recorded with a single camera positioned either at the front or back of the room, resulting in limited visibility and lower sound quality. In some classrooms, recordings are made with mobile phones, leading to shaky footage and poor audio. The lack of proper editing and credits further highlights the disparity in resources. It can be imagined that the presence of a mobile phone- or video camera-holding person at the time of recording inevitably have affected the teacher-student interactions in classroom practices as well. Moreover, almost all the videos I extracted from bottom-stream have no audio recording equipment, thus, the voices of the teachers and students are lower, and the sound quality is poorer. Meanwhile, these videos are unedited and lack proper credits. These differences described can been seen from screenshots illustrated.

Upper-stream Classroom: The upper-stream classroom is characterized by its modern and spacious design, featuring advanced teaching facilities. Notably, it includes a touch TV screen (as shown in Image 6.1), allowing students to interact directly with the digital content. The classroom is equipped with multiple cameras (Image 6.2), providing various angles and comprehensive coverage of the learning environment. Additionally, the video recordings are professionally edited (Image 6.3), ensuring high-quality visual and audio presentation.

Middle-stream Classroom: The middle-stream classroom, while relatively new, is outfitted with standard facilities mandated by state regulations. This includes a screen and a traditional push-pull blackboard (Image 6.4). Unlike the upper-stream classroom, the screen in this setting does not support direct interaction, necessitating the use of the blackboard for writing and drawing (Image 6.5). This results in a less interactive and dynamic presentation compared to the upper-stream facilities.

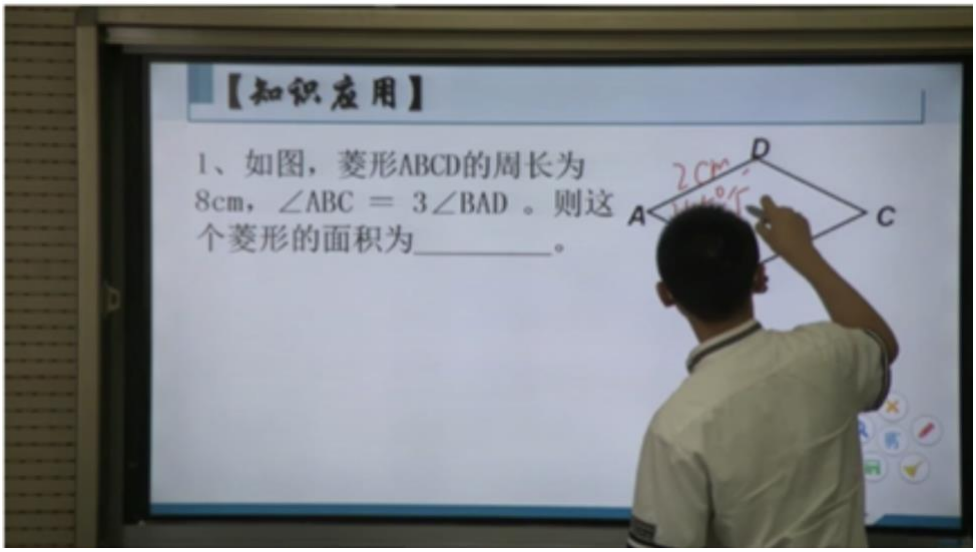


Image 6. 1

Image 6. 2

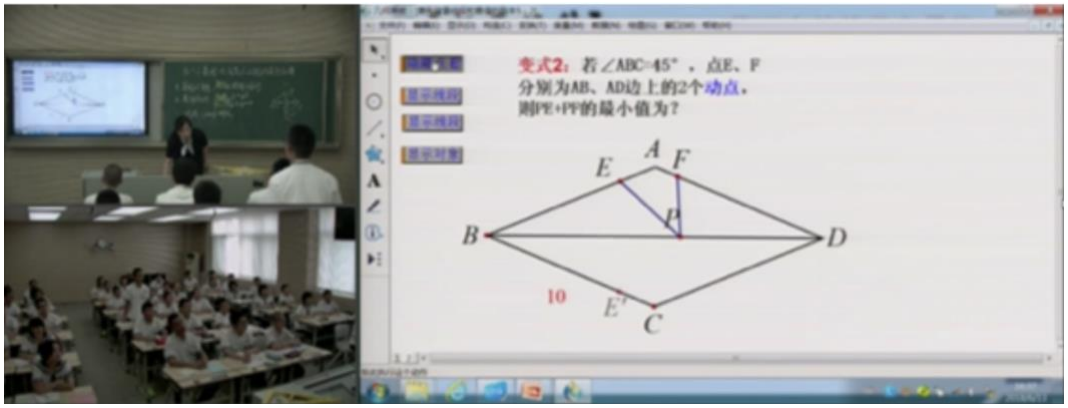


Image 6. 3

Image 6. 4

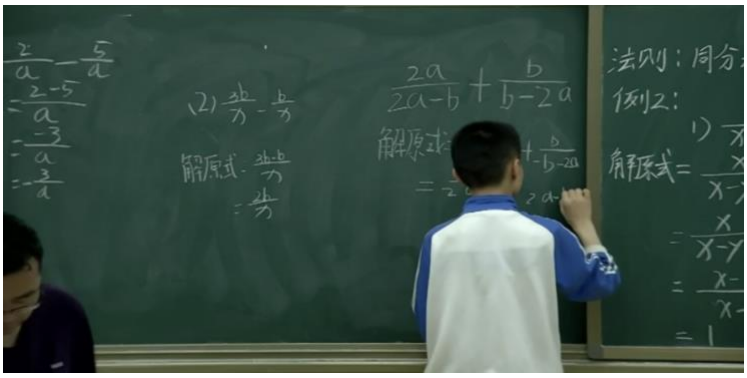


Image 6. 5

Image 6. 6

Bottom-stream Classroom: The bottom-stream classroom exhibits signs of significant wear and outdated equipment. It features a screen, and an old television mounted in the corner (Image 6.6). The video recording is captured by a single handheld camera positioned at the back of the room. This camera provides limited perspective and requires frequent adjustment as the teacher moves, resulting in less effective coverage and lower quality of the recording.

6. 4 Discussion

This study examines how teachers' selection of domains of practices and instructional strategies influences the degree of discursive saturation and the power relations that students experience. The investigation aims to elucidate how recontextualization of class differences plays out throughout this process.

A total of 33 teachers' pedagogic practices were analyzed, from the preparation stage to the presentation stage, using Dowling's SAM. The statistical results are detailed in Table 6. 1. The findings reveal that, in Chinese mathematics classrooms, teachers rarely initiate lessons within the expressive domain. Among the remaining three domains, upper-stream teachers show a relatively even distribution across the three domains, each accounting for approximately 30% of the total. In contrast, teachers from middle- and bottom-stream schools predominantly initiate lessons from the public domain, with middle-stream teachers at 64% and bottom-stream teachers nearly at 50%.

Within the public domain, however, a notable class-based difference emerges. Upper-stream teachers employed more examples from non-everyday settings, such as abstract concepts, while middle- and bottom-stream teachers predominantly use everyday settings. Specifically, two of the three upper-stream teachers employed abstract, non-everyday examples. In contrast, seven out of eight middle-stream teachers used everyday settings, and all five bottom-stream teachers exclusively chose everyday settings.

These variations in example selection are consistent with Dowling's findings from his analysis of British teacher's guidebooks. Dowling observed that working-class guidebooks tend to have teachers use simpler, simple-minded tasks and perceived as a default that these students needed a greater diversity of forms of pedagogic actions, materials and a greater variety of presentations, methods, and so on. Conversely, middle-class guidebooks often reuse similar contexts, allowing students to focus more on mathematics content. In addition, when different streams use non-daily life settings, upper-stream teachers typically extract and abstract key similarities between the background and mathematical knowledge, whereas non-upper-stream teachers provide extensive contextual details, which may obscure the mathematical content. Besides, even when all streams use examples from the daily life settings, the stratification of the daily life of the different streams is also reflected.

Table 6. 1 Descriptive Statistics of analysis results across three streams of schools

Streams of schools	Domains of Practice				Textual Strategies		Discourse Strategies		Strategic Space of Instruction		
	Esoteric	Public	Descriptive	Expressive	Expanding	Limiting	Abstracting	Particularizing	Generalizing	Fragmenting	Localizing
Upper (11)	3	3	4	1	10	1	9	2	9	2	0
Middle (11)	2	7	2	0	9	2	1	10	2	7	2
Bottom (11)	4	5	2	0	9	2	3	8	3	6	2

The study also finds no significant difference in message strategies across different streams, with nearly all teachers employing expanding message strategies. This suggests that in Chinese mathematics classrooms, there is a general tendency to integrate more esoteric domain messages from the preparatory stage through to the presentation of new content. This uniformity may be attributed to the standardized curriculum and assessment requirements across provinces. The syllabus strictly outlines what objectives and content are to be accomplished at each stage, even specific to each lesson, limiting teachers' pedagogical flexibility.

In contrast, there is a marked difference in discourse strategies. Upper-stream teachers predominantly use abstracting strategies, employing metonymic connections to link tasks logically and intuitively. This approach facilitates access to the esoteric domain and aligns with higher-order school mathematics practices. In contrast, middle- and bottom-stream teachers primarily use particularizing strategies, which aligns with Dowling's proposition that particularizing strategy is used for low ability students, translated from their social class. These teachers prefer to connect tasks based on their similarities to impoverish the complexity of the mathematical symbolic system. This approach aims to make content more accessible but may interrupt the students' access to the esoteric domain, thereby constructed students as "dependent" or "objectified". This reflects a pre-existing judgement on students' cognitive abilities based on their respective family background when teachers proceed pedagogic assemblies. When teachers select their level of classroom discourse, they by default regard higher-stream students as high ability, who can comprehend abstract classroom discourse. On the contrary, teachers by default treat lower-stream students as low ability, being competence at a comparatively low level of mathematics and low task complexity. Therefore, these teachers deconstruct abstract mathematics knowledge into multiple tasks, by using various pedagogic actions, particularizing pedagogic strategies, and setting which are highly individual experience and circumstances dependent. These ultimately constrain participation of lower-class students in esoteric mathematics.

The observed class differences in the selection and utilization of the public domain align with Dowling's findings, which suggest that pedagogic practices reflect class differences in social consciousness. Additionally, these findings offer empirical support for Bernstein's assertion that social class differences are translated into variations in cognitive skills across social groups (Bernstein, 2000), which are applied in pedagogic practices and continuously consolidate social structure. Firstly, teachers' choices of pedagogic tasks with varying contextual backgrounds indicate an internalized awareness of students' class-based

experiences. For instance, teachers consider high-class children have access to abstract information such as black holes, whereas lower-class children are exposed to highly daily-dependent information like parks nearby, reflecting an assumption that students respectively engage with such settings and material. Moreover, the use of background information in pedagogy varies according to the perceived cognitive abilities of students from different social classes. Higher-class students are considered as highly competent and thus are assumed to need less contextual support to understand abstract mathematical concepts. Conversely, lower-class students are considered less capable, necessitating more detailed contextual information to facilitate their understanding.

Clear differences are evident between the upper and lower streams, while no significant differences are observed between the two lower streams. This generally aligns with the "土" social structure proposed by Li (2016), where the gap between the middle and bottom is relatively small. This may be due to the fact that students in both lower streams predominantly come from restricted code backgrounds. The middle stream largely consists of students from migrant families, whose backgrounds are similar to those in the bottom stream. Their parents are engaged in low-income, manual labour and lack cultural capital. Only students in the upper stream possess an elaborated code. When delivering pedagogic texts, teachers select and organize tasks based on their perceptions of students' abilities, reflecting a view that migrant and rural students have similar capacities.

This differentiation in pedagogic practices does not merely recontextualize class differences but actively perpetuates them. These stratified pedagogic practices constrain students in their social class through transmitting languages and contents attributable to their social division of labours. This results these lower-class children' inaccessible to symbols and contents beyond their social division, which, ultimately, maintain the social stratification.

In summary, the class-based differences in selection and transmission of pedagogic messages observed in this study underscore the alignment with Dowling's and Bernstein's theories, demonstrating how recontextualization plays out during the convey of pedagogic messages.

Chapter 7 Data Analysis Class Differences in the Content of Feedback and the Ways Feedback is Conveyed

Introduction

This chapter presents the analysis whether, and in which way, teacher feedback exhibits class differences, operating as a recontextualized pathway of the principle of social class. Feedback on student responses allows teachers to assess students' knowledge status and then orient students towards abstract mathematical concepts and learning goals through providing clues or guidance. This chapter analyzes content of feedback and ways of its transmission. This analysis draws on Bernstein's evaluative criteria on instructional and regulative discourses for analyzing feedback content and adjusted sequencing and pace extracted from rules of pedagogic discourse for analyzing its ways of transmission. The course of feedback levels as the indicator of sequence rules within each teaching task was identified and categorised based on the framework built in Chapter of theoretical framework. Furthermore, the movement of teacher feedback along the course of feedback levels is taking as the indicator of measuring the pace of providing feedback.

This chapter consists of three sections: Section 1 focuses on the content of feedback. It analyses on evaluative criteria both on instructional discourse and regulative discourse. Criteria on instructional discourse are categorized into competence model which focuses on development of students' long-term mathematics abilities, as well as performance model which focuses on students' short-term scores in mathematics examinations. Criteria on regulative discourse are conveyed indicating its explicitness, marked as a strong framing, while their absence indicates its vagueness, noted as weak framing. Section 2 concentrates on the ways of feedback transmission. It scrutinizes class differences in the movement across the course of feedback levels and pace of providing these hierarchical levels of feedback. Section 3 summarizes the results of these dimensions across three school streams and presents a discussion on class differences exhibited on these dimensions.

7.1 Evaluation Criteria Embedded in Feedback

The first stage of analysis of evaluative criteria was to investigate all tasks across preparatory activity to the end of exercise within nine selected sample classrooms. Evaluative criteria were coded both for instructional and regulative discourse across all these tasks. Criteria for instructional discourse were coded based on their orientation, either toward fostering students' long-term mathematics competence (F^-) or their short-term performance (F^+). Criteria for regulative discourse were coded based on transmission: a strong framework (F^+) if transmitted, a weak framework (F^-) if not. Four Extracts are demonstrated to illustrate the class differences in evaluative criteria transmitted through feedback.

7.1.1 Evaluative Criteria for Instructional Discourse

The first case of criteria for instructional discourse presents an evaluation oriented to competence model transmitted by an upper-stream school teacher.

Extract 1 (*The task is Shown in Figure 7. 1, Content in brackets were added by the author for a better understating the conversations.*)

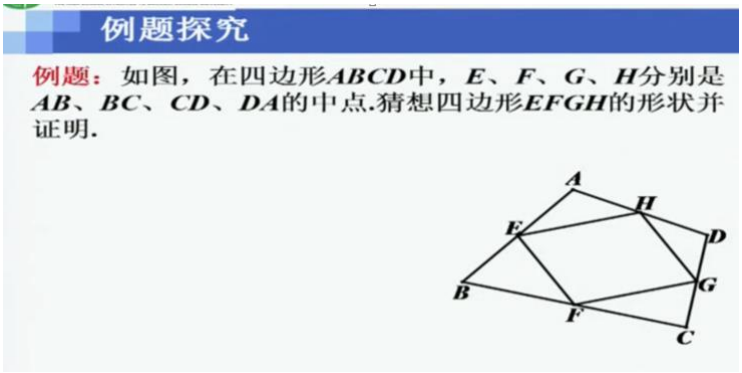


Figure 7. 1 A task demonstrating the transmission of instructional discourse criteria

Note: Example: As shown in the figure: in quadrilateral ABCD, E, F, G, H are the midpoints of AB, BC, CD, DA respectively, guess the shape of quadrilateral EFGH and prove it.

1. T: Next, let's look at an example. Take a guess, what shape do you think this quadrilateral is?
2. SS: It's a parallelogram.
3. T: Who can tell me why you think it's a parallelogram?
4. S7: Teacher, I have connected points A and C, points B and D.

5. T: Why did you think of connecting points A and C and points B and D?
6. S7: Because it has four midpoints (on each side), connecting them we can construct triangles.
7. T: Construct triangles, right?
8. S7: Yes, construct triangles. Then EH is a midsegment of triangle ABD, and FG is exactly a midsegment of triangle CBD. So, EH is parallel to BD, and GF is also parallel to BD. According to the property that two lines parallel to the same line are parallel to each other, we can deduce that EH is parallel to GF. Similarly, HG is parallel to EF. Therefore, a quadrilateral with two pairs of opposite parallel sides is a parallelogram.
9. T: Does that make sense?
10. SS: Yes.
11. T: Good, very good. He connected points A and C and points B and D separately by using the midsegments. Does anyone have a simpler solution?
12. SS: Connect one (of them).
13. T: Connect one, and what can we use to prove it is a parallelogram?
14. SS: One pair of opposite sides of a parallelogram are parallel and equal.
15. T: One pair of opposite sides of a parallelogram are parallel and equal, right?
16. SS: Yes.
17. T: If we connect AC now, we can know who is parallel and equal to whom?
18. SS: EF and HG.
19. T: EF and HG are parallel and equal. One is the midsegment of triangle ABC, and the other is that of triangle ACD. Are their base sides the same?
20. SS: Yes.
21. T: Let's demonstrate this process (display on the slide). Since E, F are the midpoints of AB and BC, so line segment EF is parallel and equal to $\frac{1}{2}$ of AC, similarly, line segment HG is parallel to AC, and HG equals half AC. Finally, based on opposite sides being parallel and equal, we conclude it is a parallelogram.

Analysis

The evaluation criterion conveyed by the teacher in this task is identified as a competence model, denoted as F^-. Firstly, all feedback provided by the teacher throughout the task is highly task-related, with embedded criterion aimed at assessing students' understanding of mathematical concepts and guiding them towards learning goal. Consequently, the teacher

transmitted only the evaluation criteria for instructional discourse. Additionally, the criteria are not provided directly and explicit but rather embedded and diffused throughout the task feedback. Specifically, from Line 1, the teacher's intent can be identified as the application of the just learned concept, that is the mastery of the property that "a midsegment of a triangle is parallel to one side of the triangle and equals half the length of the parallel side".

However, the teacher did not explicitly state this criterion but achieved it procedurally through ongoing evaluative feedback. Initially, when students respond to a question, the teacher does not confirm the answer directly but instead asks probing questions to elicit the key mathematical concept required to complete the task (Line 3). The students, however, respond by describing the steps rather than articulating the underlying concept (Line 4). The teacher's feedback remains in the form of questions, attempting again to elicit the concept (Line 5), keeping the criterion implicit. The teacher provided a clear affirmation only after the student fully described the strategy and concept, he used in solving the task (Line 11), which subtly conveys the criterion. By affirming the strategy, the teacher implicitly emphasizes mastering the properties of the triangle's midsegments to solve parallelogram-related problems. The teacher then asks if there is a simpler solution (Line 11), and the class suggests connecting a single diagonal to use the property of parallel and equal opposite sides in a parallelogram. Still, the teacher does not explicitly mention the triangle's midsegments but breaks the solution into steps through feedback and guides students to deduce the need for parallel and equal sides (Line 19). The teacher then explains this method (Line 20) and concludes by embedding the property of triangle's midsegment into the overall problem-solving strategy. By using the triangle's midsegment property, they deduce the parallel and equal opposite sides, completing the task (Line 22).

Throughout the task, the teacher does not directly instruct students to use the triangle's midsegment property to solve the problem. Instead, the teacher encourages students to identify the conditions necessary to complete the task, embedding the midsegments property within the problem-solving strategy. This approach deepens students' understanding of the mathematical concept by reinforcing its application in new contexts.

The way of transmitting criterion leads to a weak framing of hierarchical rules on pedagogic relationship. The teacher did not act as an authoritative criteria transmitter by directly informing students of the required mathematical concepts. Instead, through continuous questioning, the teacher orientated students towards the learning goal. Additionally, the teacher's "why" questions, which have open-ended answers, encourage students to engage in

higher-order thinking by prompting them to articulate their strategies and thoughts. These questions also foster reflective thinking and promote student autonomy. The weak hierarchy is also evident as the teacher did not directly confirm student answers but sought opinions from other students (Lines 9 and 10).

Regarding the mode of communication, the teacher initially preferred individualized communication, asking an individual student to articulate his thought and reasoning, which is one of indicators of identifying evaluation as competence model. Although the latter part involved dialogue with the entire class, the teacher's feedback was not imperative but predominantly took the form of questioning. Therefore, to sum up, the evaluation criterion in this task is a competence model, and the hierarchical rules between the teacher and students are characterized by a weak framing.

Extract 2

(*The teacher asked a student to write down his problem-solving process on the blackboard, and then invited the whole class to evaluate the answer together*.)

1. T: The other students look at what this student has done. First, translate "parallelogram diagonals bisect each other" into geometric language, right? Given quadrilateral ABCD is a parallelogram. Prove that angle A equals angle C, and angle B equals angle D. He used my diagram, right? No need to draw it himself. How did he prove angle A equals angle C, and angle B equals angle D? What didn't he write?
2. SS: "Prove". (The student did not write out these words before doing this exercise)

3. T: Right, we must write out "Prove". He hasn't written it out. Because of what? Because quadrilateral ABCD is a parallelogram, so AB is parallel to CD, and AD is parallel to BC. What can we obtain from parallel lines? Angle B plus angle C equals 180 degrees. Because AB is parallel to CD, right? So, angle B plus angle C equals 180 degrees. Why (angle B plus angle C equals 180 degrees)?
4. SS: Because the interior angles on the same side of a transversal are supplementary.
5. T: And angle D plus angle C also equals 180 degrees, for the same reason. Angle A plus angle B equals 180 degrees. Angle A plus angle B equals 180 degrees (The teacher repeated). So, what does this tell us?
6. SS: Angle A equals angle C.

7. T: Angle A equals angle C. Also writing angle B equals angle D following these steps (The student's answer presents the procedures of proving ∠B = ∠D which are identical as those of ∠A = ∠C). But it seems a bit messy, doesn't it? How can we rewrite it to make it clearer? Based on angle A plus angle B equals 180 degrees. Angle A plus angle B equals 180 degrees, so what can we deduce?
8. SS: Angle B equals angle D.
9. T: We can deduce that angle B equals angle D. Do we need to write this (referring that the student's answer detailed the process of proving that ∠B = ∠D).
10. SS: No.
11. T: What can we change it into?
12. SS: Similarly.
13. T: Right, similarly. Angle A equals angle C, angle A equals angle C. It's much clearer this way, isn't it?
14. SS: Yes.
15. T: So, what should we do in doing geometric proofs? Clear and concise. Who (among you) has used this method for proof? According to the properties of parallel lines. How many students? (Two students raised their hands) Two students. Alright, Student 1, tell us about your approach.

Analysis

In this instructional task, the teacher's evaluative criteria are recognized as performance-oriented, denoted as F^+. Although the teacher conveyed the criteria in this task were all for instructional discourse, she highlighted missing or incorrect aspects in students' answers, using assessments like "what didn't he write?" (Line 1) and "writing angle B equals angle D like this seems a bit messy, doesn't it?" (Line 7). These criteria were clearly informed and focused on ensuring that students' responses would score well in exams. Such details do not affect students' understanding and mastery of mathematical concepts but are crucial for achieving higher scores. To be specific, not explicitly writing "Prove" (Line 3) might not impact conceptual understanding but could lead to point deductions by strict examiners. Additionally, the teacher suggested writing the repeated steps more concisely, noting that the process of proving angle B equals to angle D is repetition of similar process of proving angle A equals to angle C (Line 9). The teacher assessed the repeated steps as "a bit messy" and, through questioning, guided the student to revise it to "similarly" (Line 12) to maintain a neat appearance on the paper. The

teacher then explicitly confirmed this answer and clearly conveyed the criteria of "clarity and conciseness" (Line 15) for the revised solution. This way of writing proof steps does not deepen students' understanding, or at least does not impair it. However, it can save time, especially during exams. Accordingly, for students, writing in this way can help them efficiently demonstrate mastery of concepts, allowing examiners to quickly assess the complete steps. This ensures students do not lose deserved points due to repetitive or unclear presentation.

Overall, these evaluative criteria conveyed within this task is identified as performance model, focusing on students' present textual product and exam-scores. The teacher informed these specific and explicit criteria directly to all students, presenting a communication mode with the whole class, which demonstrates a strong framing of hierarchical rules.

Apart from criteria for instructional discourse, evaluative criteria related to regulative discourse in classroom tasks were found in feedback from middle and bottom-stream teachers.

7.1.2 Evaluative Criteria for Regulative Discourse

Extract 3

1. T: m^2-9, m^2-9. The second one, 1- $16b^2$. Come on, let me hear someone. Come. Look up and see, 1- $16b^2$, 1- $16b^2$. S3, what is it equal to? (Student does not stand up)
2. T: Sit there while answering a question, huh? What is 1-$16b^2$?
3. S3: 1-4b.
4. T: It is 1-$(4b)^2$, not just 1- 4b.

Analysis

"Sit there while answering a question, huh?" (Line 2) is a rhetorical question that implicitly conveys the criterion, "students must stand up when answering questions". This criterion for student behaviour reflects a strong farming of hierarchical rules between the teacher and students. The teacher's requirement for standing up while answering questions underscores their authoritative position in pedagogic communication. Sitting while answering can be perceived as disrespectful towards teachers, echoing traditional Chinese Confucian pedagogic practices where teachers play a central, authoritative role.

This practice also mirrors social norms in other contexts, where children are expected to show deference to elders or professionals, adhering to established social rules due to their lower hierarchical position.

Extract 4

1. T: Then I'll let the student from the front to speak. Come on, you again (referring to a student who just answered a previous question).
2. (This student stood up and was going to answer)
3. T: Raise your hand first!
4. (The student sat down, then raised her hand.)
5. T: Say!
6. S: This one is correct.

Analysis

This extract illustrates a strong control of the teacher over the classroom communication. When the student had already stood up to answer the question, the teacher said, "raise your hand first" (Line 3). After the student sat down and raised her hand again, the teacher allowed her to stand up and answer. The teacher clearly transmitted a criterion of classroom behaviour: students must "raise your hand first" and wait for approval before participating.

Moreover, this teacher repeated the phrase "raise your hand first" multiple times throughout the class. For example, when selecting a student to answer questions, the teacher said, "okay, you answer, you raised your hand the quickest". This criterion of selection reflects a formalized and strict hierarchical order, demonstrating teacher's strong control over students. It is also a microcosm of social hierarchy in the classroom, where a child must obtain permission from superiors, including parents and teachers, to participate in the order of activities.

7.2 Class differences in Ways and Paces of Providing Feedback

This section analyzes the ways of providing feedback, focusing on the feedback levels teachers enable their students to access and the pace at which they progress through these levels within a specific task. The analytical framework is outlined in the instructional rules section of pedagogic discourse in Chapter 2.

7.2.1 Extract 5

1. T: Can you cut a right-angled triangular piece of paper into two parts and then rearrange them to form a rectangle? (Students start working with scissors and paper.) Which group would like to share how you did it? S1, please represent your group and share with us.
2. S1: We connected the midpoints of one leg and the hypotenuse of the original right triangle, and then cut along this line, splitting the triangle in half (in two parts). We then flipped one half upside down to make a rectangle.
3. T: Let me take hers and share it with you all. Look, this is her original right-angled triangle. She took the midpoints of one leg and the hypotenuse, and then cut the triangle into two parts along the line connected by the two midpoints. She then rearranged the pieces to make a rectangle. Now I would like to ask S1, how did you come up with this approach?
4. S1: By dividing the hypotenuse, the pieces fit together perfectly. If you cut one leg into two sides, the resulting two opposite sides will be equal. Also, with a 90-degree angle, it can be made into a rectangle.
5. T: Very good, please sit down. Let's look at her reasoning. She said that by dividing at the midpoint of the hypotenuse, the resulting two sides can be perfectly combined, right?
6. SS: Yes.
7. T: Right? It also ensures that this side (the leg) is also divided from the midpoint, right? So, it is equal to the remaining side (half of the previous leg, pointed out by the teacher)? Well, let's see, we've got a rectangle. Now, let me show it. Here (pasted on the blackboard), I also made a right triangle. How did I cut it? Like S1, I also connected the midpoints of these two sides. Then, I cut the triangle along the line linking these two midpoints, then I rearranged the cut-off part to combine it with the other side (operating on the blackboard). Did it form a rectangle?
8. SS: Yes.
9. T: Is there any other way? Are there any other midpoints on the two sides that can be connected?
10. SS: Yes.
11. T: Can we cut along the midpoints of the hypotenuse and the other leg (the other right-angled side)? If I cut this side, can it also be made into a rectangle? Let's look at the slide: (shows two methods of taking midpoints and then rearranging into a rectangle on Slide).

12. T: Now, can you think from the perspective of geometric transformation about how it forms a rectangle?
13. SS: Rotate.
14. T: Rotate around which point?
15. SS: Point E.
16. T: Rotate the triangle CDE around point E in which direction?
17. SS: Counterclockwise.
18. T: By how many degrees?
19. SS: 180 degrees.
20. T: Does this form the rectangle we need?
21. SS: Yes.
22. T: Now, let's watch the animation. (The slide shows the dynamic transformation from triangle to rectangle.)

Course of Feedback Levels Within the Task

The teacher implicitly acknowledged the correctness of the student's work by saying, "I'll share what she did with you," (Line 3) rather than using explicit confirmation signals like "yes" or "good." He revoiced the procedures the student took to complete the task and then orientated the discussion to process level by asking, "how did you come up with this approach?" (Line 3). This question aimed to uncover the crucial concepts behind the student's process. The student responded with a comprehensive strategy, which the teacher confirmed and reiterated, emphasizing her conceptual rationale. The teacher also demonstrated the procedure to the entire class using his own work.

Next, the teacher extended the task by asking if there were other possible solutions, which indicates an abstract level of feedback. Encouraging multiple methods to solve the same problem helps students consider different perspectives and develop a deeper understanding of the concept. This can be termed as "instructional density", referring incorporating more goals and strategies into a single lesson, which can be used for distinguishing outstanding teachers from their more average colleagues (Hall, 2003, p. 317). After providing a method directly, the teacher further extended the task by asking students to think about forming a rectangle from the perspective of geometric transformations. During this abstract level of feedback, the teacher connected previously learned abstract mathematical concepts, geometric transformations, with the properties of rectangles. This approach helped students apply their mastered knowledge to

new mathematical content, enhancing their constructive comprehension. Thus, in this teaching task, the teacher's feedback ultimately reached the abstract level.

Pace

The description of providing feedback levels reveals that the pacing of this task was a strong framing, as well as all tasks coded: the teacher controlled the expected rate at which level of feedback were acquired. However, this teacher's expected rate of acquisition was high, namely, the pace was quick. To be specific, he bypassed simple confirmation and immediately described the student's procedures. Furthermore, he did not repeatedly ask for getting confirmation from other students but moved directly to the process level. After conveying messages at this level, he quickly guided students to the abstract level by initiating a question.

In addition, at the abstract level within the course of feedback, the students' answer was incomplete and did not meet the school's requirement for a legitimate text. The teacher used brief questions to prompt students to think about the missing parts of their answer, leading to a complete and precise product. Specifically, when the teacher asked students to think about forming a rectangle from the perspective of geometric transformations, the students only answered "rotate" (Line 13). This answer lacked defining conditions. The teacher's brief but effective hints helped the students quickly identify the missing conditions, allowing them to arrive at the correct answer within seconds.

In summary, the teacher's progression through the feedback levels and swift pace, combined with targeted questioning, ensured that students efficiently accessed esoteric mathematical concepts. The following task also demonstrates progression through hierarchical feedback levels, but at a slower pace.

7.2.2 Extract 6

1. T: Since we just talked about the conditions required to use the formula for difference of squares, let's take a look. I'll write down a few expressions, then you see if they can be factored using the formula for difference of squares. How about $-x^2 + y^2$?
2. Ss: Yes, it can.
3. T: Can it?
4. Ss: Yes, it can.
5. T: But at first glance, does $-x^2 + y^2$ look like it fits the formula for difference of squares?

6. Ss: No.
7. T: No. So, what should we do?
8. Ss: Change it.
9. T: Change it. How do we change it? What if we write it as $y^2 - x^2$? (writes on the blackboard). Can we use the formula now?
10. Ss: Yes.
11. T: Yes, we can. Now let's look at $-x^2 - y^2$. Can we use the formula here?
12. Ss: No.
13. T: No. Someone might suggest factoring out the negative sign. If I factor out the negative sign, what happens to the terms inside? They change their signs. The first term becomes x^2, and the second term? Plus y squared. Does this satisfy the formula for difference of squares? Is it still not satisfied?
14. Ss: Not satisfied.
15. T: Is it still not satisfied? So, it's still not satisfied. This still not satisfied. Now think about $x^2 + y^2$. Can it be factored using the formula for difference of squares?
16. Ss: No.
17. T: $x^2 + y^2$, can it?
18. Ss: No.
19. T: No. No, as we said earlier, although both terms are squares, the difference of squares formula requires one positive and one negative term. It doesn't matter which is first, right? We can switch their positions, but they must have opposite signs. Opposite signs, correct? In our formula, the first term is positive and the second is negative. Here, the first term is negative and the second is positive. Can we factor it? Yes. Yes. But these two, $-x^2 - y^2$ and $x^2 + y^2$, can't be factored using the formula. Both terms in these expressions have the same sign, either both negative or both positive. Right?

Course of Feedback Levels Within the Task

This task comprises two exercises designed to reinforce students' mastery of the difference of squares for factorization. In the first exercise, the teacher initially confirmed student responses and prompted further exploration with the question, "so what should we do?" (Line 7). When students responded, "change it" (Line 8), the teacher proceeded directly by writing "$y^2 - x^2$" on the blackboard (Line 9) without elaborating on the specifics or rationale behind the change. After verifying that this expression could be factored using the formula, she transitioned to the

next exercise. The feedback in this exercise remained primarily at the task level, focusing on the question itself without delving into mathematical symbols or strategic insights.

In the second exercise, the teacher's feedback progressed from task-level confirmation to process-level guidance, emphasizing the need to factor out the negative sign to alter the signs within the expression. The summary underscored the prerequisite of having one positive and one negative terms for successful application of the formula, marking an upward movement in the progressive feedback levels.

Pace

The teacher's pace on progressing along these levels of feedback was slow. This was evident in her repeated confirmation-seeking behaviours at a low feedback level, even after receiving concise responses from students. Specifically, upon receiving the response "Yes, it can" (Line 2), she would ask again, "can it?" (Line 3). Similarly, in the second exercise, despite advancing to the process level, she continued to repeat questions such as, "does this satisfy the formula for difference of squares? Is it still not satisfied?" (Line 13). When the whole class responded negatively, she reiterated these questions multiple times, "is it still not satisfied? So, it is still not satisfied. This still not satisfied" (Line 15), without introducing new mathematical principles or symbols. This approach resulted in inefficient repetitions of confirmed responses. By contrast, the subsequent task illustrates a consistent pattern of maintaining a low expected rate for students' knowledge acquisition, despite engaging with abstract level within feedback.

7.2.3 Extract 7

1. T: Next, let's all complete this exercise together. (Shows exercise on the slide) Have a try. Using the prepared parallelograms (two pieces of paper), follow the instructions as shown. (Reads the exercise) "combine two identical parallelogram paper pieces, pin them together at their centre O, and rotate one of the parallelograms 180 degrees around O. What do you observe? Try it yourself first, and then discuss your findings with your peers. Do you notice the same things?
2. (The teacher circulates around the room)
3. T: Are we done? Which group would like to share their findings? S1, would you like to go ahead?

4. S1: I found that after rotating 180 degrees, the shape completely overlaps with the original. It is a centrally symmetric figure.
5. T: Rotating one parallelogram 180 degrees around the center makes it completely overlap with the other. What does this indicate?
6. S1: It is a centrally symmetric figure.
7. T: Yes, and what is a parallelogram?
8. SS: A centrally symmetric figure.
9. T: So, we conclude that a parallelogram is a centrally symmetric figure. Now, where is its centre of symmetry?
10. SS: The intersection of its diagonals.
11. T: Correct, the intersection of its diagonals is the centre of symmetry. Good, very good.

Course of Feedback Levels Within the Task

In this task, the feedback provided remained at the abstract level. The student initially responded with the advanced term "a centrally symmetric figure" (Line 4), but the teacher redirected the discussion by posing a vague classification question, "what does this indicate?" (Line 5). The student reiterated the abstract answer. Finally, the teacher confirmed and reinforced the concept of "a centrally symmetric figure" (Line 9). Throughout the task, the focus remained consistently in the domain of esoteric mathematics knowledge. Subsequently, the teacher directed attention to specific properties of the parallelogram, particularly its "centre of symmetry" (Line 11), thereby maintaining the feedback provided at the abstract level.

Pace

Despite engaging at the abstract level through the course of feedback, the teacher demonstrated a low expected rate for students' knowledge acquisition. Following the students' initial response, the teacher's feedback did not progress to the process level or explore the abstract concept further. Instead, there was a deliberate slowing down in the pace for engaging students with the abstract mathematical term. The teacher repeatedly posed questions such as "what does this indicate?" and "what is a parallelogram?" (Line 7) culminating in the confirmation that "we conclude that a parallelogram is a centrally symmetric figure" (Line 9). By

emphasizing this term multiple times, the teacher aimed to ensure all student understanding of this specific mathematical terminology.

The following task illustrates how the teacher's feedback oscillated through course of feedback levels, indicating a generally slow instructional pace.

7.2.4 Extract 8

This extract is from the same teacher in Extract 7. However, in this conversation, she attempted to slow the pace using a different approach: by proceduralising a complex mathematical principle into step-by-step instructions, gradually deconstructing the abstract concept into a concrete context. She brought the exercise, which had already reached the abstract level, back to the specific task level to help students acquire the knowledge.

1. T: (Reads the question) Given the parallelogram ABCD as shown, with points E and F on diagonal AC, and AE equals to CF, prove that BE equals DF. Let's do a quick analysis and think about it, then answer. (Several minutes later). Do you have any ideas?
2. SS: Yes.
3. T: Raise your hand if you have an idea. S2 (calls on a student with her hand raised).
4. S2: Since ABCD is a parallelogram, AB equals CD and AB is parallel to CD. Therefore, angle BAE is equal to angle DCF. Also, since AE equals CF, triangle BAE is congruent to triangle DCF, so BE equals DF.
5. T: Did everyone use the same method as S2?
6. SS: Yes.
7. T: Very good. To prove BE equals DF, where did she place them?
8. SS: In congruent triangles.
9. T: Triangles ABE and CDF. And how did she prove it?
10. SS: By congruence.
11. T: Using triangle congruence to complete the proof, right? Can we all describe this process verbally?
12. SS: Yes.
13. T: Prove that…, one, two!
14. SS: Given quadrilateral ABCD is a parallelogram, so AB equals CD, and AB is parallel to CD. Therefore, angle BAE is equal to angle DCF. Also, since AE equals CF, triangle ABE is congruent to triangle CDF, so BE equals DF.

15. T: Very good. Now, look at this proof process again. (Displays the proof on the slide) Have you all finished reading it?
16. T: Through this exercise, we can see that when proving line segments or angles are equal in parallelogram problems, what do we generally do? We convert them into?
17. SS: Triangles.
18. T: We convert them into triangles. Right? By proving the triangles are congruent, we can establish the equality of line segments or angles.

Course of Feedback Levels Within the Task

In this task, the teacher's feedback oscillated within the course of feedback levels. Initially, the teacher sought confirmation from the entire class regarding the student's response, which was at the task level. She then transitioned to the process level by asking the class about the strategy used by S2. When the entire class has identified the abstract concept of "congruent triangles" (Line 8), the teacher returned to the specific task context by referencing "triangles ABE and CDF" (Line 9) to aid understanding. She then moved back up to the process level by asking, "how did she prove it?" (Line 9). After the students provided answers, the teacher confirmed their responses and had the students collectively read out the proof process shown on the slide. Finally, she has a summary at the abstract level, demonstrating a movement back and forth throughout the course of feedback levels within this task.

Pace

The pace of the progress along the course of feedback levels is slow, revealing a low expected rate for knowledge acquisition of this teacher. Even after a student clearly provided a complete answer and the entire class confirmed their understanding of "congruent triangles", the teacher did not advance to the abstract level. Instead, she deconstructed the concept back into the task itself, specifying "triangles ABE and CDF" as concrete symbols. She then proceeded by asking, "how did she prove it?" to proceduralize the abstract response.

After the entire class provided the theoretical basis of "congruence" (Line 10), the teacher repeated the confirmation, "using triangle congruence to complete the proof" (Line 11). Subsequently, she asked the entire class to collectively read out the already twice confirmed proving process. When the entire class smoothly repeated the complete proof process,

indicating their mastery of the method, key concepts, and procedural steps, the teacher still did not advance. Instead, she displayed a detailed pre-prepared proof process on the slide for the students to review again. Only then did she summarize and move into general problem-solving strategies for such problems. Therefore, in this extract, throughout the feedback, the teacher procedurally deconstructed the abstract concept, gradually reducing the complexity of the task. She also required multiple repetitions from the students, demonstrating a low expected rate on students' knowledge acquisition.

7.3 Discussion

Table 7. 1 summarizes the number of tasks distributed into each indicator of these dimensions, feedback levels and pace, and evaluative criteria, across three school streams.

Table 7. 1 Summary of numbers of tasks in each dimension of feedback across three school streams

School Streams	Total Number of tasks	The Highest Level of Feedback Accessed			Pace		Evaluative criteria		
		Task	Process	Abstract	Quick	Slow	Instructional Discourse		Regulative Discourse
							F^- (Competence)	F^+ (Performance)	F^+
Upper	28	2	11	15	28	0	26	2	0
Middle	22	3	11	8	12	10	8	14	9
Bottom	25	6	13	6	14	11	12	14	12

7.3.1 Class Distinctions in Providing Levels of Feedback

The table illustrates a class distinction in the distribution of tasks based on the highest levels of feedback reached: In upper-stream schools, feedback for over half of the total tasks reaches the abstract level, accounting for nearly double of the number of tasks that reach the abstract level provided by their counterparts in their middle- and bottom- stream schools. The results align with Bernstein's proposition that middle-class schools transmit more vertical knowledge characterised by abstract symbols and daily independent context, which positions students into vertical power relations. On the contrary, feedback provided by teachers in middle- and bottom-

stream schools mostly stops at the level of process, indicating a limit on students' opportunities to access the esoteric domain of mathematics knowledge. This limitation further indicates that these students are unable to enter to the hierarchical power relations represented by this abstract knowledge.

7.3.2 Class Distinctions in Transmission Pace of Feedback

All teachers exhibited strong control over the expected rate of knowledge acquisition, representing a strong framing of pacing. However, the expected rates within the strong framing of pacing varied by streams. Upper-stream teachers showed a high expected rate, progressing efficiently from lower to higher levels of feedback without excessive repetition, assuming their students could keep up. This is presumably based on their perception of their students' high cognitive skills, which Bernstein suggests is translated from their socio-economic status. By contrast, middle- and bottom-stream teachers exhibited lower expected rates, frequently repeating messages or oscillating between levels within the course of feedback. They assumed a high rate of knowledge acquisition would be challenging for their students, hindering their understanding of abstract concepts. This assumption about cognitive ability is also rooted in students' positions in social relations.

7.3.3 Class distinctions in Evaluative Criteria Conveyed by Feedback

Evaluative criteria showed apparent class distinctions. Upper-stream teachers focused on instructional discourse which is highly task-related, emphasizing content that cultivates students' long-term mathematical competence. Their criteria were embedded and diffused throughout the feedback within tasks, making criteria less explicit and more challenging for students to recognize. Students from upper-stream families, familiar with such weak classification contexts, tend to recognize teachers' expectations and produce legitimate texts. In contrast, middle- and bottom-stream teachers transmitted more strong framing evaluative criteria for instructional discourse, focusing on students' short-term performance. They guided students on refining procedures in writing solutions for better test scores, but without focusing on students' conceptual understanding.

Additionally, some tasks extracted from middle- and bottom-stream classrooms transmitted evaluative criteria for regulative discourse (e.g., classroom behaviour, attitudes, dispositions), reflecting high teacher control over classroom communication and a strong

framing of hierarchical rules on pedagogic relationship. The rest tasks that do not explicitly convey criteria for regulative discourse indicate their weak framing, which are not illustrated in the table.

Morais's (2002) research in Portuguese science classrooms, along with Bourne's (2004) case of socially disadvantaged students achieving high exam scores in the U.S. (as presented in the literature review), both support a strongly framed instructional discourse. In term with evaluative rules, explicit criteria for teachers' expected responses, approaches to identifying problems and clarification of abstract concepts can improve accessibility and foster students' mathematical competence (Ellery, 2017; Morais et al., 2004). Morais & Miranda (1996) also clearly pointed out that marking exam requirements is beneficial for clarity, the focus should be on understanding concepts to better master recognition rules, but not on writing conventions. This approach enables students to produce legitimate product in exams and move upward within pedagogic institutions, but it fails to foster students' long-term mathematics competence, which is the true selection and exclusion mechanisms in the social divisions of labour. Regarding regulative discourse, Morais suggested a weak framing of evaluative criteria while Bourne's case studies also emphasize an integration of a weak framing teacher-student relationship, particularly through gaze, gestures, and movement. A weak framing of evaluative criteria for regulative discourse can create a warm, relaxing atmosphere for students to express their ideas and engage in classroom activities.

In conclusion, by dissecting these dimensions, this chapter reveals how teacher feedback transmits and legitimizes class differences. It does so by controlling access levels and paces to abstract mathematical knowledge and conveying differentiated evaluative criteria of school success to students from different social streams. This process ultimately assigns students to their respective positions in social relations, perpetuating social stratification.

Chapter 8 Conclusion

Introduction

This chapter discusses and summarizes the main findings of the preceding three chapters. The aim of this study is to explore how social class differences are recontextualized within mathematics classroom pedagogy. Specifically, it investigates how class differences are transformed into micro-level pedagogic practices in mathematics classroom, ultimately achieve their legitimation at the level of social consciousness of acquirers and thereby reproducing social insulations. To achieve this goal, the introduction chapter identified three potential recontextualized pathways: forms of pedagogic communication, the transmission of pedagogic messages, and the provision of feedback, which were subsequently investigated and explored.

This chapter will discuss the main findings of the three analytic chapters to illustrate how they answer the research questions of this dissertation. The chapter is structured into four sections: Section 1 revisits the research objective and specific research questions, providing a brief description and evaluation of the theoretical framework constructed. Section 2 offers an overview of the main findings from the analysis chapters. Section 3 presents the theoretical and practical implications of the research. Section 4 describes the limitations of this study and attempts to provide insights for future research.

8.1 Revisiting of Research Questions and Theoretical Framework

8.1.1 Origins and Identification of the Research Questions

This study originated from my curiosity about the persistence of social and educational stratification: why do students and their families from the subordinate social class accept these their dominated positions rather than resist them? This research aims to explore how the differences in macro social rules are transformed and legitimized at the micro classroom level, thereby being invisibly transmitted to acquirers, leading them to accept and internalize their social positions as normal. The objective of this research is then narrowed down to the field of mathematics education and identified as: to investigate how social class differences are transformed and transmitted in mathematics classroom pedagogy, and how this process permeates students' consciousness, shaping their perception of their societal position as natural.

Accordingly, the research focuses on two levels: the macro-level of social structures and the micro-level of pedagogic practices. The purpose is to explore how macro class differences are recontextualized into micro pedagogic practices, regulating teachers' classroom pedagogy from the underlying. The relationship between these two levels situates this study within Bernstein's theory of pedagogic discourse. By examining differences exhibited in pedagogic practices, the study aims to recover their underlying social rules. In turn, it seeks to understand how these deep regulative principles operate, transform, and legitimize, thus facilitating their invisible transmission.

The construction of the theoretical framework is intertwined with the process of identification the research questions. The continuous interaction and adjustment between Bernstein's pedagogic discourse theory and the research data helped refine and ultimately define the specific research questions, alongside building the analytical framework needed to address these questions.

Given Bernstein's focus on pedagogic communication, this research first identifies forms of pedagogic communication as a possible recontextualized path. Bernstein's classification and framing of differential strengths are employed to analyze the power relations embedded in different communication forms. Secondly, due to Bernstein's emphasis on the role of evaluative rules in pedagogic practices, feedback which is provided only for transmitting criteria is recognized as another recontextualized path to explore. Furthermore, since Bernstein defines pedagogic practice as a blend of horizontal and vertical knowledge, the pedagogic messages conveyed in pedagogic practices are identified as the third recontextualized path.

Additionally, for the analysis of pedagogic messages transmitted in classroom practices, this study employs Dowling's SAM, which focuses on the amount of vertical knowledge embedded in pedagogic messages and the ways of transmitting pedagogic messages. Concepts and instruments from Bernstein's theory and Dowling's SAM, integrated by other scholars' concepts, are utilized to match the study's questions. Finally, the specific research questions and the necessary analytical framework to achieve the research goals are established.

8.1.2 A Brief Commentary on Bernsteinian Theory

Bernstein proposed a general theoretical framework, pedagogic discourse, gradually refined with a model, pedagogic device, and other specific analytical instruments, making it detailed and applicable. Bernstein's pedagogic discourse provides a structuralist foundation, positing

that instructional discourse in pedagogic practices is governed by underlying regulative discourse. This framework facilitates the formulation of hypotheses by linking deep control rules to surface practices. He developed a specific model, the pedagogic device, to deconstruct the invisible operating process of these controls.

The pedagogic device comprises a set of rules—distributive, recontextualizing, and evaluative—that create various fields: production, recontextualization, and reproduction. This model procedurally demonstrates how underlying regulative discourse is realized in pedagogic practices. Bernstein also developed conceptual tools, such as classification and framing, to analyze the transmission of macro rules into micro practices.

Concepts drawn from his work, such as different values of knowledge, rules of instructional discourse, types of evaluative criteria, and ways of transmitting evaluative criteria, provide a structured and detailed theoretical framework for this research. Additionally, Dowling, a Bernsteinian scholar, expanded on Bernstein's theory in his SAM, offering detailed analytical tools to explore how regulative discourses are subtly transmitted in micro-level mathematics pedagogy.

8.2 Overview of the Analysis

The research aim is subdivided into three specific potential pathways for investigation. In this section, each sub-section will provide a concise overview of the specific research questions, samples and methods used. In addition, the main findings from each section will be discussed.

8.2.1 Forms of Pedagogic Communication as a Recontextualized Pathway

To investigate whether forms of pedagogic communication act as a pathway for the recontextualization of social class differences, this study employed the quality of classroom interactions as an intermediate variable, a factor widely recognized for its direct impact on students' school achievement. The research objective is addressed through the following specific questions:

1. Do forms of communication correlate interactional quality in classrooms?
2. Are forms of communication and interactional quality in teaching processes regulated by social class principles?

3. If forms of communication and interaction quality are both regulated by social class principles, do variations in duration of forms of communication amplify or mitigate differences in interaction quality between schools of different streams, thereby reproducing educational stratification?

Interaction forms were categorized into five types based on their framing strengths and the sample's typical characteristics. Statistical methods, including correlation and linear regression analysis, were employed to examine the differences in interaction forms and quality within classrooms across different streams, as well as the predictive role of school stream on interaction quality.

Main Findings

The findings reveal that teachers predominantly allocate time to interaction with whole-class, aligning with the expectation that a teacher-centred model still dominates Chinese classrooms. Class differences were evident only in the duration of peer interactions. Teachers in upper-stream schools allocated more time to peer interactions, and quality of classroom interaction and teacher instruction was also higher in upper-stream schools. Additionally, the duration of peer interactions mediated the relationship between school stream and the quality of both interaction and teacher instruction.

Specifically, when peer interaction occupied a larger proportion of class time, the quality of classroom interaction and teacher instruction was higher. This may be attributed to the weak framing of peer interactions, which allows students more control over classroom communication. In such settings, students have greater opportunities for autonomy through sharing, discussion, reflection, and constructing their understanding of abstract concepts. Increased student control over the communication process fosters a more relaxing interaction environment, enhancing students' engagement in classroom activities. This shift in control from teachers to students indicates a weak hierarchical relationship, with teachers transitioning from primary knowledge transmitters to facilitators of pedagogic communication. This also indicates a foundation of a warm and close pedagogic relationship which can prompt students' classroom participation. Moreover, a weak framing of pedagogic communication corresponds to a weak classification of space, granting students more freedom to move and exchange materials.

This weak framing of classroom communication is typically found in middle-class family communication styles, which encourages students to initiate discussions, debate, and negotiate themselves. Consequently, this result confirms class-based differences in the duration of peer communication and the quality of interactions in classrooms of different streams.

8.2.2 Pedagogic Messages as a Recontextualized Pathway

Pedagogic practice encompasses both horizontal and vertical knowledge. The quantity of vertical knowledge and the methods of its transmission can potentially transform and legitimize social class differences. This study explores this pathway by addressing the questions presented in Chapter 4, which are expanded upon after the construction of the theoretical framework, as well as in the following two sections:

1. Are there class differences in the pedagogic messages transmitted by teachers from schools of different streams?
2. Are there class differences in the ways pedagogic messages are transmitted by teachers from schools of different streams?
3. Are there class differences in the use of content, specifically the use of pedagogic tasks selected from the public domain in the stage of preparation by teachers from schools of different streams?

This section employs Dowling's SAM as the analytical framework, using the process from teachers' preparation to the presentation of new mathematical content as the unit of analysis. By examining the amount of vertical knowledge provided during the preparation stage, termed "discursive saturation" by Dowling, and the strategies for introducing new mathematical content, the study investigates whether teachers from different streams demonstrate class-based differences in these aspects. These differences ultimately distribute varying amounts of esoteric knowledge to students and position them within hierarchical power relations.

Main Findings

The findings reveal that teachers from different streams exhibit distinct preferences in selecting tasks with varying degrees of discursive saturation during the preparation stage. Upper-stream

teachers show no particular preference for any specific domains of practices. In contrast, middle- and bottom-stream teachers prefer selecting instructional tasks from the public domain for preparatory activities.

When transitioning from the preparation stage to the presentation of new mathematics content, most teachers, regardless of stream, employ expanding textual strategies by introducing more esoteric mathematical symbols and expressions, likely adhering to detailed requirements from the official pedagogic field like educational ministry. However, upper-stream teachers use abstracting discursive strategies, connecting tasks through metonymic links based on spatial or logical proximity of tasks. This approach, requiring abstract intuition from students, aligns with Bernstein's concept of "elaborated code," typical of middle-class interaction patterns. Consequently, the instructional strategies of upper-stream teachers are categorized as generalizing, exposing students to abstract mathematical knowledge associated with higher power relations.

In contrast, middle- and bottom-stream teachers use particularizing discursive strategies, linking tasks through metaphorical relationships based on their similarities. This proceduralised connection method reduces the complexity of abstract mathematical content, making them more accessible to students. This approach matches the "restricted code" prevalent in working-class interaction patterns. Consequently, these teachers' instructional strategies fall into the fragmenting or localizing domains, limiting students' access to esoteric mathematical knowledge and positioning them within lower power relations. The selection and employment of teachers' strategies are grounded in their perceptions of students' cognitive abilities, which, according to Bernstein, are translated from students' social class backgrounds. Ultimately, social stratification is maintained through these differentiated transmissions of pedagogic messages.

Beyond the primary dimensions of selection in differentiated domains of practices and transmission strategies, the recontextualization of social class differences also occurs in more subtle and hidden pedagogic practices. Specifically, even when teachers across different school streams choose tasks from the public domain during the preparation stage, upper-stream teachers tend to use examples from non-everyday contexts, while middle- and bottom-stream teachers prefer examples from everyday life.

When employing these public domain tasks, upper-stream teachers typically provide only brief background information, using it as a portal to introduce students to more abstract mathematical knowledge through their instructional strategies. In contrast, middle- and bottom-stream teachers offer detailed contextual information and use different backgrounds for

different tasks, unlike upper-stream teachers who usually apply the same context across multiple tasks. Excessive background information and details can distract students, keeping them anchored in horizontal knowledge and preventing them from accessing more advanced mathematical knowledge. Furthermore, even when all streams of teachers use examples from everyday life, the backgrounds of these examples reflect the social class differences of daily life.

Overall, the pedagogic messages transmitted, and the ways employed for transmitting function to recontextualize social class differences. By selecting tasks with varying degrees of abstraction and esoteric knowledge and by employing differentiated transmission strategies, teachers stratify students within hierarchical power relations. This study uncovers the underlying social class principles embedded in micro pedagogic practices, confirming that social class differences are transformed into the transmission of pedagogic messages. This transformation legitimizes the stratification of students' access to abstract mathematical knowledge, subtly assigning their positions within hierarchical power relations.

8.2.3 Classroom Feedback as a Recontextualized Pathway

Classroom feedback serves as a crucial carrier for teachers to assess students' knowledge and provide criteria and strategies to guide them toward learning goals. This feedback can significantly recontextualize social class differences. This study explores this objective through answering two specific questions:

1. Do there any class differences presented in feedback content provided by teachers across schools of different streams?
2. Do there any class differences presented in ways of feedback transmission?

Using Bernstein's rules of instructional discourse as an analytical framework, this qualitative and exploratory study examines pedagogic practices across different streams. Classroom videos from nine teachers, three from each stream, were selected, analyzing all tasks from the preparation stage to the end of exercises. Feedback provided by teachers was scrutinized.

Main Findings

Paces of Transmitting Feedback

The study reveals that teachers across all streams exhibit strong control over the pacing of feedback, consistent with the teacher-centred educational tradition prevalent in China. Teachers dominate the transmission of pedagogic messages. However, within this strong framing of pacing, class differences present in the expected rate of progressive feedback levels.

Upper-stream teachers exhibit a quicker pace, progressing efficiently from task-level feedback (confirming or denying student responses) to process-level feedback (evaluating students' strategies and methods) and ultimately to abstract-level feedback (generalizing solutions to other contexts). This high-efficiency progression aligns with Bernstein's concept of "elaborated code," characteristic of middle-class interaction patterns.

In contrast, middle- and bottom-stream teachers display a relatively lower pace. They tend to remain at lower feedback levels, often confined to task-specific feedback, including confirming or correcting student responses or evaluating the solutions or strategies students used. They do not generalize strategies to broader contexts or connect them with previously learned abstract concepts. Alternatively, they deconstruct complex mathematical content, oscillating between different feedback levels to reduce the complexity of abstract mathematics content. Teachers' different expected paces are based on their perceptions of students' abilities, which are influenced by students' social class backgrounds and the coding orientations acquired through family interactions. Families with elaborated coding orientations encourage children to be creative and apply learned language and vocabulary to new contexts, fostering their skills in generalization and abstraction. In contrast, families with restricted coding orientations do not provide an environment conducive to generalization. Instead, their children are encouraged to accept and repeat information within familiar, everyday contexts, thereby limiting the development of their cognitive skills and abstract thinking abilities.

Differentiated Criteria embedded in Feedback

Teachers' feedback also conveys differentiated evaluative criteria to students. While teachers across streams provide evaluation criteria on instructional discourse, upper-stream teachers transmit competence-oriented criteria. These criteria are highly task-related but implicit and diffused across whole pedagogic tasks, aiming to cultivate students' long-term mathematical competence. Only students with elaborated code orientation, who have acquired these implicit

criteria through family interactions, can recognize teachers' intentions and meet the expectations, producing texts legitimized by schools.

Middle- and bottom-stream teachers, however, focus on performance-oriented criteria, which are explicit and related to task completion details such as presentation and neatness. These clear criteria aim to improve students' task performance in exams, ensuring they do not lose marks unnecessarily. Although accessible to all students, mastering these criteria does not enhance mathematical competence or facilitate access to advanced mathematical knowledge; it merely improves task execution.

Furthermore, middle- and bottom-stream teachers provide evaluation criteria on regulative discourse, conveying explicit assessments for students' behaviour, attitudes, and dispositions. These criteria represent a strong framing of hierarchical rules where teachers act as judges of student behaviours, potentially creating a negative classroom atmosphere that undermines student autonomy. In contrast, Bernstein (2000) and Morais (Morais, 2002) advocate for progressive pedagogy with a weak framing of evaluative rules on regulative discourse to foster a relaxed and supportive classroom environment, encouraging student engagement and the development of understanding through debate and negotiation.

To sum up, classroom feedback, through its pace during transmission and the criteria conveyed, plays a crucial role in recontextualizing social class differences. By setting differentiated expected paces and providing varied criteria to students, teachers from different school streams assign their students into their respective social positions.

8.3 Implications of Findings

8.3.1 Theoretical Implications

Firstly, this study applies Bernstein's theory of pedagogic discourse and Dowling's SAM to the Chinese cultural and educational context, providing empirical support for their cross-cultural applicability. Additionally, the study extends research on some concepts within Bernstein's theory. The core of Bernstein's theory emphasizes the use of control principles to maintain power relations, focusing on the varying strengths of framing of rules within instructional and regulative discourses. This study deepens the understanding of how teachers' expected rates to transmitting pedagogic messages within a strong framing of pacing are influenced by the principle of social class. In applying Bernstein's and Dowling's theories, concepts from other scholars, such as Lacan and Freud, are integrated to expand and offer diverse methods for explaining and understanding how macro-level class differences are recontextualized in micro-

level pedagogic interactions. Moreover, Bernstein's theory on classroom pedagogy is concretely applied to the mathematics classrooms, extending this general theory to a specific subject area, thereby enhancing its practical relevance.

Secondly, this study provides empirical investigations at the micro pedagogic practices for these recontextualization-related theory and method, including both qualitative and quantitative analyses. Thus, it supports the empirical applicability of Bernstein's theory and Dowling's SAM.

8.3.2 Practical Implications

Firstly, this study provides empirical evidence to counter the "culture of effort" argument, which was one of the initial motivations for this dissertation. The findings indicate that school failure is more attributable to structural factors rather than a lack of individual effort. Social stratification begins at the micro classroom pedagogic and permeates students' consciousness, constructing the awareness of segregated social groups. Consequently, students from lower social class often do not recognize their dominated social positions as a result of social class operations but rather as their predetermined fate.

Secondly, the study offers specific recommendations for teacher training. Teachers can enhance classroom interaction quality by re-organising their pedagogic practices. Specifically, teachers can organize more peer interactions, select tasks suitable for peer discussions, and create an environment conducive to such discussions. This approach aids students in understanding abstract mathematical concepts and developing autonomy. Regarding teacher feedback, the study suggests providing clear evaluative criteria for understanding advanced mathematical concepts, helping students generalize strategies from specific tasks and connect them with other mathematical concepts, fostering long-term mathematical competence rather than short-term test-taking skills.

Additionally, for students' classroom behaviour, attitudes, and dispositions, teachers should offer implicit evaluative criteria to establish equal teacher-student relationships, creating a relaxed classroom atmosphere that promotes student participation. In terms of task selection and usage, teachers can employ a background into multiple tasks rather than different backgrounds in different tasks.

Finally, the study proposes recommendations for curriculum design to address educational inequities. In textbook development and task selection, there is a potential to

narrow achievement gap by focusing on the mathematical concepts embedded in the background information rather than the details of the background.

8.4 Limitations and Future Research

Despite these insights, several limitations merit consideration. Firstly, all data were sourced from an online platform established by the Chinese Ministry of Education, lacking participatory classroom observations. This may have led to the omission of various details not captured or noticed during recording. Data collection during the COVID-19 pandemic, constrained by official policies, made classroom access impossible. Future research could incorporate more in-depth methods, such as supplementary teacher interviews, to capture additional details.

Additionally, the sample size of this study is relatively small, meeting only the minimum standards for independent t-tests, which limits its ability to represent larger regional populations. The exploratory analyses in the third section have even smaller samples, making it difficult to generalize the findings to all classrooms. The lack of sample typicality further challenges the generalizability of results across the province or other regions in China. Future studies might consider increasing the sample size to enhance statistical significance and generalizability. Additionally, expanding the sample to include other geographic areas and diverse school streams, particularly urban public schools, would provide more representative data.

Furthermore, this study did not have access to teachers' personal background information, such as education level, teaching experience, and family background, making it impossible to assess how these factors might influence their selection and arrangement on forms of communication and pedagogic messages. Future research could investigate whether teachers' backgrounds affect their control over classroom interactions, selection of pedagogic materials, and ways of providing feedback.

Finally, this study only investigated three potential pathways for recontextualization of social class differences, providing three perspectives for narrowing the gap of educational inequality from pedagogic practices. However, it did not cover all possible pathways. Future research might explore additional recontextualization pathways to offer comprehensive suggestions for reducing educational inequality in micro classroom interaction.

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