

Teacher agency for integrating history into teaching mathematics in a performance-driven context: A case study of a beginning teacher in China

Abstract

The importance of integrating history into mathematics education is widely recognised in the literature and advocated in curricula worldwide, including in China. However, under the influence of the long-standing centrally designed curricula, teachers in China are accustomed to content- and teacher-centred examination-driven teaching practices. Adopting a life story approach, this paper reports the case of a mathematics teacher who integrated history into her mathematics teaching during the initial two years of her teaching in a Shanghai high school. The agentic perspective adopted in the study allows us to focus on how the teacher's agency was enacted and achieved when engaging in teaching practices. Our findings reveal the roles played by personal qualities, prior experiences, and the structure and culture of schooling in the teacher's agency in integrating history into teaching under a dominant examination-driven context. Implications of the results for integrating history into teaching in restricted contexts are then discussed.

Keywords: teacher agency; context of tension; integrating history into teaching mathematics; Chinese mathematics education; case study

1. Introduction

Inspiring prospective teachers (Nolan, 2012) and in-service teachers to adopt student-focused pedagogies is challenging and complex for mathematics teacher educators, particularly in China where tensions in teacher-centred, content-focused, and examination-oriented practices of mathematics teaching are predominant (Leung, 2001).

Mathematics teaching and learning in China has attracted researchers' attention worldwide owing to Chinese students' outstanding performances in international assessments (e.g., the latest PISA 2018, OECD, 2019) compared with their Western counterparts. Some studies have attributed this to the long-standing emphasis in China's mathematics curriculum on acquiring basic mathematical knowledge and grasping basic mathematical skills (the "two basics") (Zhang, Li, & Tang, 2004) and the achievement/goal-oriented approach to mathematics learning (Guo & Leung, 2020). However, comparative studies have also indicated that this superiority is not maintained when solving non-routine mathematical problems (e.g., Cai & Lester, 2005), probably owing to the overemphasis on mathematical content. Moreover, the Programme for International Student Assessment (PISA) 2012 results claimed that students in Shanghai, China, showed lower perseverance and openness to problem solving than the Organisation for Economic Co-operation and Development (OECD) average, despite outperforming all other students worldwide (OECD, 2013).

Corresponding to the curriculum's emphasis on the "two basics" and achievement/goal-

oriented learning, Chinese mathematics teachers are usually trained to deliver the centralised curriculum, focusing on the designated content (Zhang & Wong, 2014), and they pay far more attention to students' performances in public examinations rather than students' individual needs (Ma, Lam, & Wong, 2006). Many experienced teachers are used to conducting "exam-oriented teaching with the emphasis on mathematical contents required by the national curriculum" (p. 13), and they exert a strong influence on beginning teachers' professional development by virtue of the compulsory mentorship system in China (Lu, Leung, & Kaiser, 2020).

However, China's current curricular reform focuses on the promotion of quality citizenship to meet the demands of an increasingly globalised world (Lu & Wang, 2018). Accordingly, the curricular standards (MOE, 2018) highlight the necessity of promoting students' sustainable and lifelong development, including not only their cognitive development but also their interest in learning, self-perception, and confidence. The curriculum serves as a basis for developing textbooks and mathematics teaching practice guidelines (Borromeo Ferri, 2018). Teachers' efforts are needed for the implementation of curricular standards (Howson & Wilson, 1987), and teacher agency is required to conduct curricular reforms (Tao & Gao, 2017). Teachers must confront the tension between teaching for the promotion of global citizenship and the predominant exam-oriented teaching.

Agentic teachers not only complete teaching tasks but also have the ability and willingness to improve their own capabilities for lifelong learning and sustained professional growth (Lipponen & Kumpulainen, 2011). Competent implementation of innovative teaching approaches in mathematics requires a certain kind of agency for preservice and practising teachers (Klein, 1999). Agency is "the capability of individual human beings to make choices and to act on these choices in ways that make a difference in their lives" (Martin, 2004, p.135). Because of agency, people can "play a part in self-development, adaption, and self-renewal with changing times", since it "embodies the endowments, belief systems, self-regulatory capabilities and distributed structures and functions through which personal influence exercised rather than residing as a discrete entity in a particular place" (Bandura, 2001, p. 2). Agency is "not easily won" (Klein, 1999, p. 91). However, once a teacher is consciously practising agency, they will consider teaching a meaningful vocation rather than a job (Priestley, Biesta, & Robinson, 2015a). With agency, teachers become "active agents" rather than "pawns in the reform process" (Lasky, 2005, p. 900–901).

Unlike exam-oriented teaching, integrating history into mathematics teaching (IHT) aims to assist students in gaining motivation, strengthening their mathematical cognition, and to support their conceptual development in mathematics (Jankvist, 2009; Gulikers & Blom, 2001). The educational value of mathematical history has long been acknowledged in China's mathematics curriculum (Wang, Qi, & Wang, 2017). The curricular standards consider it important to incorporate the history of mathematics, including "mathematical thoughts, spirit, language, methods, views and the process of how mathematics is being developed", to reflect "the contribution and significance of mathematics in the development of people's life, scientific

technology, and society; as well as human activities” (MOE, 2018, p. 10). Notwithstanding this emphasis, IHT often becomes a luxury in teachers’ daily teaching life, highly valued but minimally applied (Wang, Wang, & Rugh, 2018).

This paper presents the case of a beginning mathematics teacher who enacted agency in integrating history into her mathematics teaching in China, where tensions are particularly prevalent owing to the predominant exam-oriented teaching practice. The teacher, Doris, was a mathematics teacher who taught Grade 10 and Grade 11 students consecutively during the initial two years of her teaching career in a Shanghai high school. She enacted agency in situating herself in a school community dominated by exam-oriented teaching practice and in pursuing her intention to promote students’ interest and motivation in the learning of mathematics through IHT. The case narratives not only offer meaningful scenes of Doris’ experiences but also offer a forward glance, helping readers to envisage how she anticipated situations in advance and envisioned alternative features (Flyvbjerg 2006, p. 240). We captured the complexity of Doris’ teaching life with particular focus on her agentic choices and actions, organised around the priority sets of *with/without IHT*, and the timeline sets of *before*, at the *beginning*, in the *midst* of, and at the *end* of the two years.

2. Theoretical framing and literature survey

2.1 Teacher agency and teacher beliefs

There is an emerging tendency to emphasise the importance of teacher agency in view of its active role in directing teacher practice (Donnell & Gettinger, 2015) and modern curricular reform (Priestley, 2011), particularly where tension exists between professionalism and the promotion of standardisation which reduces teachers’ autonomy (Wills & Sandholtz, 2009). As an agent, the teacher may be a planner, forethinker, motivator, self-regulator, and self-examiner, stemming from the four characteristics of agency: intentionality, forethought, self-reactiveness and self-reflectiveness (Bandura, 2001).

The concept of teacher agency is usually understood as individual characteristics, such as capacity and action (Hadar & Benish-Weisman, 2019), or an emergent ecological phenomenon (Priestley, Biesta, & Robinson, 2015b). As capacity, agency allows teachers to direct their own working within structural constraints (Hilferty, 2008). As action, agency includes taking a stance and impacting teaching practice (Eteläpelto, Vähäsantanen, & Hökkä, 2015). More comprehensively, researchers have usually recognised teacher agency as comprising both capacity and action — “a combination of a teacher’s capacity to initiate and the enactment of this capacity to actively direct his/her professional life” (Hadar & Benish-Weisman, 2019, p. 138). The ecological view of teacher agency considers it an emergent phenomenon of the ecological conditions by which the agency is enacted and something that teachers achieve within their social and material environments (Priestley et al., 2015b).

The perception of teacher agency as comprising both capacity and action emphasises the connection of teacher agency and beliefs with teaching practice. Agency embodies personal

values, beliefs, and self-regulatory capabilities that impact teachers' development at the individual level (Hadar & Benish-Weisman, 2019); it also derives and constructs the direction and course of action (Wilson & Deaney, 2010). By defining agency as "an intentional belief and an action taken to achieve a specific outcome" (p. 151), Hadar and Benish-Weisman (2019) examined the relations between teachers' values (e.g., self-enhancement and openness to change), their agentic capacity (including self-efficacy, proactive personality, and self-promotion focus), and their agentic behaviours (e.g., agency behaviour, creative behaviour, and agentic behaviour). The results show that teacher values are related to agentic capacity — capacity enacted as a mediation between values and agentic behaviours — and teachers' agency reflects what they bring into their schools (Hadar & Benish-Weisman, 2019). These findings echo earlier studies emphasising the importance of teacher beliefs and values in the manifestation of agentic capacities and actions. However, we still have no clear idea of how agentic capacities mediate teacher values and agentic actions towards specific teaching practices in specific contexts.

The ecological view focuses on the process by which agency is achieved through different interactions between individual experiences and contextual factors within different situations (Biesta, Priestley, & Robinson, 2015). From this perspective, Priestley, Biesta, and Robinson (2013) proposed a three-dimension model of agency: *iterational*, *practical-evaluative*, and *projective* dimensions. Teacher beliefs play an important role across the entire agency achievement process: beliefs from teachers' past experiences contribute to the iterational dimension of agency; beliefs impact teachers' engagement with the present, which concerns the practical-evaluative dimension, and beliefs oriented towards the future influence the project dimension (Biesta et al., 2015, p. 637). Furthermore, research also suggests that teacher beliefs may change as they achieve agency within curricular reforms (Wallance & Priestley, 2017). In the context of promoting a student-centred STEM programme, Bonner, Diehl, and Trachtman (2020) interviewed 13 teachers in three schools to explore the role of teacher belief change and agency development while enacting the practice. The results suggest that teacher agency can be developed when teachers reflect on the prior related experiences for planning and when they further conceptualise their authority that distributed to their students; teacher agency seemed to be easier exerted at the level of classroom than at school level; and teacher beliefs could be changed during communicating and interacting with students.

To summarise, the capacity and action view of teacher agency places the individual teacher in the centre, considering her/his motivations, goals, beliefs and agentic actions, which is congruent with our focus on beginning mathematics teacher's agentic practice of IHT. The ecological view leads us to recognise how agency is enacted in concrete settings under the particular conditions and circumstances of China's mathematics education. We focus on teacher agency among beginning mathematics teachers and the specific practice of integrating mathematical history in the following literature survey on teacher agency in teaching mathematics.

2.2 Teacher agency in mathematics teaching

Acceptable notions of good mathematics teachers are produced and reproduced by the school's discursive practices; during this process, teacher agency is shaped and developed (Nolan, 2016). Compared to the teacher-centred approach, student-centred approaches create greater space for both the teacher and the students to play an active role in mathematics teaching and learning (Felton & Koestler, 2015). However, student-centred teaching approaches in mathematics education are usually considered to be “extra” or “time-filler”, since they are not connected closely enough to curriculum outcomes and the learning of key mathematical contents (Nolan, 2014, p. 269). This makes it difficult for mathematics teachers to enact agency to promote innovative mathematical teaching practices, particularly novice mathematics teachers (Nolan, 2016). Although they have been introduced to innovative pedagogies prior to entering schools, they are likely to find that what they observe in authentic classrooms differs from how they have been taught in the teacher education programme.

These are common problematic issues affecting the implementation of innovative mathematical pedagogies worldwide, but particularly in China, which is known to implement traditional and old-fashioned mathematical teaching characterised by teacher-centred, content-oriented and examination-driven teaching (Leung, 2001). By enacting agency, Chinese teachers are able to continue their traditional teaching practice while considering and trying out innovative pedagogical ideas from the West, such as building good relationships with their students and promoting learning through fun (Lai, Li, & Gong, 2016). However, little research has examined how mathematics teachers enact their agency with respect to innovative teaching practices within a context such as China, where extreme tension exists, as mentioned above, between the long-standing predominantly examination-oriented approach to mathematical teaching and the movement towards student-centred teaching. Departing from this, our study provides a case study of a specific mathematical teaching practice incorporating mathematical history.

2.3 Integrating history into mathematical teaching

In the teaching of mathematics, mathematics should not only be considered polished products that form part of mathematical knowledge but should also be regarded as processes of knowledge production to make mathematics interesting, meaningful, and relevant, in harmony with other intellectual and cultural pursuits. In the wider context, it allows young people to be educated in the sciences (Clark et al., 2016). IHT can be seen as a student-centred pedagogy, since it exposes students to how mathematicians work, which would increase students' interest in mathematics (Artique & Blomhøj, 2013). The complementary and supplementary roles of mathematical history in mathematics education have been recognised in the teaching and learning of mathematics (e.g., Jahnke, 2000), highlighting the values of mathematical history in the learning of mathematics and the development of an inquiry-view of mathematics and

mathematical activities. This perspective on the nature of mathematics will lead to a learner-focused practice of teaching (Ernest, 1989).

Although IHT may be characterised as a teaching practice aimed at promoting students' autonomy in the learning of mathematics, there are various approaches to IHT that incorporate different aims and conditions and can provide different spaces in which teachers can enact and develop agency in their teaching practices. Tzanakis et al. (2000) proposed three broad approaches: (1) directly providing historical information to facilitate history learning, (2) implementing a teaching approach that is explicitly or implicitly inspired by history, and (3) focusing on mathematics *per se* and the social context for the development of deep awareness of the discipline's nature as well its relationship to other disciplines. The first approach — direct provision of historical information — appears to have limited impact on the development of agency by only providing one type of alternative material. Teachers appear to have few opportunities to enact agency by directly providing historical information in mathematics classrooms. Moreover, this approach usually attracts objections of a *practical and didactical nature*, since students regard the learning process as history learning, and usually they dislike history class (Clark et al. 2016).

We cannot simply draw conclusions about teacher agency from one single application of IHT. Teacher agency is achieved from continual interactions between the individual teacher's experiences and contextual factors. In this paper, we employ the life story approach to investigate how a mathematics teacher enacts and develops teacher agency by carrying out IHT in her early teaching career in an exam-driven context of mathematical teaching. We used Jankvist's (2009) categorisation of IHT approaches, considering the specific type of history in use, the amount of history being used, and the ways in which students work with the history, and so on (p. 249). The three approaches are *illumination approaches*, *module approaches*, and *history-based approaches*. In the *illumination approaches*, mathematics teaching and learning is supplemented by historical information, and it happens either in the actual classroom teaching or the textbooks used. With the *modules approaches*, instructional units are devoted to history and usually based on specific topics. The *history-based approaches* allow history to structure the sequence and the mathematical content presentation method rather than explicitly discussing the history itself.

2.4 Research questions

In China, research groups, including mathematicians, historians of mathematics, mathematics educators, and school mathematics teachers, have invested significant effort in promoting IHT;

however, the phenomenon whereby teachers consider IHT highly valuable but seldom apply it in their practice persists (Wang et al., 2018). Given the active role of teacher agency in shaping new mathematics teachers' pedagogic preferences and practices (Noyes, 2004), it is interesting to investigate how Doris, a beginning mathematics teacher, practised IHT in the exam-driven context of China from the perspective of agency. The research questions addressed in this paper are as follows:

- (1) How did Doris enact agency in practising IHT in the exam-oriented teaching context?
- (2) How did Doris achieve her teacher agency when confronting the tension between the implementation of IHT and the dominant teaching practice?

3 Research design

3.1 Research context and the participant

Our inquiry is part of a multi-case study of beginning mathematics teachers' professional learning in high schools in Shanghai. Doris (pseudonym) is distinguished from others because she is the only one who conducted and insisted on IHT in the two-year teaching under investigation. Moreover, although IHT has been advocated by the mathematics curriculum and an increasing emphasis on IHT has emerged among China's teaching community (Wang et al., 2018), none of her colleagues had implemented such teaching practices before she entered the school. However, Doris' colleagues warmly welcomed her IHT practice, demonstrating that the school encourages diversity of teaching practices, particularly alternative approaches to more traditional practices.

Doris earned a bachelor's degree in Mathematics and Applied Mathematics from a normal university in Shanghai. Normal universities in China are traditionally teacher-preparation institutions wherein undergraduate mathematics programmes offer courses related to both mathematics and pedagogy. Doris was subsequently recruited into the Master's Programme in Mathematics Education in the same university, through a project that employed outstanding normal university students to serve as volunteer teachers in China's less-developed regions for a one-year period after completing their undergraduate studies and before commencing postgraduate study. During the master's programme, she had opportunities to learn pedagogy in mathematics in general and history and pedagogy of mathematics (HPM) in particular.

3.2 The life story approach

As mentioned earlier, we employ the life story approach in this study. It is an "ideographic,

subjective approach to expressing the parts of one's life as a whole and conveying the meaning taken from them" (Atkinson 2007, p. 233). The life story approach and narrative inquiry have recently been used in research on mathematics education, particularly with regard to teacher identity (Lutovac & Kaasila, 2018) and teacher emotional factors, such as mathematics anxiety (González & Sierra, 2020), to capture rich information on teachers' lives to help them develop professionally. This approach is in line with our focus on agency to understand in detail how Doris participated in the community. The story began when Doris commenced her mathematical teaching career in a high school in Shanghai and ended when she completed the initial two-year teaching period.

Data collection and analyses

The life story interviews utilising open-ended, reflective questions were conducted with Doris before and after her classroom teaching, so that she could elicit more subjective meanings from her daily teaching practices. Data were collected over her two-year teaching period, from September 2013 to May 2015, followed by supplementary interviews to confirm the authors' interpretation of the data. The data set includes interviews, video-taped classroom observations of twelve lessons, field-notes, and related documents. The interviews were conducted in each of the four semesters over the two years, from the beginning of Doris' teaching career, and included questions to elicit her previous experiences, her teaching preparation methods, and her reflections on her teaching, etc.

To address the research question about how Doris enacted agency, we paid particular attention to teaching practice. We observed Doris' classroom teaching to identify how she conducted her mathematics teaching at the *beginning*, in the *midst* of, and at the *end* of the two years. Two trajectories were identified in Doris' teaching practice: *the basic teaching* task (completing the teaching of mathematical topics required by the curriculum in time and having students perform well in traditional tests), which conforms with her views regarding a set of core values and discourses that exist in the environment, and the task incorporating IHT. For the practice of IHT, *illumination* and *module* approaches were identified. The interviews conducted before and after Doris' classroom teaching were analysed to understand her agentic choices and actions when practising teaching, including preparing for, implementing, and reflecting on the teaching. Excerpts expressing her views about the kind of teaching practice she was conducting, what she should conduct and preferred to conduct, and the purposes for which she conducted specific teaching practices, etc., were used to identify the agentic choices made to enact practical actions. Moreover, an interview with Doris' mentor, whose mentoring provided support to Doris,

demonstrated his views about how Doris might improve her teaching.

Guided by Biesta et al. (2015), we investigated how Doris achieved agency by focusing on the role of teacher beliefs in the *iterational*, *practical-evaluative*, and *projective* dimensions, which reflected *the past*, the *present*, and the *future* of Doris’ story. The interview data concerning Doris’ beliefs with respect to mathematics content and the teaching and learning of mathematics (Beswick, 2007), were collected at the *beginning*, in the *midst* of, and at the *end* of the two investigation years and analysed with open coding to facilitate a more nuanced account of Doris’ views and beliefs and thus allow us to determine how her agency was achieved.

As summarised in Figure 1, we use the life story approach to present a timeline centred on the initial two years of Doris’ teaching career as a mathematics teacher at a Shanghai high school to explore how she enacted agency in conducting two teaching trajectories and how she achieved agency of IHT in the exam-oriented context.

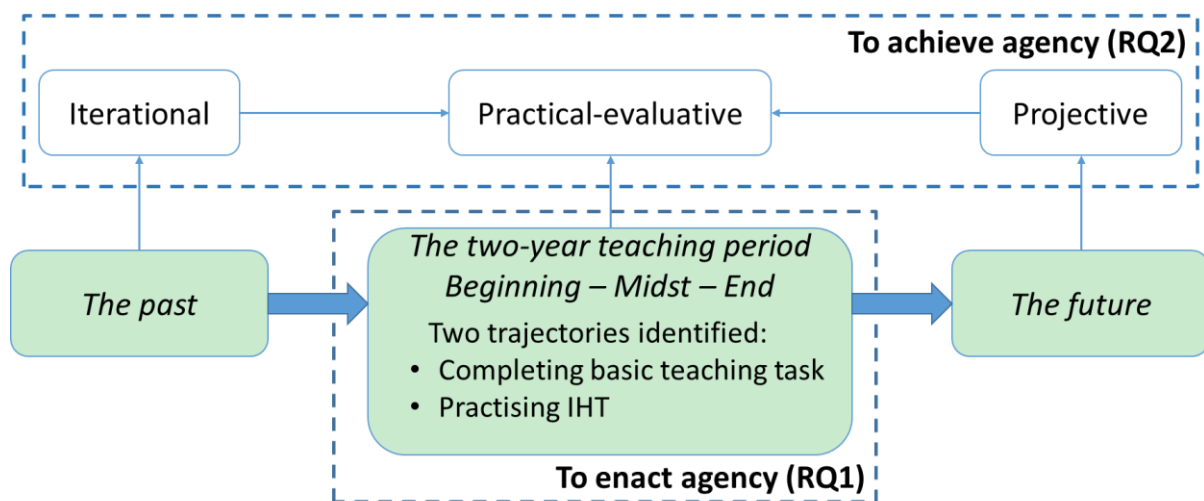


Figure 1 The life story research design to investigate Doris’ agency

4 Data reporting and interpretations

4.1 Enacting teacher agency

Doris exhibited strong agency in realising her own preference for IHT implementation in an environment that strongly emphasised students’ performances in examinations. Before describing how she exercised the agency, we first introduce how she conformed to the *doxa* — the system of core values and discourses established by social practice (Bourdieu, 1977; Nolan, 2016) — for a better understanding of how she enacted agency later.

4.1.1 Doris' trajectory of teaching mathematics as completing the basic teaching task

According to Doris, she obeyed the rules to teach the required content clearly within the required time schedule (i.e., delivering the centralised mathematics curriculum) to her students, so that they could perform as well as their counterparts in regular traditional tests. She considered this the *basic teaching* task, the completion of which would allow her to be seen as doing similar things to her colleagues and thus survive in the teacher community in which she was situated. To complete the *basic teaching* task, she typically (1) maintained the same teaching pace as her colleagues in teaching the same mathematical content, as required by the curriculum; (2) emphasised students' performances in completing supplemented exercises on the content taught; and (3) accelerated the teaching progress for the content that she considered to be easy, leaving time for students to complete more exercises on the more challenging items to reinforce their understanding of the content. She frequently reflected actively on her teaching, paying attention to students' responses to her instructions and students' performances in the exercises as well as the tests for all students in the grade. When she found that the students completed the exercises carelessly, she felt angry and believed that this would lead to their achieving lower test scores than their peers. She also carefully reviewed students' performances in weekly unit tests to monitor their learning progress.

This *basic teaching* dominated Doris' mathematics teaching approach throughout the two years, and the practice gained support from the experienced teachers around her, particularly her mentor. For example, when she felt confused about the appropriate sequence in introducing a mathematical topic (e.g., whether directly telling the students or introducing the topic through an elicitation approach), she would seek her mentor's advice, which was based on his rich experience in conducting examination-driven teaching. Moreover, Doris was also encouraged by her mentor to exhibit normative teaching manners (such as clear and well-structured blackboard writing), so that she could perform as an outstanding mathematics teacher "in the eye of the world". From the mentor's perspective,

优点就是，反应还是比较快的，在课堂上跟同学的沟通、互动上，也还是不错的。就是还蛮有活力的一个老师啦。那么从细节上来讲呢，像我们中国，比较传统的呢，对老师的基本功的要求还是蛮高的，比如板书.....要想成为高端老师，不一般的老师，那么从一开始的时候就好好有意识地去培养。

Her advantage is that she reacts fast and is good at communicating and interacting with students in class, an active teacher, but (is not good at) the details. As in China, traditionally, there are high demands on the teachers' basic skills (in teaching), such as blackboard writing.... To be a high-level teacher, it is necessary to develop (basic teaching skills) from the very beginning.

Following two years of teaching students from Grade 10 to 11, Doris thought she had no difficulties in completing the basic tasks required to teach the curricular contents of high school mathematics, with particular focus on students' performances and by implementing teacher-centred teaching.

However, Doris considered this kind of teaching to be that required by the environment but not an approach that supported what she believed to be most important for mathematics teaching. She said that her ideal teaching would be learner-centred and would require proper assessment, which is different from *Gaokao*¹. However, she had little ability to change the situation meaningfully. Therefore, she tried IHT as a means of motivating students' active learning.

4.1.2 Doris' trajectory of teaching mathematics with IHT

The agency that Doris enacted in implementing IHT was manifested in her agentic choices and actions in implementing various approaches to IHT, conducting self-learning, reflecting on the practice, and disseminating the practice. During the process, she experienced both constraints and supports in the environment.

Implementing various approaches of IHT

Doris reported that she continuously bore in mind that she should integrate mathematical history and culture into her teaching from the earliest stages of her teaching:

一开始就在做这件事情。但是具体怎么做的方法, 是在备一些新课的过程中, 暑假大概备了第一章,就已经开始做一些准备工作了, 然后会找一些数学史的素材.....就是一定要把这个数学史呀, 在平时的教学的时候就融入这个概念了, 然后在, 你在备课的时候就开始摸索了。但是这个里面的, 就是

¹ *Gaokao* refers to China's national examination for university admission.

尝试的各种方法，从一开始就是稍微提一下，讲个小故事之类的，到后来开始各种各样的花样出来。也要看，这个这个素材，对吧，要看内容，还要要看我对这个内容的熟悉程度也都不一样。比如三角那一块，正好是我比较熟悉的内容，所以就可以做很多事情。

I started doing this (IHT) from the very beginning. I usually think about how to do it when preparing new lessons. In the summer (before teaching in the school), I had prepared the first chapter (according to the textbook) ... At that moment, I made some preparations, finding materials on mathematical history... that is, integrating this (mathematical history) into our daily teaching, which requires exploration when planning the lessons. I tried several approaches: at the beginning, I just mentioned it (mathematical history)—like telling a story—and tried various approaches. It depends on the materials, right, the (mathematical) contents, and to what extent I am familiar with the contents. For instance, trigonometry is one part I am familiar with, so I can do lots of things.

From our investigation of Doris' two-year teaching period, we observed that different approaches to IHT could be used — for example, *illumination* and *modules* approaches (Jankvist, 2009). There are two examples of the illumination approach: in the second semester, Doris provided a mathematical problem on *proof without words* related to the topic of *trigonometric identities* that she was teaching, for students to complete after class, and in the first semester of the second academic year, she introduced the origins of *analytic geometry* when starting the new topic in class. In the former case, Doris said she was happy with the students' strong interest and involvement in doing the mathematical problem; however, she was unable to give them too much feedback because she needed to save time to keep the same teaching pace as her colleagues and complete the *basic teaching task*. In the latter case, she thought the mathematical content was not hard to teach, and more importantly, she was eager for students to understand the development of mathematics, although

未必对理解（数学内容）有多大帮助，但，你知道我学这个的嘛，我的课上总是有意识地让他们去了解这些东西。

It may be not helpful to understand (the mathematical contents). But, as you know,

I have learned (IHT in the master’s programme), so I always have the consciousness to let them know this (history) in my class.

The modules case took place when Doris was teaching formulae for the volume of solids in the second semester of the second teaching year. Rather than the drill and practice of the formulae that her colleagues usually implemented, Doris demonstrated the derivation of the formulae using Zu Geng’s principle (Cavalieri’s principle). The design involved the teaching of three lessons (see Figure 2) in the form of “historical packages”, referring to a collection of “materials narrowly focused on a small topic, with strong ties to the curriculum, suitable for two or three class periods, ready for use by teachers in their classroom” (Tzanakis et al., 2000).

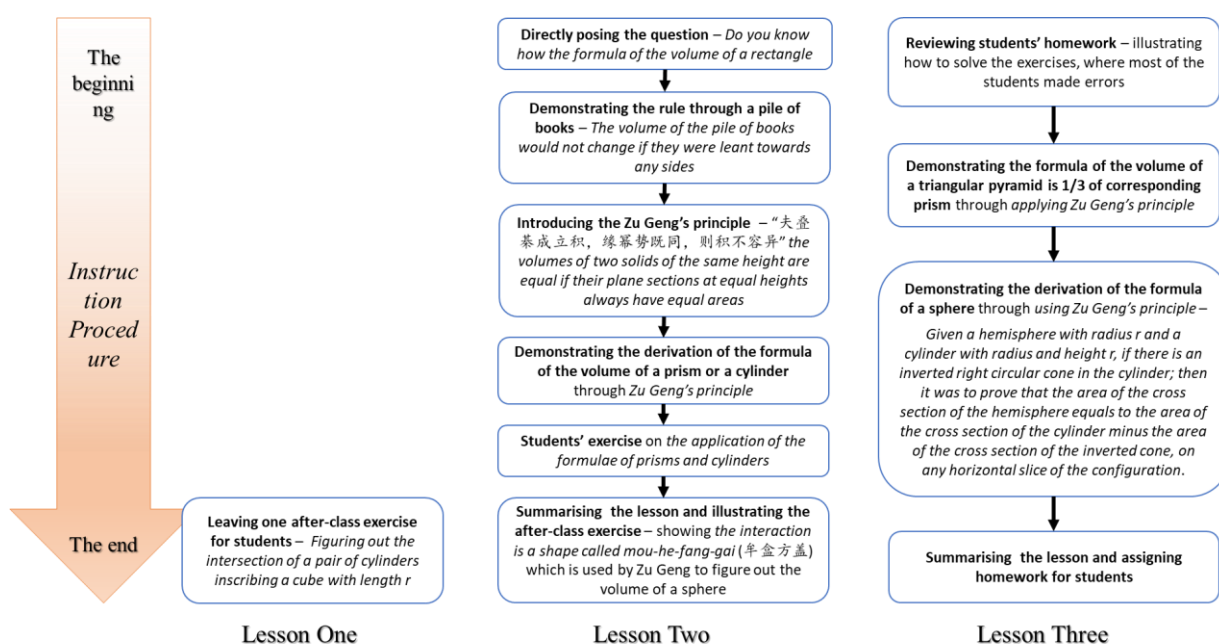


Figure 2 The modulus approach to demonstrate the derivation of the formulae of the volume of solids: the lesson design

Self-learning and reflections on the implementation of IHT

Doris stated that she had received training of IHT during her study in the master’s programme. However, to practise IHT in the real classroom setting, she needed to determine the appropriate time to do it — for example, when the mathematical contents were not too challenging to teach and conducive to integration with the historical facts. Moreover, she said she also needed to prepare well, such as reading the historical facts carefully to gain a comprehensive understanding, combining her knowledge of the curriculum and her students, and sometimes seeking her mentor’s comments on the design.

Doris felt extremely satisfied and encouraged when she saw the students show interest when she introduced the historical facts and then engaged themselves in solving and discussing the problems she provided. In the case of the abovementioned modulus approach, the students discussed the after-class exercise spontaneously.

刚刚他们在排队准备做操的时候, 我就听到好几个在讨论我最后留的这个问题 (正方体用圆柱体切割问题), 我蛮惊喜的。所以我觉得问题本身是否有趣味性也很重要。

I heard a number of students discussing the problem I left to them (the shape of the interception of a pair of cylinders inscribing a cube) just now when they were queuing up to do the *morning exercise*. I am surprised. So, the interest in the problem per se is important as well.

However, she was disheartened when she found that the students did not perform well in the homework, and so she spent more time reviewing students' work (at the beginning of Lesson Three in Figure 2). She attributed such a result to her emphasis on Zu Geng's principle instead of intensive practice on the related exercises. Doris then doubted whether her insistence on IHT was right. She said the students needed to perform well in the traditional examinations, for which only drill and practice worked.

我的精力也很有限, 就是, 然后人会有一点惰性。然后呢, 还有环境是否允许。因为, 我花时间去做这些东西, 必须是我先保证了学习成绩。

My energy is limited, and people are usually lazy. Does the environment really allow (to practise IHT)? I have to guarantee (students') achievements first before spending time on doing it (IHT).

Despite this pressure, Doris said she would still continue practising IHT as she believed "it was just right to insist", especially when she considered students' active responses to this practice.

Performing the practice of IHT

Although Doris' practice of IHT did not corroborate the dominant practice of the environment, she was appreciated by her colleagues, who were experienced teachers. For instance, when she practised IHT in a public lesson which demonstrated the application of

mathematical induction, she expressed her sincere gratitude to her mentor for their support in preparing the lesson. She intended to emphasise the application of the recursive principle and to use typical mathematical problems from historical materials to organise the instruction but was confronted with difficulties in searching for appropriate problems.

一开始是,我做不下去了,挑不到好的题目,然后觉得做不下去了,挑了一堆题目来讲数学归纳法,乱,没有一个主题,它是一个类似于拓展性质的课,我就跟师傅说,算了,就随便上一节家常课吧。他就不答应,他说你再想、你再找,就逼着你找。我觉得有个,就是关键时候,师傅的那种鼓励和他对你的那种高要求,就是逼着你去做,这个也很重要。

At the beginning stage (of preparing the lesson), I felt I could not continue (the original lesson plan), since I could not find good (mathematical) problems. I selected several mathematical problems to teach mathematical induction. There was no theme, which made the lesson messy. It was kind of an exploring lesson. Then I said to my mentor that I would change to teach a regular lesson. He disagreed and pushed me to find (more problems). I think the mentor's encouragement and high requirements at some key points in time are also important.

She also appreciated the mentor's further discussions with her regarding selection of the problem and the detailed instructional plan. 'Since he (the mentor) has rich (teaching) experience and enough knowledge foundation, he often provides valuable suggestions on how to deal with the instructional procedure smoothly', Doris reported.

Doris was highly praised for her performance in the public lesson, and she also received positive feedback from the students²:

刚开始时,我几乎无从下手,但一节课下来....., 成果丰富。

When first (reading the problem), I hardly knew where to start, but at the end of the lesson, I did a lot.

² The excerpts of students' voice provided by Doris from her diary.

我们需要大胆一些,, 往往在不知不觉中发现了规律, 有了灵感和思路。

We should be bolder (to explore), ..., then we may find something subconsciously, having inspiration and train of thought.

4.2 Doris' beliefs

As we can see from the above story about Doris, she enacted agency in practising IHT while insisting on completing the basic teaching task in accordance with the *doxa*. To understand how Doris' agency was achieved, we placed greater emphasis on her beliefs, looking back to *the past* two years and focusing on her beliefs as reflected in the two years' teaching.

According to Doris, she had genuine enthusiasm for teaching, and considered it her “talent”:

从小就, 自己, 先是自己爱, 就是比较爱学习的。然后就是, 遇到的老师, 可能对自己有一定的影响....., 我遇到了几个好的老师, 我就觉得做老师挺有意思的。然后可能也是有点天赋吧, 反正从小到大就是想过要做老师, 也没想过做别的。嗯, 你相信天分吗? 对, 我觉得一个人是否干什么, 有的时候是注定的。

First, from childhood, comparatively, I liked learning. And then, the teachers I encountered probably influenced my (choice)..... I met several good teachers, who made me feel that it is meaningful to be a teacher. Then, probably [I have] a bit of talent. Whatever it is, [I] have not considered other jobs except for being a teacher from my childhood. Em, do you believe in talent? Yeah, I think what career one chooses is sometimes destined.

She also appreciated her mathematics learning experiences in her bachelor's and master's programmes. As such, she was determined to become a mathematics teacher for a long time, bringing relevant experiences into her teaching career that shaped the professional beliefs and agency.

4.2.1 The beliefs Doris brought into the teaching career

In the interviews with Doris, she reported that she considered mathematics to be “the base and instrument of all sciences”, “everywhere in our lives”, and as “fostering one's logical thinking”.

She appreciated the function of mathematics in fostering logical thinking and believed that one's life could benefit from this:

你做事会非常有章法，而不是很混乱，你做事就像去推理证明一样有章法。

You will be well organised when doing something, without mess. You will be organised, with reasoning.

She emphasised both students' and teachers' efforts in mathematics learning and teaching. She hoped the students could preview the lesson before class, determine their own learning approaches, try to understand the mathematical content, and do their homework independently; and they should also have positive attitudes towards learning mathematics. As a teacher, she considered the ability to arouse students' interests in learning to be the most crucial ability:

如果一个老师能够让学生对自己的学科产生兴趣、产生浓厚的兴趣，他就成功了，就成功了。因为学生学习一门学科，他最大的老师就是兴趣。

If a teacher can help the students become interested in the subject she/he teaches, she/he is successful, since the greatest 'teacher' for students to learn the subject is interest.

Doris mentioned that her learning experience in the master's programme, during which she majored in HPM, led her to think that IHT is an effective means of promoting students' interest and motivation in learning mathematics.

However, at the beginning of her teaching career, she claimed that her priority in teaching was to *complete the basic task of teaching school mathematics* well rather than IHT, to help herself and her students "stand firmly (站稳脚跟)" (survive) among the mathematics teacher group and the student group in the same grade in the school at that moment, which can only be achieved by her students' good achievements in examinations in relation to their peers. To do so, she emphasised teacher authority in class:

课上要跟着老师的步子走，我甚至详细地要求到了他们课上，他们的书桌上必须有课本、作业册、草稿本，因为随时，我说你要动手算，你就能拿出笔和本算。

(The students) should follow the teacher's steps in class. I even required them to have their textbooks, exercises books, and paper on the desk, so that they can do exercises at any time once I say 'please do (the exercises)'.

It appears that Doris had two objectives when she started teaching: promoting students' interest and motivation in learning mathematics through IHT and completing the exam-oriented basic task of teaching that was considered the priority. There appeared to be some space, however, since she did not seem to be overemphasising students' achievements:

脚跟已经站稳了 (学生成绩还可以), 不要最差就可以。

(We have already) stood firmly (since the students performed fine among their counterparts in the examination). Not the worst, then it is fine.

4.2.2 Doris' beliefs during the two-year teaching period

Through interviews with Doris *in the midst* and *at the end* of the two-year teaching period, we studied her views in relation to the two teaching trajectories, including her views on the teaching and learning of mathematics and the environment, etc.

In an interview after one year of teaching, Doris reported that the first criterion for teaching mathematics well is to complete the basic teaching task:

就是按照教材上的, 教材是最基本的, 主要就是考什么我们就得讲什么.....,
有些是书上没有的, 肯定要补的, 这个要依靠备课组的老师, 因为有些东西
我并不知道。

Following the textbooks, textbooks are the basis. We should teach what is tested in examinations.... Something (tested) that is not in the textbooks should be supplemented. This depends on the teachers from the lesson preparation group, since I have no idea about it.

It was exam-oriented teaching, closely following the textbooks and the collective lesson plans. Based on completing the basic tasks, Doris said she would “do something related to mathematical history and culture (去做一点文化历史方面的东西)”.

She then emphasised teachers' professional skills, including a sound mathematical knowledge

base (就本身你数学要好, that is your [the teacher's] mathematics should be good), and good pedagogical skills. With these, 'your working skills can be recognised by the students (你的工作能力能够得到学生的肯定)', reported Doris; and she considered it the most important.

On the other hand, Doris claimed that "education should be a little bit idealistic" whereby "it could have a more positive impact on society" and "its own development could be easier". This "idealisation" did not concern the number of exercises that students complete but rather their efforts and values of the subject, and it cannot be evaluated by the current high-stake examinations. She believed that she could insist on a degree of "idealisation" through practising IHT with the aim of encouraging students' own exploration of mathematics.

However, when students did not do their homework well, Doris felt disappointed and complained:

这不是一个, 就是这大环境并不允许你去花非常多的精力在这件事情上。就
变成了这是一个, 其实我认为是一个主要的事情, 但是实际的限制是这变成
了你课余在你有余力的时候才能去稍微做一点的事情。有点矛盾。

This is not what the environment allows you to spend much energy in doing (IHT).
This becomes a contradiction, as it was the thing I thought was important, but the
reality forced you to do it only during spare time with extra effort.

At that moment, she usually backed out: "I would finally become exhausted one day".

However, in the last interview to summarise the 'harvest' of her teaching, she appreciated her insistence on IHT and expressed her willingness to continue:

最大的收获是知道自己要做什么, 就是, 怎么讲, 抛开成绩、对成绩的这种
过分关注。然后, 要让学生了解更多这种数学本质的东西,,要教会他们
怎么学数学.....我甚至有考虑到后面的一轮选修课, 要开微积分,,更多地
在高中渗透数学史、数学文化。

The biggest harvest is knowing what you yourself should do. That is, how to say, abandoning the overemphasis on achievements, and then letting the students know

better about the essence of mathematics, Teach them how to learn mathematics.... I have even considered teaching calculus in the round of selective courses...to integrate more mathematical history and culture into high school teaching.

Doris first attributed the “harvest” to students’ needs and particularly their positive responses, for instance, when the students showed active engagement in completing the mathematical problems Doris provided and when “they continually asked me follow-up questions about the problem after the class”. She then emphasised the support from the mentor and the collective lesson preparation group involving all mathematics teachers teaching in the same grade with her:

他们鼓励你这么做。而且他们知道你喜欢这样做之后，他们也会拿这一类的问题来问你，跟你讨论。

They encourage you to do so (IHT). And when they know you like to do it (IHT), they will ask you related questions, and discuss with you.

Moreover, she said that she was satisfied with the students’ achievements in the two-year’s teaching, during which she insisted the pattern of practising IHT based on completing the basic teaching task.

我没想要再高的成绩，到现在的程度我已经很满意了。现在的成绩说明我现在的能力，或者说我现在的教学模式可以达到一个我认为我比较满意的结果，就验证了我是、算是正确的。那么我就可以继续这样走下去。如果我这样走下去，学生的成绩不是很满意，我可能就放弃了。

I do not expect better achievements. I am satisfied with the current situation. (Students’) current achievements show that my current ability, or my current teaching pattern has achieved a result I think I am satisfied with. This verifies that I am right. Then I can continue. But I will give up if students’ achievements are not satisfactory when I continue.

It appears that Doris’ teaching was not completely exam-oriented, but it was still constrained by examinations.

5. Summary, discussion and conclusion

The above analysis presents the life story of Doris who enacted agency in the initial stage of her teaching career, when she practised IHT as the opportunities arose in the spare time, on condition that the basic tasks of teaching could be completed and students' performances in examinations would not be negatively influenced. Regarding practising IHT, the above analysis raises issues about the ways in which teacher agency may be achieved in an exam-oriented and performance-driven context. First, "teacher agency is highly dependent upon the personal qualities that teachers bring to their work" (p. 636. Biesta et al., 2015). The professional knowledge, skills, and—especially—beliefs that stemmed from Doris' learning experiences in the bachelor's and master's programmes construed the major part of the iterational dimension of her agency. On the other hand, these experiences also nurtured the capacities related to her work, such as delivering the centralised curriculum (Zhang & Wang, 2014), which contributed to her successful completion of the basic teaching tasks.

Concerning the practical-evaluative dimension of teacher agency, our results echo Bonner et al.'s (2020) study that teachers' lived experiences with students significantly impact and shape teacher agency and even the change of beliefs, including Doris' beliefs, within the restrictive condition of not influencing the students' performances in traditional examinations. Our data also suggest that the school environment leaves space for Doris to practice IHT but that this space is limited. Doris' colleagues, particularly her mentor, provided supports for her to practice IHT mentally and practically and showed interest in the practice by autonomously communicating with Doris about it. This phenomenon may be deemed consistent with the current mathematics curricular standards in China (MOE, 2011, 2018) as well as educational research in the country (Wang et al., 2018), which advocate the educational values of mathematical culture and history. These then make it proper for Doris to perform IHT in a public lesson, during which her mentor was involved much, and Doris was highly praised. It was not only Doris' achievement but also her mentor's. It appears that this kind of activities for teachers to perform their teaching to their peers would probably become the catalyst for teachers to implement IHT and to recognise the values of implementing IHT through deeper involvement of both experienced and beginning teachers. One might also argue that teaching competition raises other uncomfortable issues, such as the implementation of one approach in ordinary classrooms but performing in public or open lessons with another. This is not the agency required for practising IHT but for elaborate teaching performance.

Our data do not point towards a clear direction in which Doris should shape her agency in the

long term, that is, whether she should insist on practising IHT or follow her colleagues in delivering exam-oriented mathematics teaching, conforming to the context. We can only clearly see from the data that her choices usually depended on students' performances. This, once again, strengthens the dominant position of the exam-oriented and performance-driven teaching practice and demonstrates that, in the context of China, teachers are accustomed to implementing alternative teaching methods whilst maintaining traditional teaching practices, as earlier studies have suggested (e.g., Lai et al., 2016). Therefore, we suggest that teachers promoting student-centred pedagogies, such as IHT in our study, should accept the existing *doxa*, particularly restrictive educational contexts, and recognise that no education changes are likely to occur immediately. As mentioned above, several measures have been taken to create space for the promotion of IHT in China, advocating the incorporation of IHT into curricular standards and educational research.

From Doris' case of enacting agency, we propose the possibility of promoting student-centred pedagogies, such as IHT, on larger scales, based on our findings regarding the experienced teachers' involvement in Doris' deployment of IHT and their interest in that practice. A collaborative mentorship has been recognised between Doris and her mentor, in which Doris performed more actively, suggesting that both the mentee and the mentor can learn from one another (Lu, Leung, & Kaiser, 2020). The structured intra- and inter-school *teaching and research* (*jiaoyan*, 教研) systems in China may have a positive impact on the promotion of student-centred pedagogies, particularly in well-developed regions (Shi, Gu, Bao, Yang, Huang, Wu, & Gu, 2016). More optimistically, changes in *doxa* may occur, and a new balance between the sociological and professional subjects may be achieved with the mediation of agency (Eteläpelto, Vähäsantanen, Hökkä, & Paloniemi, 2013). However, this necessitates further inquiry about the various possibilities with particular attention to the characteristics of specific contexts.

In conclusion, we presented Doris' case to provide some implications for the possibility that early-career teachers may implement student-centred pedagogies in contexts dominated by traditional teaching practices. The life story approach shows vividly and in an in-depth manner how a beginning teacher enacted and shaped agency in IHT within an exam-oriented and performance-driven context, and provides insights into the theory and practice of teacher professional development. We acknowledge, however, that the limited case study cannot capture the whole picture and that further research is needed, especially from an agentic perspective. Notwithstanding this limitation, the case gives assurance that student-centred teaching against

a dominant unfavourable teaching environment is still possible. It implies the importance of teachers' personal qualities and the experiences that form their professional beliefs, knowledge, and skills in their teaching careers and the structure and culture of schooling that provides space for teachers to enact and shape agency in practising student-centred teaching. Moreover, it reminds us that educational changes cannot happen immediately, and from another perspective, the dominant teaching style may have some saving graces. For instance, the traditional dominant teaching style may focus on teachers' comprehensive understanding of the curricular content and their skills in clearly conveying the content to their students, which provide the bases for conducting student-centred and even innovative teaching. Thus, the specific context of this study not only provides an interesting case study of student-centred teaching against examination-driven teaching, but also provides pointers for supporting inquiry-based teaching, which may offer insights applicable to other contexts.

References

- Atkinson, R. (2007). The life story interview as a bridge in narrative inquiry. In D. J. Clandinin (Ed.), *Handbook of narrative inquiry: Mapping a methodology* (pp. 224–245). Thousand Oaks, CA: Sage Publishing.
- Artique, M., and Blomhøj, M. (2013). Conceptualizing inquiry-based education in mathematics. *ZDM Mathematics Education*, 45, 797-810. doi: 10.1007/s11858-013-0506-6.
- Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology*, 52, 1-26. doi: 10.1146/annurev.psych.52.1.1
- Beswick, K. (2007). Teachers' beliefs that matter in secondary mathematics classrooms. *Educational Studies in Mathematics*, 65, 95-120.
- Biesta, G., Priestley, M. & Robinson, S. (2015). The role of beliefs in teacher agency. *Teachers and Teaching*, 21(6), 624–640.
- Bonner, S. M., Diehl, K., & Trachtman, R. (2020). Teacher belief and agency development in bringing change to scale. *Journal of Educational Change*, 21, 363–384.
- Borromeo Ferri, R. (2018). *Learning How to Teach Mathematical Modelling in School and Teacher Education*. New York: Springer. doi.org/10.1007/978-3-319-68072-9
- Bourdieu, P. (1977). *Outline of a theory of practice* (R. Nice, Trans.). Cambridge: Cambridge University Press.
- Cai, J., & Lester, F. A. (2005). Solution and pedagogical representations in Chinese and U.S. mathematics classroom. *Journal of Mathematical Behavior*, 24(3–4), 221–237.
- Clark, K., Kjeldsen, T. Schorcht, S., Tzanakis, C., & Wang X. (2016, July). History of mathematics in mathematics education. Recent developments. *History and Pedagogy of Mathematics*. Retrieved from <https://hal.archives-ouvertes.fr/hal-01349230/document> on December 13th, 2019.
- Donnell, L. A., & Gettinger, M. (2015). Elementary school teachers' acceptability of school reform: Contribution of belief congruence, self-efficacy, and professional development. *Teaching and Teacher Education*, 51, 47–57.
- Ernest, P. (1989). The knowledge, beliefs and attitudes of the mathematics teacher: A model. *Journal of Education for Teaching*, 15(1), 13–33. doi: 10.1080/0260747890150102

- Eteläpelto, A., Vähäsantanen, K., Hökkä, P., & Paloniemi, S. (2013). What is agency? Conceptualizing professional agency at work. *Educational Research Review*, *10*, 45–65. doi: 10.1016/j.edurev.2013.05.001
- Eteläpelto, A., Vähäsantanen, K., & Hökkä, P. (2015). How do novice teachers in Finland perceive their professional agency? *Teachers and Teaching*, *21*(6), 660–680.
- Felton, M. D., & Koestler, C. (2015). “Math is all around us and ... we can use it to help us”: Teacher agency in mathematics education through critical reflection. *The New Educator*, *11*(4), 260–276. doi: 10.1080/1547688X.2015.1087745
- Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, *12*(2), 219–245. doi: 10.1177/1077800405284363
- González, M. S. G., & Sierra, G. M. (2020). The history of a teacher’s relief of his mathematics anxiety: the case of Diego. *Educational Studies in Mathematics*, *103*, 273–291.
- Gulikers, I., & Blom, K. (2001). A historical angle: a survey of recent literature on the use and value of history in geometrical education. *Educational Studies in Mathematics*, *47*(2), 223–258. doi: 10.1023/A:1014539212782
- Guo, M., & Leung, F. K. S. (2020). Achievement goal orientations, learning strategies, and mathematics achievement: A comparison of Chinese Miao and Han students. *Psychology in Schools*. <https://doi.org/10.1002/pits.22424>
- Hadar, L. L., & Benish-Weisman, M. (2019). Teachers’ agency: Do their values make a difference? *British Educational Research Journal*, *55*(1), 137–160.
- Hilferty, F. (2008) Theorising teacher professionalism as an enacted discourse of power, *British Journal of Sociology of Education*, *29*(2), 161–173.
- Howson, G., & Wilson, B. (Eds.). (1987). *School mathematics in the 1990s*. England: Cambridge University Press. doi.org/10.1017/CBO9781139013529
- Jahnke, H. N. (2000). The use of original sources in the mathematics classroom. In J. Fauvel, & J. van Maanen (Eds.), *History in mathematics education, the ICMI study* (pp. 291–328). Dordrecht: Kluwer Academic.
- Jankvist, U. T. (2009). A categorization of the “whys” and “hows” of using history in mathematics education. *Educational Studies in Mathematics*, *71*(3), 235–261. doi: 10.1007/s10649-008-9174-9
- Klein, M. (1999). The construction of agency in mathematics teacher education and development programs: A poststructural analysis. *Mathematics Teacher Education and Development*, *1*, 84–93.
- Lai, C., Li, Z., & Gong, Y. (2016). Teacher agency and professional learning in cross-cultural teaching contexts: Accounts of Chinese teachers from international schools in Hong Kong. *Teaching and Teacher Education*, *54*, 12–21.
- Lasky, S. (2005). A sociocultural approach to understanding teacher identity, agency and professional vulnerability in a context of secondary school reform. *Teaching and Teacher Education*, *21*(8), 899–916. doi: 10.1016/j.tate.2005.06.003
- Leung, F. K. S. (2001). In search of an East Asian identity in mathematics education. *Educational Studies in Mathematics*, *47*(1), 35– 51.
- Lipponen, L., & Kumpulainen, K. (2011). Acting as accountable authors: Creating interactional spaces for agency work in teacher education. *Teaching and Teacher Education*, *27*(5), 812–819. doi: 10.1016/j.tate.2011.01.001
- Lutovac, S., & Kaasila, R. (2018). An elementary teacher’s narrative identity work at two points in time two decades apart. *Educational Studies in Mathematics*, *98*(3), 253–267.
- Lu, X., Kaiser, G., & Leung, F. K. S. (2020). Mentoring early career mathematics teachers from the mentees’ perspective — a case study from China. *International Journal of Science and Mathematics Education*, *18*, 1355–1374.

- Ma, Y., Lam, C., & Wong, N. (2006). Chinese primary school mathematics teachers working in a centralised curriculum system: a case study of two primary schools in North-East China. *Campare: A Journal of Comparative Education*, 36(2), 197–212. doi: 10.1080/03057920600741206
- Martin, J. (2004). Self-regulated learning, social cognitive theory, and agency. *Educational Psychologist*, 39(2), 135–145. doi: 10.1207/s15326985ep3902_4
- MOE (Ministry of Education of China). (2011). *Yiwu jiaoyu shuxue kecheng biao zhun (2011nian ban)* [Compulsory education mathematics curriculum standards (2011 Edition)]. Beijing: Beijing Normal University Publishing Group.
- MOE (Ministry of Education of China). (2018). *Putong gaozhong shuxue kecheng biao zhun (2017nian ban)* [High school mathematics curriculum standards (2017 Edition)]. Beijing: People's Education Press.
- Nolan, K. (2012). Dispositions in the field: Viewing mathematics teacher education through the lens of Bourdieu's social field theory. *Educational Studies in Mathematics*, 80(1/2), 201–215. doi: 10.1007/s10649-011-9355-9
- Nolan, K. (2014). Discursive productions of teaching and learning through inquiry: Novice teachers reflect on becoming a teacher and secondary mathematics teacher education. In L. Thomas (Ed.), *Becoming teacher: Sites for teacher development in Canadian teacher education* (pp. 258–288). Ottawa: Canadian Association for Teacher Education (CATE).
- Nolan, K. (2016). Schooling novice mathematics teachers on structures and strategies: A Bourdieuan perspective on the role of “others” in classroom practices. *Educational Studies in Mathematics*, 92(3), 315–329.
- Noyes, A. (2004). Where have all the maths teachers gone? *Proceedings of the British Society for Research into Learning Mathematics*, 24(3), 21–26.
- OECD (2013). *PISA 2012 Results: Ready to Learn: Students' Engagement, Drive and Self-Beliefs (Volume III)*, PISA, OECD Publishing. doi: 10.1787/9789264201170-en
- OECD (2019). *PISA 2018 Results (Volume I): What Students Know and Can Do*. PISA, OECD Publishing, Paris. <https://doi.org/10.1787/5f07c754-en>.
- Priestley, M. (2011). Whatever happened to curriculum theory? Critical realism and curriculum change. *Pedagogy, Culture and Society*, 19(2), 221–237.
- Priestley, M., Biesta, G. & Robinson, S. (2013). Teachers as agents of change: Teacher agency and emerging models of curriculum. In M. Priestley & G. Biesta (Eds.), *Reinventing the curriculum: New trends in curriculum policy and practice* (pp. 187–206). London: Bloomsbury.
- Priestley, M., Biesta, G., & Robinson, S. (2015a). *Teacher agency: An ecological approach*. London: Bloomsbury Publishing.
- Priestley, M., Biesta, G., & Robinson, S. (2015b). Teacher agency: What is it and why does it matter? In: R. Kneyber & J. Evers (Eds), *Flip the system: Changing education from the bottom up* (pp. 1–11). London: Routledge.
- Shi, N., Gu, L., Bao, J., Yang, Y., Huang, H., Wu, Y., & Gu, F. (2016). Shanghai shuxue jiaoyu gaige jiben jingyan baogao [A report of Shanghai mathematics educational reform]. *Shanghai Jiaoyu [Shanghai Education]*, 2016, 9(a), 20–23.
- Tao, J., & Gao X., (2017). Teacher agency and identity commitment in curricular reform. *Teaching and Teacher Education*, 63, 346-355. doi: 10.1016/j.tate.2017.01.010
- Tzanakis, C., Arcavi, A., de Sa, C. C., Isoda, M., Lit, C-K., Niss, M., de Carvalho, J. P., Rodriguez, M., & Siu, M-K. (2000). Integrating history of mathematics in the classroom: An analytic survey. In J. Fauvel, & J. van Maanen (Eds.), *History in mathematics education The ICMI Study* (pp. 201–240, Chapter 7). Dordrecht: Kluwer Academic Publishers. doi: 10.1007/0-306-47220-1_7

- Wallace, C. S., & Priestley, M. R. (2017). Secondary science teachers as curriculum makers: Mapping and designing Scotland's new Curriculum for Excellence. *Journal of Research in Science Teaching*, 54(3), 324–349.
- Wang, J., & Lu, X. (2018). Selection of content in high school mathematics textbooks: An international comparison. *ZDM Mathematics Education*, 50, 813–826.
- Wang, X., Qi, C., & Wang, K., (2017). A categorization model for educational values of the history of mathematics: An empirical study. *Science and Education*, 26, 1029–1052. doi: 10.1007/s11191-017-9937-8
- Wang, K., Wang, X., Li, Y., & Rugh, M. S., (2018). A framework for integrating the history of mathematics into teaching in Shanghai. *Educational Studies in Mathematics*, 98, 135–155. doi: 10.1007/s10649-018-9811-x
- Wills, J. S. & Sandholtz, J. H. (2009). Constrained professionalism: Dilemmas of teaching in the face of test-based accountability, *Teachers College Record*, 111(4), 1065–1114.
- Wilson, E., & Deaney, R. (2010). Changing career and changing identity: How do teacher career changers exercise agency in identity construction? *Social Psychology of Education*, 13(2), 169–183.
- Zhang, D. Li, S. & Tang, R. (2004). The “two basics”: Mathematics teaching and learning in Mainland China. In L. Fan, N. Y. Wong, J. Cai, & S. Li (Eds.), *How Chinese learn mathematics: Perspectives from insiders* (pp. 188–207). Singapore: World Scientific Publishing Company. doi: 10.1142/9789812562241_0007.
- Zhang, Q., & Wong, N. Y. (2014). Beliefs, knowledge and teaching: A series of studies about Chinese mathematics teachers. In L. Fan, N. Y. Wong, J. Cai, & S. Li (Eds.), *How Chinese teach mathematics: Perspectives from insiders* (pp. 457–492). Singapore: World Scientific Publishing Company.