A case study on Chinese high school teachers:
the relationships between teachers' epistemic beliefs
and their teaching practice
in Chinese examination-oriented context

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Many studies have shown that it is important to understand teachers' epistemic beliefs in educational reform because their epistemic beliefs often influence teachers' behaviours. Based on previous study, there were two kinds of teachers' epistemic beliefs: reflective-collaborative and knowledge transmission. Teachers' teaching practices could be learning-focused or content-focused. The aim of this study was to find out Chinese high school teachers' epistemic beliefs and their teaching practices and how they were related to each other.

In this study, the participants were 10 high school teachers from China. Interviews were conducted online in their mother tongue. The interview questions were adapted from previous research, and content analysis was used to analyze the transcripts.

The results showed that the teachers held both epistemic beliefs. Metacognition and reflection were important, but so was the transmission of knowledge. In their self-reports, teachers would use different teaching methods depending on the situation, trying to find a balance between their own beliefs and the exam-oriented social context. For most teachers, there was no strong link between teachers' epistemic beliefs and practices, which might be caused by the socio-cultural context and the lack of adequate competencies.

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许多研究表明，在教育改革中了解教师的认知信念是非常重要的，因为教师的认知信念常常影响教师的行为。根据以往的研究，教师的认知信念有两种：反思-合作和知识传递。教师的教学实践可以学习为中心，也可以内容为中心。本研究旨在了解中国高中教师的认知信念和他们的教学实践，以及两者之间的关系。

本研究的参与者是 10 名来自中国的高中教师，访谈是以他们的母语即中文在线进行的。访谈问题改编自以前的研究，访谈记录采用内容分析法进行分析。

研究结果表明，教师可能同时持有两种认知的信念。他们认为，让学生参与到知识建构的过程中来很重要，但知识的传递也很重要。在教师们的自我报告中提到，他们会根据不同的情况使用不同的教学方法，这些老师试图在自己的教育信念和以考试为导向的社会文化背景之间找到一个平衡点。对大多数教师来说，教师的认知信念和教学实践之间没有紧密的联系，这可能是由于社会文化背景和缺乏足够的能力造成的。

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1   Introduction

Aiming to 'rebuild the culture of teaching and learning', China had launched several national curriculum reforms in the past 20 years, the educational goals evolved from 双基 (Shuangji, fundamental knowledge and skills) to 素质 (Suzhi, qualities), and then the present 素养 (Suyang, competencies). The idea of suyang (competencies) transforms the educational goal from knowledge acquisition to the development of key competencies, including learning to learn, problem-solving, and cooperative learning abilities (Wang, 2019). However, when new pedagogical methods and beliefs were introduced to school leaders and teachers, the feasibility was questioned (Yin et al., 2014). It's not easy to change teachers' beliefs and practices. Teachers' beliefs and practices may not change immediately as the reform guidelines were launched.

The Chinese education system is strongly characterized, even dominated, by examination-oriented culture in which all stakeholders in education place special emphasis on student performance in examinations, especially the college entrance examinations (Yin et al., 2014). Students' scores are the importantevaluation criteria not only for students but also for teachers and school leaders. This was especially true at upper secondary schools, the target of which is to help students achieve greater scores at the college entrance exam since this exam has long been considered as the most important life-changing opportunity for Chinese students and their families. During these 20 years of pedagogical reform, various domestic researchers advocated that we need to transfer our teaching beliefs and practices. However, teachers' teaching practice may not change as expected. Thus, I would like to find out whether their beliefs or their

practices need to be refreshed to cope with the reform. There is very limited empirical research related to Chinese teachers' epistemic beliefs, especially high school teachers who undertake the greatest pressure of succeeding in examination. This study thus is designed to explore the epistemic beliefs of Chinese high school teachers, their teaching practices, and therelationship between their beliefs and pratices.

There is growing evidence that teachers' practices and preferences is mediated by their epistemic beliefs (Buehl & Fives, 2009). Research on teachers' beliefs is considered to be essential and valuable in the educational field since it is the heart of teaching (Kagan, 1992). Especially in educational reforms, teachers must be willing to question and refresh their current knowledge and understanding of learning, teaching, and related practices (Lonka, 2018). Hence, in order to understand teachers' behaviours, more attention should turn to teachers' beliefs (Pajares, 1992).

Epistemic beliefs refer to the beliefs about the nature of knowledge and knowing (Lonka et al., 2021; Buehl & Fives, 2016; Lammassaari et al., 2021). Hofer (2004) proposed a multidimensional model of epistemic beliefs: the first dimension is *the nature of knowledge* containing *the certainty of knowledge* and *the simplicity of knowledge*, seeing knowledge as certain or tentative, discrete or interrelated; another dimension is *the process of knowing* including *the source of knowledge* and *the justification of knowing*, believing the knowledge should be transmitted from the authority or constructed by the learner, directly from teachers or critically reflected.

In terms of the purpose of teaching, teachers' teaching approaches can be classified into two orientations (Postareff & Lindblom-Ylänne, 2008): learning-focused (aiming at promoting students' learning and teachers' teaching) and content-focused (focusing on knowledge transmission and repeating). During these 20 years of pedagogical reform, the Chinese education system has also embraced many of the pedagogical affects advocated by the West, like inclusion curriculum, student-centered teaching, constructive teaching, and collaborative learning. However, these 'ideal' teaching methods may not be implemented in teachers' daily teaching.

Overall, this study focuses on teachers' epistemic beliefs and their teaching approaches, trying to clarify the relationship between teachers' beliefs and practices under the Chinese examination-oriented background.

2   Theoretical background

Research on epistemic beliefs and teaching practice are wide and broad. In this part, key concepts and relevant previous research will be introduced. For the first part, the development and variation of epistemic beliefs will be listed, and then the scope is narrowed to explain what teachers' epistemic beliefs are. In the second part, teaching approaches and conceptions of teaching will be identified. At last, the relationship between teachers' epistemic beliefs and teaching approaches will be analysed.

2.1 Epistemic beliefs

The definition of teachers' beliefs had long been messy, causing difficulty in relevant studies (Pajares, 1992), so the confusing relevant terminology: 'epistemic cognition, 'epistemology' and 'epistemic beliefs' need to be clearly clarified first. The term 'epistemic cognition' was coined by Kitchener (1983). She used this term to describe the highest level of cognitive processes when people deal with complex problems in the three levels of cognitive process: (1) cognitive level, which refers to computing, memorizing, reading, solving problems, etc.; (2) metacognitive level, the process monitored by individuals when engaging in the cognitive tasks; (3) epistemic cognition level, individuals mediate on the limits and certainty of knowledge as well as the criteria of knowing. However, Hofer (2016) critisized that the mental processes happened in the third level were not mentioned, and thus he proposed that epistemic cognition as a term to describe a set of mental processes that include the development and application of the concepts of one's conceptions of knowledge and knowing. In a word, epistemic beliefs can be seen as an essential part of epistemic cognition (Lonka et al., 2021). The term 'epistemology', refers to the theory of knowledge, the nature and

justification of human knowledge (Hofer & Pintrich, 1997; Hofer, 2000; Lonka & Lindblom-Ylänne, 1996). Besides, researchers also argued about the relationship between conceptions of learning and epistemic beliefs (Entwistle & Peterson, 2004). Hofer and Pintrich (1997) argued that conceptions of learning should be considered separately from personal epistemology while Schommer and Aikins (2002) insisted the interpretation, which would benefit teachers to understand studetns' learning. Lonka et al.(1996) also claimed that students' conceptions of learning did reflect their personal epistemologies. In their research   Lonka et al. (2021) found that conceptions of learning were closely related to students' epistemic profiles.

2.1.1 The development of the definition of epistemic beliefs

Originally, the first wave of research on epistemic beliefs was qualitative and interview-based, several parallel developmental models were proposed at this time (Hofer, 2016). They can be grouped into four categories: *dualism, multiplicity, contextual relativism,* and *commitment within relativism* (Kuhn 1991; Perry 1970). Research in the second wave was always conducted more quantitatively through Likert-scale questionnaires (Hofer, 2016). During this period, epistemic beliefs were considered to be the construct as multidimensional, and more research had explored how epistemic beliefs link to other constructs (Schommer 1990). The third wave of research has grown rapidly over the past decade, greatly opened up in the content and scope (Hofer, 2016).

First wave

Perry (1970) was interested in students' beliefs about knowledge and knowing. He carried out a long-term study of Harvard undergraduates and found the intellectual and ethical development of students, which were regarded as 'epistemological development' by follower researchers, could be categorized into four sequential positions: *dualism, multiplicity, contextual relativism,* and *commitment within relativism*. Perry portrayed the improvement of college undergraduates: students hold the dualistic and absolutist view of knowledge at the beginning that they believe the authorities can decide the right or wrong. However, gradually they would realize the diversity of the world, and may transform into multiplicity, which means all views are equal and everyone can have their own opinion. Then, students came to an upper stage, relativism, after they could perceive that knowledge is relative, sequential, and contextual; only a few students can reach the highest position, commitment within relativism, in which individuals commit to their values, carriers, relationships, and personal identities (Hofer & Printch 1997; Lonka et al., 2021).

Perry's work started a new stage for other researchers to explore the cognitive process of students: what does it mean to 'know something', 'learn something' and 'understand something' (Hofer, 2016). However, Perry's study was limited to the elite male sample. In the context of this, Belenky et al. (1986) investigated how women view knowledge and knowing and focused more on the source of knowledge while Perry was concerned with the nature of knowledge (Hofer & Printch 1997). To quantify the ways how college students interpret their learning experience over time, Baxter Magolda (1992) began a five-year longitudinal study at Miami University, and her finding shows that gender-related patterns may exist

in both genders, which is consistent with Belenky et al.'s research. Based on Perry's study, a development scheme with epistemological elements has been developed by King and Kitchener (1994). In this study, King and Kitchener proposed a reflective judgment model which contributes to the clarification of the dimensions of epistemic cognition (Hofer, 2016). Besides, Kuhn (1991) expanded the epistemological research to a broader population and non-academic daily questions that lack definitive solutions through ill-structured problems to investigate individuals' epistemic thinking. In this period, the fundamental lines of epistemic cognition were drawn by pioneers.

Second wave

The milestone of the second wave was Schommer's (1990) proposal for a multidimensional model of epistemological beliefs, which challenged the epistemic developmental models and started a new era for research in epistemological beliefs. In his study, participants were asked to do the self-report through Likert-type questionnaires. Schommer developed a ground-breaking 63-item measurement to assess a larger group, which is broader than qualitative methods like an interview (Hofer, 2016). In Schommer's research, the epistemic beliefs model has five dimensions: fixed ability, quick learning, simple knowledge, certain knowledge, and source of knowledge. Besides, this research also links epistemic beliefs to other constructs, which means these beliefs can affect the process of learning and comprehension (Lonka et al., 2021). In addition, Kardash and Scholes (1996) explored how beliefs about the certainty of knowledge affect the cognition process when dealing with complicated questions, results show that the less one believes in certain knowledge, the higher need for cognition to

complete the complicated questions. Furthermore, students with more advanced epistemic beliefs would learn better in a constructivist atmosphere (Windschitl & Andre, 1998). A similar conclusion can also be found in Lonka and Lindblom-Ylänne's (1996) research: epistemic beliefs can influence the learning strategies of students, compared with 'dualists', 'relativists' are more inclined to conduct a more elaborative method in the study. In the meantime, some science researchers showed interest in students' beliefs about the nature of science and how these beliefs influenced learning and understanding of science (Lederman, 1992; C. Tsai & Liu, 2005). Furthermore, research about whether epistemic beliefs are domain-specific or general suitable continues to expand and grow (Buehl, Alexander & Murphy, 2002; Hofer, 2000). Most importantly, multidimensional model of epistemic beliefs was proposed by Hofer (2004): the certainty of knowledge, reflecting a preference for pursuing certain and stationary facts, in contrast to the tentative and evolving knowledge; the simplicity of knowledge, regarding knowledge as discrete rather than contextual or interrelated; the source of knowledge, refers to the knowledge constructed by the leaner or accepted from the authority; the justification of knowing, simply follow the authorities like teacher or reflected critically. In sum, the second wave made the linear direction of epistemic beliefs clearer and lead to a new way of assessing epistemic beliefs through quantitative ways.

Third-wave

In the third wave, research about epistemic beliefs has been flourishing among the area of educational psychology and learning science (Hofer, 2016). New methods and measures have been developed to assess epistemic beliefs（Kelly,

2016; Mason et al. 2010; Elby & Hammer, 2010). The relevant research have proliferated in different culture, expanded from western countries to Asia, (Buehl, 2008; Chai, 2010; Lammassaari et al., 2021). Fruitful research focused on domain generality (Muis et al., 2006) and domain specificity (Tsai, 2002). Scientists also have explored the epistemic beliefs in the new contexts like ICT use (Deng et al., 2012) to catch the technology development in educational area. The participants involved were broader, the previous research mainly focusing on college students and gradually being expanded to children, adolescentsand adults, also the teachers (see Lonka & Lindblom-Ylänne, 1996; Conley et al., 2004; Cano, 2005; Greene & Yu, 2014; and Brownlee et al., 2013). Researchers became more curious about how epistemic beliefs influence the learning of students and teachers' practices (Lonka et al., 1996; Gill et al., 2004; Kienhues et al., 2008).

2.1.2 Teachers' epistemic beliefs

In recent years, research on teachers' epistemic beliefs has quickly developed (Brownlee et al., 2013; Buehl & Fives, 2016). Some researchers focus on how epistemic beliefs may vary in different contexts (see Olafson & Schraw, 2006)while others were interested in how teachers' epistemic beliefs can be changed through proper instruction or relevant teacher education courses (Brownlee et al., 2001; Ravindran et al., 2005). Scientists have found that teachers' epistemic beliefs play an important role in the success of educational reforms (Woolfolk-Hoy et al., 2006) because teachers' epistemic beliefs can influence teachers' teaching practices (Sinatra & Kardash, 2004). Sosu and Gray (2012) claimed that teachers' instructional preferences can be predicted by their

epistemic beliefs, about the nature of knowledge and learning. To some extent, we have to admit that the teaching practices are affected by various factors like the beliefs of the teachers, the national contexts like the evaluation system, and the norms and values of a culture (Deng et al., 2012).

Although some researchers have found inconsistencies between epistemic beliefs and instructional preferences (Cheng et al., 2009), we can still say that teachers' epistemic theories play an important role in teachers' teaching practice，as well as the assessment and works (Vedenpää & Lonka, 2014; Richardson, 1996; Barnes et al., 2020). In his study among 396 Chinese high school practicing teachers, Deng et al. (2014) concluded that teachers who hold a relativistic epistemic belief would prefer to adopt a constructivist pedagogy to support students' own constructivist process in learning, whereas those who view knowledge more ascertain and can be delivered directly are more inclined to use a traditional teacher-centered way to teach. Different from the four dimensions: the certainty of knowledge, the simplicity of knowledge, the source of knowledge, and the justification of knowing were most used in multidimensional models to describe students' epistemic beliefs (Hofer, 2004). To measure teachers' epistemic beliefs, Lammassaari et al. (2021) used an instrument adapted from MED NORD questionnaire designed by Lonka et al. (2008) to examine medical students' epistemic beliefs. It contained four aspects: valuing metacognitive thinking, collaborative knowledge building, surface approach to learning, and emphasizing certain knowledge in teaching. In their research, Lammassaari et al. (2021) proposed two teachers' epistemic theories: reflective-collaborative theory and knowledge transmission theory. The reflective-collaborative theory

emphasizes metacognition and collaborative knowledge building, while the knowledge transmission theory concerns certain knowledge and surface learning. Meanwhile, important and matching aspects of beliefs and self-reported practice can be found in their study.

2.2 Approaches to teaching and conceptions of teaching

According to teachers' descriptions of teaching, Postareff and Lindblom-Ylänne (2008) concluded two main teaching approaches: learning-focused and content-focused. Deeply, they also concluded four aspects of teaching: (1) teaching process, which includes lesson planning, teaching, and assessment practices; (2) learning environment, like teacher's and student's roles, interaction, and atmosphere; (3) conceptions of learning; (4) pedagogical development, about the development of teacher's own teaching and awareness. The key variation of these two approaches is the purpose of the teaching. For learning-focused teaching, the goal of teaching is the improvement of students' learning and also the teacher's teaching continuously, which emphasizes the students' participation in the knowledge construction. Differently, the content-focused approach aims at transmitting the knowledge and repeating the traditional teaching methods. Teachers who use this approach may consider it as a more comfortable way and believe that detailed information is more important but pay less attention to students' learning. They also pointed out one interesting finding: for those teachers who reported a learning-focused approach, assessment of students' learning was considered to be an important aspect, and these teachers tended to use various methods to measure students' deep understanding. However, teachers who reflected content-focused teaching were seldom concerned about

assessment practices, or they would tend to use the traditional methods which make them more comfortable because they didn't realize that there are other methods to evaluate students' learning.

The researchers also found that teachers' conceptions of teaching influenced the methods they chose to teach. Kember and Kwan (2000) defined two branches of conceptions: teaching as learning facilitation and teaching as the transmission of knowledge. The former contains two dimensions: teaching should satisfy students' learning needs and help students grow into independent learners, while the latter contains other two sub-categories: teaching is a way to pass information and make it easier to understand. This research also pointed out that teachers who hold the conceptions of learning facilitation would tend to use a learning-focused approach, while those who focused on simply information transmitting would prefer the content-based approach.

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2.3 The relationship between teachers' epistemic beliefs and their teaching practice

Many research revealed the consistency between teachers' beliefs and their practices, while some other found   weak relations (Fang, 1996). The relationships between teachers' epistemic beliefs and practices might link to the school or classroom culture (Hakkarainen, 2009). Tsai (2002) found that the traditional cultural background may influence the teachers practice, which made the relationship between teachers' beliefs and practices even more complicated. For example, compared with Taiwanese teachers who grow up in Confucian culture (see Wang & Mao, 1996), Finnish teachers tend to hold more of western thinking which valued more on metacognition and collaborative knowledge

construction (Lammassaari et al., 2021). Besides, Lammassaari et al. (2021) also found that teachers may feel it more difficult to put reflective-collaborative beliefs into practices than knowledge transmission beliefs. Another possible influencing factor could be research methods: when asked about the nature of learning, teachers expressed less tendency of constructivist towards open-ended questions than structured items (Vedenpää & Lonka, 2014). Hence, qualitative methods were used in this study to evaluate and analyze Chinese high school teachers' epistemic beliefs, how they teach in practice, and he relationship between their epistemic beliefs and their practice, either controversial or correspondent.

3 Research task and research questions

This study aims to explore the relationship between high school teachers' epistemic beliefs and teaching practices (in an examination-oriented context). The research questions are as follows:

1. What kind of epistemic beliefs do these Chinese high school teachers hold?

Many people have a stereotype about Chinese education being all about memorizing. In a previous study (Lammassaari et al. 2021), knowledge transmission beliefs and reflective-collaborative beliefs were not contrast. Hence, it was expected that Chinese high school teachers would put more emphasize on knowledge transmission but also implied deep learning in some aspects. For the first aim to identify what kind of epistemic belief theories Chinese high school teachers hold, I was interested to know whether these Chinese high school teachers were more inclined to value more on surface learning or deep learning.

2. What are the teaching practice preferences of these Chinese high school teachers?

I expected that Chinese high school teachers are more accustomed to the traditional teaching approach like content-based teaching. For the second aim to analyse their self-reported teaching practice, I wanted to find out the innate purpose of teaching underlined the manifest practices,

3. What are the relationships between these teachers' epistemic beliefs and their teaching practice?

Based on Deng's (2012) research, Chinese teachers' constructive beliefs are aligned with their pedagogical beliefs. But Lammassaari et al (2021) found that

there is a gap between teachers' constructive beliefs and reported correspondent practices, which might result from participants' awareness of what is highly valued by exterior but difficult to put in practice. For the third aim to evaluate the consistency between teachers' beliefs and practices, we wanted to provide a deeper understanding of Chinese education system through teachers' beliefs and practices. I expect that teachers who believe in knowledge transmission theory were more adapted to act in line, while teachers who highly value the reflection and knowledge construction would be more difficult to put in practice.

4 Method

4.1 Participants

This study was conducted in China, with 10 teachers from senior high schools in different cities. The criteria for selecting participants were: full-time teachers who had been taught in senior high school in China for over 5 years; being willing to share their experience with the researcher; the balance between different sexuality. Moreover, the selection of participants followed a convenience sampling approach (Merriam, 2015). Potential participants were reached from the following sources: the online community of teachers to which the author belongs to, author' previous classmates and friends from several top normal universities in China; and author' previous colleagues. Participants were informed about the purpose of the study and participated voluntarily. At last, ten teachers participated in the study, including 5 females and 5 males. They taught different subjects, including Chinese, math, physics, and history (see Table 1). The data were anonymized as T1 to T10.

Table 1. The basic information of participants

Participants	Gender	Teaching Years	Subject
T1	Female	6	Physics
T2	Male	6	Physics
T3	Male	9	Chinese
T4	Male	7	History
T5	Female	7	Chinese
T6	Male	5	Math
T7	Male	6	Physics
T8	Female	6	Math
T9	Female	10	Chinese
T10	Female	11	Chinese

4.2 Instruments

The semi-structured interview questions were designed based on the previous study (Lammassaari et al., 2021; Lonka et al., 1996), measuring different dimensions of teachers' epistemic beliefs. Because of the Covid, the semi-structured interviews were conducted online, approximately 40- 60 minutes each, and participants were given an outline of the interview in advance to be prepared. Besides, their anonymity will be guaranteed, and participation will be based on a voluntary basis. The language of the interviews was Chinese, which was the native language of the interviewees, to ensure accuracy of communication and expression. The structure of the interviews is consistent, but the specific questions are constantly optimized and adjusted according to the interviewer's response and background. All interviews were recorded and transcribed with authorized permission. The themes of the interviews focused on: (1) how they understand learning, both their own and their students' learning; (2) what they value in their teaching; and (3) their self-reported teaching practices. If answers were not detailed enough or were unclear, the interviewer asked clarifying questions to follow up.

4.3 Analyses

Content analysis was used in this study. To ensure the accuracy of the words, the coding process was based on the Chinese text, which was then translated into English. The manuscript was read repeatedly until the author was very familiar with it. Based on Lammassaari et al. (2021)'s study, the data of epistemic beliefs were analyzed according to reflective-collaborative beliefs (valuing metacognition and collaborative knowledge construction) and knowledge transmission beliefs (emphasizing certain knowledge and surface learning).

According to Postareff and Lindblom-Ylänne (2008), teachers' teaching practice can be divided into two categories: learning-focused and content-focused, the former emphasizes collaborative construction of knowledge with students, while the latter focuses on delivering detailed information.

Therefore, the data were analyzed by applying these four theory-driven coding units: epistemic beliefs of reflective-collaborative beliefs (BR); epistemic beliefs of knowledge transmission beliefs (BK); learning-focused practice (PL); content-focused practice (PC). Sub-coding emerged during the process would be recorded. Some descriptions could not be classified in any category, such as when asked about the nature of learning, but the teacher talked about the purpose and outcome of learning, in which case they would be marked and analyzed separately. Since the analysis was done by one person, three coding sessions were conducted one month apart to ensure accuracy, with slight differences in the analysis of the text at each coding session, and the last coding was used in the results. Atlas. Ti was used to code and analysis. Here is an example of the coding in Table 2.

Table 2. The major coding units

Code	Description	Example
reflective-collaborative beliefs (BR)	valuing metacognition and collaborative knowledge construction	And for students, learning is a process of gaining knowledge and skills through interaction with teachers and classmates in a group. (T1)
knowledge transmission beliefs (BK)	emphasizing certain knowledge and surface learning	But for my discipline, I think it's more about the method of knowledge transmission. Because a lot of the mathematical processes need to be derived. Including some mathematical definitions, you must explain them clearly to students, start from the definition, and then teach them how to apply it. (T6)
learning-focused practice (PL)	emphasizing collaborative construction of knowledge with students	Many teachers tend to tell students directly about it. But I would ask them what is it? Why is it? I ask a lot more questions than other teachers, and I also encourage them to ask: Why? What? How? (T9)
content-focused practice (PC)	focusing on delivering detailed information	If it is about preparing for the exam, it is like finding the blind spots, we need to find the spots, whether they know it or not because sometimes they said that they know it, but actually they're not very sure of it, so we need to find them all. (T2)

5 Research results and their interpretation

Results were analyzed and interpreted to answer the research questions. For the first research question, as table 3. showed below, for these ten Chinese high school teachers, most of them hold the knowledge transmission beliefs and the reflective-collaborative beliefs simultaneously. As for the teaching practice, listed in table 4, learning-focused approaches were reported more among Chinese teachers. The potentially relevant reasons for variation were proposed in the second part. In the third part, the majority of the participants presented a complex relationship between their epistemic beliefs and their reported teaching practices.

5.1 Chinese high school teachers' epistemic beliefs

Out of expectation, among all the descriptions of participants' epistemic beliefs, metacognition and collaborative knowledge construction as well as the knowledge transmission were both valued by almost all teachers. The inside aspects of teachers' epistemic beliefs were also analyzed in detail as showed below in Table 3.

Table 3. Teachers' epistemic beliefs

Categories	Aspects	Sample description
Reflective-collaborative beliefs (BR)	Value students' participation in knowledge construction	'… and this communication always happens between students and teachers when they meet difficult problems. And this kind of communication contributes to brainstorming, which is very important in students' learning.'
	Value understanding rather than rote memorising	'After teaching them (students) clearly, I think it is necessary to guide them, not just to stick to the knowledge, but also to guide them to know something behind the knowledge.'

	Value students' reflection in the process of learning	'I think a child who can think about reflection is basically a precursor to being able to find a way to solve the problem on their own.'
	Believe that the justification of knowing should be critically reflected, not from the teachers or the answers	'In the case of mainland students, you need to pull them out of the quagmire of standard memorization. ... It is still necessary to start from this angle by reawakening that spirituality in the student's heart, as I said before, to awaken him to feel the charm of knowledge and wisdom.'
Knowledge transmission beliefs (BK)	Believe that teacher was the authority of knowledge and learning	'Trust the teacher, trust his way. This is true, I think it is quite obvious.'
	Value the surface learning approach, emphasize on the knowledge transmission	'For the teacher, I think the most essential thing is the dissemination of knowledge, I think the key issue is the transmission of knowledge.'
	Value the certainty and simplicity of knowledge	'Teachers need to cut knowledge into pieces and use the most understandable way to teach students and explain to them.'
	Believe that the goal of learning was the higher grades	'Like learning, like I said earlier, in the face of the group of students that I'm teaching now, their learning is to solve the existing problems , how to get to the top, to become the top group of people.'

We can find from the above that some teachers believe that it is important for students to learn what is behind the knowledge and that emphasis should be placed on deep learning rather than surface learning; some teachers believe that it is necessary to communicate with classmates and to collide in thinking; some

teachers believe that it is significant for students to participate in the construction of knowledge, and some teachers believe that students' reflection plays an important role in learning.

> That is because if you do not study something in a certain depth, you will not feel its fascination, and without feeling its fascination, you do not have an impression of it. Without a real impression… But actually, you haven't learned anything, because once that external force disappears, soon you will forget what you have memorized. Or even the external force does not disappear, but in terms of the knowledge itself, with a slightly flexible change, especially in the change of the essential knowledge whose essential part hide at a very deep level, maybe many people will feel confused and do not know how to deal with it. (T10)

Most teachers believe that knowledge transmission comes first in all learning. Although they agree that student participation in learning is important, it does not prevent them from maintaining the belief that the teacher should be the dominant and authoritative figure in student learning, students who do not follow the teacher's instructions are often perceived as disrespectful and distrustful of the teacher. This is exactly what is often highlighted and emphasized in Confucius.

> But I think the first thing I would say is that if a student says he has his own pace of learning and doesn't want to follow the teacher, from my point of view, I think the essence of this student's view is that he doesn't trust that teacher. (T5)

Some people are pulled by these two different beliefs, which creates a cognitive conflict that is reflected in the teaching practices she employs. On one hand, they believe that it is important to engage students in the construction of knowledge. On the other hand, they also believe that the students' construction must be as perfect as the teacher expected.

> *(Students were asked to make a mind map to build their own system of knowledge about a type of physics experiment)* I even made a framework myself and asked the students to do it again, and I think the result was much better than before. So I think that for this type of assignment, it is still

necessary to give an answer that the teacher thinks is perfect and to model it to the students as the teacher himself thinks. (T1)

Some are able to reconcile their cognitive conflict and find an appropriate way to apply it in their teaching practice. They try to make these two perceptions work in harmony in the actual Chinese context.

> The problem is that these two views fundamentally, if you go deeply, it's contradictory, it doesn't fit together … So in the end, I say, on the one hand, we need to improve the students' performance, it is a test-taking ability development, on the other hand, we need to adhere to some so-called ideal things, I will also try to integrate this ideal thing into the examination-oriented education, that's the way. (T3)

However, Other teachers expressed dissatisfaction with examination-oriented learning and claimed that they valued deep learning or collaborative learning rather than simple knowledge transmission, but in-depth conversations revealed that their misunderstanding of deep learning, constructivism, and collaborative learning:

'Heuristic teaching' equals to 'multiple solutions to one problem':

> In fact, when it comes to teaching, I am very opposed to this way (memorize). That is to say, I think we should adopt a heuristic teaching method ... I still tend to give multiple solutions to one question, or one solution to multiple questions … and eventually, it will help them get higher grades on the test. They can find the quickest way to find out the method of solving such type of problem in the fastest and most effective way, and also how to get the highest score. (T6)

'Collaborative learning' equals to 'High-achieving students tutor low-achieving students to solve problems:

> But why do I say we can't amplify the effect of collaboration? Because when the top students teach the students with weak grades, it is not that easy. Students with good grades can teach, but students with poor grades may not understand … but if it's between classmates, they may not know or understand (and there would be no way to solve the problem of the low-achieving student). (T9)

In sum, for the first research question, these Chinese high school teachers hold the knowledge transmission beliefs and reflective-collaborative beliefs at the same time. And this is aligned with Watkins and Biggs' research (as cited in Lammassaari et al., 2021), who reported that memorising and deep understanding were both valued in Chinese context although memorising may come first.

5.2 Chinese high school teachers' teaching practices

Among the descriptions of their self-reported teaching practices, most of these Chinese high school teachers mentioned learning-focused approach and content-focused approach at the same time, but varies in detail, as shown in table 4.

Table 4. Teachers' teaching practice

Categories	Aspects	Sample description
Learning-focused practice (PL)	Constructing knowledge with students' participation	'So I will let the students figure out their own review framework, they will have a plan, but this plan is their own, the teacher only gives them guidance.'
	Activating students to enhance learning	'Then I would actually ask the students why these are the three elements of force? (Let the students know) to think more deeply about the nature of the knowledge, so later the students will learn some more and see a theorem given by another person, or something, and they will want to guess.'
	Encouraging students' improvising in the class	'In fact, I think it is still very good, i students also feel that this lesson is very exciting, they feel very excited, they feel they can hold the course, feel the whole rhythm flows with their own progress. '

Content-focused practice (PC)	Focusing on knowledge transmission, students were seen as passive recipients and listeners	I only have one piece of advice for all of my students, that is, you listen carefully and then I will teach very well.
	Concentrate on certain facts and details	'I focused too much on the standard answers, when many students could say something that wasn't a standard answer, but he or she might be in the right direction, I should give positive feedback instead of rushing to refute, I don't do this very well and I'm a bit rigid.'
	Emphasizing more on teachers' teaching rather than students' learning	'In fact, I feel rather passive myself, most of the time, we aim to solve the problems. So I spent a lot of time teaching students how to deal with problem-solving.'

The majority of these ten Chinese high school teachers had reported learning-focused practices in their teaching. Some teachers pay more attention to motivating students in teaching, focusing on students' development rather than merely knowledge absorption. Or they would emphasize on the construction of students' own knowledge system.

When asked to give an example of their teaching practices, some teachers' (T1, T6 and T8) first instincts were the lesson which was learning-focused and student-centered, although it may not be their usual style.

> And then if we were to write such an essay too, how should we write it, how would we create it? … How would we study it? Then in the process of research, we might go deep with this article, the creator of the same type of article, the questioner of the test, and the developer of the answer, respectively. Because sometimes the reference answer is not exactly correct, we even have to consider his future trends of change. Then our research work will form a comprehensive system. (T10)

Half of the teachers had reported content-centered practices, mainly involve three aspects: transmitting the knowledge to students, in which students were seen as passive recipients and listeners; concentrating on certain facts and details so students' learning would be easier; emphasizing more on teachers' teaching rather than students' learning, which made teachers more comfortable.

> In fact, if you do well in the three things - attending class, doing homework, and reviewing - the learning outcome is naturally good. (T2)

> At first, I would let the students talk about their ideas first, but it turned out that the answers were either very incomplete or critical. (T3)

Some teachers mentioned that examination-oriented teaching and having students chase for standard answers may not be conducive to students' learning, but they would still use traditional teaching methods. The teaching practices adopted by the teachers may be due to inertia, after all, they have been taught the same way since they were young, and partly due to pressure from society, schools and parents.

> It's that I would like to operate this way (try a more advanced way of teaching), but the feasibility would be very low. On the one hand, I would also be very tired (because there is only me trying to do this). On the other hand, if I didn't have a way to withdraw, I would be under huge pressure. Suppose I don't do well in this class (grades drop), then the leaders and parents will see it and they will definitely blame me, which will cause me a lot of trouble. (T7)

Some teachers described that different teaching methods were used for students at different levels, as lower-achieving students were often perceived as having difficulty disciplining themselves and thinking deeply. They believe that the purpose of teaching was to transmit simple content to students and help them get basic grades.

When I was in a private school, I couldn't give students time for communication and discussion because the students there were problematic. If I gave them time, they would not communicate or discuss, they would simply just talk and gossip, and they could not have the ability to learn on their own. So, for this kind of student, I will lecture all by myself, I rarely let them express their own opinion. (T9)

In fact, for the students who have already been left behind, their study habits are so poor that they basically don't know how to study or can't understand what the teacher is teaching. So why do we have small groups? Take them, get them involved, let everyone have a little bit of fun, and at least they can grasp the basic information. (T2)

Within my expectation, when asked about the purpose of teaching, many high school teachers, may always talk about the achievement:

But for different high schools, I think the requirements are different. If it's a lower-level high school, getting into college and getting a bachelor's degree is enough for the students, so they can get as much education as possible. The students I teach, are still in the upper-middle class, which means they can get a higher level of education or go to what we call a C9 consortium or 985 (C9 is a consortium whose members are the nine top universities in China, and 985 is a program established in China in 1998).   (T2)

T5 cannot be categorized here because her self-report teaching practices didn't belong to any of this. When being asked about teaching or learning, her responses were more based on the higher level as a whole rather than on individual teaching practices.

According to the results mentioned above, more Chinese high school teachers reported learning-focused teaching practice, although it might result from that they would prefer to show that their teaching practices were advanced when interviewed. It is also possible that when asked about their usual teaching practices, the first thing that comes to mind was that they were most impressed by teaching practices that were different from their regular teaching.

(This physic course was conducting an experiment to verify the conservation principle of momentum, and one group of students found problems during the caculation) I was also very confused … then, of course, his result was not conserved, as some students reacted immediately to find out, and I point out this only after he has spoken. I might have gone over it quickly if no student had asked the question. Then the sum of the momentum should be the vector sum, I think this group of students would definitely have a deep impression, while others just follow one direction in the experiment, they would not realize the importance of the vectorial nature of the momentum at all. (T1)

So, the whole lesson did not finish because the students were the host to talk about the content, so finally, we did not finish all the tasks. But it did not matter, that is, the whole effect, in fact, I think it was still excellent, including later students also felt that this lesson was very exciting, they felt very excited, they felt they could hold the course, felt the whole rhythm flows with their own progress. Then I felt that the students responded well, and I myself became more and more excited. (T8)

5.3 The relationship between these Chinese high school teachers' epistemic beliefs and their practices

Within my expectation, teachers' epistemic beliefs do not always align with practices. Interesting results emerged when we observed teachers' epistemic beliefs and practices together. Among these ten Chinese high school teachers, three of them (T1, T3 & T4) hold both constructive and knowledge transmission beliefs simultaneously, and they reported two kinds of teaching practices at the same time. T6 hold the two kinds of beliefs but only reported content-focused practice, while T7 and T8 valued both but only reported learning-focused practice. T9 didn't value knowledge transmission but reported content-focused practices. Only T2 and T10 were consistent in beliefs and practices.

T2 believes the power of knowledge transmission, so he taught in a typical and traditional way. In his self-report, he repeatedly mentioned the College Entrance Exams. Students were clearly divided into different levels according to their

grades and learning ability. Different students were asked to set different goals - which level of the university to go to. He believed that the most important thing for a teacher is to help students get to a better level in the school, which mentioned repeatedly in the conversation.

> We should give them a clear position at the beginning and know where their highest level is approximately. Like I said, to get into Sun Yat-sen University, you probably need to be in the top 30 or 40 in the whole grade. If your current ranking is 300, how do we break down the 270th place gap into different milestones for that many exams … Then the first stage is 100, then 50, 40, 30, 20, 10, 5, and so on, and so on in stages, each time they progress, the difficulty is actually the same. So let them know at the beginning that they do need to improve by about 100 places, and in that case, it will be fine. (T2)

T10 is exactly the opposite of 2. When asked 'what is learning?', T10 answered:

> "Learning it's supposed to make a breakthrough, it's possible that you don't understand the thing at first … That also is a kind of learning, which has to be purposeful, self-willing, active, interested, not driven by the external push, and I think that kind of can be considered as real learning".

She acts as what she values: students' participation in knowledge construction and metacognition, leading students to explore the world behind the surface content and regard the standard answer as one of the learning materials, rather than an authority.

> It is easy for the teacher to see that what he or she thinks is confusing as the student's confusion, and to think that what he or she thinks is interesting that the student is also interested in, and treat the thinking process of his or her own imagination as students'. (T10)

> Because the answers are not always correct, students need to think critically about the standard answers and even adjust them based on their own understanding and thinking. (T10)

T10 also endorsed the importance of reflection, but she noted that the majority of children lack the ability to reflect.

It's definitely important, but not enough ability … But if the teacher doesn't give a specific goal, direction, or even something more detailed, normally their reflection is meaningless. That's not to say that there aren't students who can reflect well, there certainly are. But the majority of people's reflections are the kind of things they don't even know what they're talking about. (T10)

In general, the relationship between teachers' beliefs and practices is intertwined, not only in terms of personal perceptions but also in terms of the overall examination-oriented educational environment in China.

6 Discussion

6.1 Chinese high school teachers' epistemic beliefs

For the first research question, the result shows that most of these Chinese teachers emphasize on both constructive and transmissive beliefs, which is aligned with the previous study (Lammassaari et al., 2021; Tsai, 2002). Most of these teachers would consider themselves as the authority in the class and try to find an efficient way to transmit the certain knowledge to help students get a higher grade, but these didn't stop them from valuing students' participation in knowledge construction, deep understanding and reflection. In their descriptions, it is obviously that most teachers were holding both two kinds of beliefs. Teachers in this generation experienced the most traditional way of teaching during their growing process in Confucian culture, which may contribute to their transmissive beliefs. In addition, there is a common belief, deeply rooted among Chinese teachers, especially high school teachers, that the college entrance exam is an opportunity to change the fate of students. Thus, when it comes to learning, teachers, students, and parents tend to talk about studying rather than learning, focusing on the outcomes that studying can bring (like T2) rather than learning process. While studying in teacher education programs or working at schools, , teachers might be exposed to various pedagogical theories and teaching methods, and gradually formed their own belief system in such an environment (Deng 2012). Such as T1 and T8, they might never realize their constructive epistemic beliefs before they were inspired by the accidental student constructive events which surprised them. Several teachers mentioned that it was the first time they were asked about the essence of teaching and learning. Hence, teachers

holding knowledge transmission theory may also develop some constructive epistemic beliefs unconsciously.

6.2 Chinese high school teachers' teaching practices

For the second research question, out of my expectation, the results showed that Chinese teachers' teaching practices were not dominated by content-focused teaching.) Teachers who reported content-focused teaching practices often emphasize on students' achievement, while teachers focusing on learning always pay attention to students' deep understanding and learning. Teachers may express their preferences for learning-focused teaching which allowed students to participate in knowledge construction process, but in reality traditional and transmissive teaching methods were used in class. After all, seeing successful experiences in the past decades, Chinese high school teachers tend to believe that the most effective way to get higher score is to transmit knowledge to students. Teachers who use open teaching practices may risk undertaking the failure pressure from school, parents, and even students. Without enough scientific proofs, they still believe that student-based learning was not suitable in Chinese big-scale class and examination-oriented context. Besides, teachers also believe learning-focused is not suitable for students achieving higher grades. According to Watkins and Biggs' research (as cited in Lammassaari et al., 2021), it could possibly explain the Chinese phenomenon 'memorising before understanding'. In summary, most Chinese high school teachers may use learning-focused and content-focused approach depending on contexts, but only few of them may stick to learning-focused approach or content-focused approach.

6.3 The relationships between Chinese high school teachers' epistemic beliefs and teaching practices

According to the third research question, this study aims to find the relationship between Chinese high school teachers' beliefs and practices. I expected that a strong relationship could be found between transmissive beliefs and content-based practices. The results showed that teachers who highly value reflection and metacognition always reported related teaching practices; while teachers who held knowledge transmission beliefs did not report content-based practice. Except T2 and T10, teachers in the current study reported inconsistency between their beliefs and practices. The relationships between beliefs and practices vary among previous research (see Deng, 2012; Lammassaari et al., 2021; Tsai, 2002). Some participants provided few details about their teaching practices, which makes it difficult to further explore the relationship between their beliefs and practices.

For some teachers, they valued metacognition, reflection, and students' participation in knowledge construction, but they have difficulty implementing in their teaching. On one hand, teachers may lack skills to design a complete learning-focused lesson to support students' deep learning. Some teachers reported learning-based practice happened occasionally in their class. On the other hand, students might get used to being a passive receiver and be inactive in knowledge construction process lacking of necessary skills and instructions. Nearly all participants mentioned students have problems with open-ended tasks or questions designed in class. Students prefer traditional assignments rather than complex tasks requiring metacognition, in which students had to participate in the knowledge construction process on their own and build their own cognitive

system. During the interviews, teachers indicated that they were willing to use more advanced teaching methods, but their students could not accept. Teachers were concerned whether it was the current overly detailed teaching that was depriving students' abilities to learn constructively.

In conclusion, except for very determined teachers like T2 or T10 who practice their beliefs, most teachers are looking for a balance between beliefs and practices in the complex contexts, which means it was difficult to clearly link their practices with their epistemic beliefs.

6.4 Methodological reflections

In a qualitative study, the trustworthiness needs to be reflected critically. Lincoln and Guba (1985) proposed four criteria in qualitative study: credibility (internal validity), transferability (external validity), dependability (reliability), and confirmability (confirmability).

6.4.1 Credibility

Credibility means the study can measure what researchers need to find out (Lincoln & Guba, 1985). In this study, participants were selected based on my personal network. I had a longstanding familiarity and trust with them which meant allowing more authentic expression without worry and pressure. Meanwhile, the interviews were conducted in the interviewees' native language, which allowed them to better understand the questions and express their opinions. During the interviews, I also tried to avoid using leading questions, and   repeated the points they mentioned in order to extend the topic further. However, due to

interview language and lack of finance support for thesis writing, there were no other researchers available to assist with cross-comparisons during data analysis. Data was collected online. Although I had observed their teaching practices before, this could not be used as a rigorous triangulation method to validate their self-report in the current study. Based on my personal experience of 3-year teaching practices in a public school and 2-years teacher training, I am familiar with the discourse system of teachers, and have a great understanding about teachers' beliefs and behaviours to fully understand participants' expressions.

6.4.2 Transferability

Transferability refers to whether the findings of this study can be applied to ither situations or wider population. As Bassey (1981) discussed, if someone believes that he or she is in the same situation as described in the study, they may find the findings in this study can be applied to their situation. The interviewees in this study worked in various regions of China, including economically developed cities and remote areas. The gender ratio was balanced, the disciplines taught included both arts and sciences, and working years were mainly between 5 and 11 years. However, it should be noted that they mainly graduated from the top normal universities in China. These participants all worked in high schools, suggesting that they may differ significantly from teachers in both middle school and elementary school, both in epistemic beliefs and practices. Therefore, the results of the study may not be applicable to a broader group.

6.4.3 Dependability

As for the dependability, it is concerned about whether the same results could be presented when the research work was repeated in the same context. Hence, the details of the research design and the whole process should be described in detail. In this study, T5's statements about her teaching practices were not counted in the analysis because her responses rarely included her personal teaching practices but described more from the perspective of an administrator. Hence, guidance during the interview process may need to be adjusted. Therefore, interviews after T5 were adjusted to avoid the problems that appeared earlier.

6.4.4 Confirmability

Confirmability refers to the objectivity of the study concerning whether the findings were dependent on the specific researcher. In this study, how the data was collected and processed has been discussed in the previous section. In the first step of analyzing the data, it was 'theory-driven', which means that the relevant parts of existing theories in the interviewees' representations were collected. Then, more detailed classification was done in a 'data-oriented' way according to the interviewees' representations. It is important to acknowledge that in this study, the participants' representations might be affected by their relations with the researcher. On the one hand, they may be more willing to reveal their true or embellished thoughts; on the other hand, perhaps the researcher was influenced by previous impressions of the participants unconsciously during the process of data analysis.

7   Conclusions and Implications

This study explored the relationships between Chinese high school teachers' epistemic beliefs and their teaching practices. It was found that the majority of these ten teachers hold knowledge transmission beliefs and reflective-collaborative beliefs simultaneously. They did not only value the knowledge transmission, but also students' participation in the knowledge construction; they believed that teachers should be the authority in the class, but they would appreciate student-centered learning approach; they always mention the aim of learning was getting a higher grade then entering a better university, while they often emphasized the deep understanding at the same time. For Chinese high school teachers, these two kinds of beliefs are not mutually exclusive but coexist. As for the teaching practice, their self-report indicated that content-focused approach was used more frequently in the daily teaching since they needed to find a balance between the examination-oriented contexts and their own beliefs. Besides, their learning-focused teaching competences should also be considered. According to this study, it is difficult to find the general relationships between Chinese teachers' epistemic beliefs and their practices. Reasons leading to the complexity of the relationships between Chinese high school teachers' epistemic beliefs and practices are various, but the most significant are the limitations of the overall sociocultural context and the lack of relevant competency development in teacher education. Only few of them can act as what they believe.

More research on Chinese teachers' beliefs should be developed. In the process of reviewing domestic and international materials, I found that foreign research in teachers' epistemic beliefs has been very systematic and advanced, but it is still

an area that few people have explored in China. It is useless to tell teachers what to do, but first understand what they think, and practice now and where is the problem. In the current socio-cultural context in China, how can teachers be empowered to put their beliefs into practice is a question that more researchers and teacher educators need to think about.

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Appendices:

APPENDIX 1: Interview structure

1. In your opinion, what is learning?

2. In your opinion, what is the role of teachers in learning?

3. What is good teaching in your mind? What are the key elements?

4. Can you give an example of your daily teaching?

5. Can you briefly describe the characteristics of your students?

6. How would you handle it if a student raised a different opinion in class? Can you give an example in your class?

7. What do you do if a student brings up something that is not part of your design? Can you give an example in your class?

8. What would you do if a student insisted on learning at his or her own pace rather than following you?

9. Do you think it is important to reflect in students' learning? Why?

10. How do you deal with students' learning difficulties?

APPENDIX 2: Consent form

Consent form

Dear participant,

I am Qiu Yue from the University of Helsinki. I will conduct a research project on Teachers' beliefs about student support and would like to invite you to participate. This study aims to explore Chinese senior high school teachers' beliefs about student support.

During the study, the online interview will take approximately 60 minutes to complete. The procedure will be video recorded. All information obtained will be used for research purposes only. Only the researcher will have access to information that can be associated with your identity. In the event of publication of this research, no personally identifying information will be placed on any materials associated with this study. All electronic data will be encrypted for security purposes. All data will be destroyed five years after project completion. You have the right to review and erase the video records. This research does not provide you with personal benefits, but the data collected will provide valuable

information for studying the issue of teachers' beliefs. Participation is entirely voluntary. This means that you can choose to stop at any time without negative consequences. If you have any questions about the research, please feel free to contact Qiu Yue （+8618088823344, 1994qiuyue@gmail.com） .

If you understand the contents described above and agree to participate in this research, please sign below. Your help is very much appreciated.

Yours sincerely,

Qiu Yue
Master Program in Changing Education
The University of Helsinki

Reply Slip

Name of Participant: _____

I indicate my willingness to volunteer for this research by signing below.

Signature: _____

Date: _____