PFS4051 01E

Honor Projects

Impact of Practicum on Mathematics Pre-service Teachers' Beliefs on Teaching and Learning in Hong Kong

Student Name: Chong Wing Sze

Student ID:

Submission Date: 15/4/2025

Number of Words: 6145

Table of Content

Introduction

According to the Hong Kong Education Bureau (2022, 2023), individuals aspiring to become qualified primary teachers must possess professional training and a relevant degree to satisfy teacher registration requirements. All universities offering teacher-training degree programs[1] incorporate practicum or field experiences into their curriculum. Students must complete the practicum to meet graduation criteria and obtain qualifications as teachers in Hong Kong.

Education Bureau (2015, 2017) promotes schools to plan school-based mathematics curricula. It emphasizes the use of the flexibility provided by curriculum frameworks to cater to learner diversity, leading to teachers achieving a paradigm shift from teacher-centered classroom practices to learner-centered learning. The change and reform in education give teachers more freedom to design the lesson based on their beliefs on teaching and learning to help students develop essential thinking and personal and social skills. Nurjannah and Kusnandi (2021) stated that "Mathematics is an abstract science. When someone learns mathematics, it means that someone is learning abstractly" (p. 2). Mathematics often involves abstract thinking, symbolic representation, and cumulative knowledge, presenting challenges for both teachers and students. Mastering foundational skills, problem-solving, and critical thinking is crucial for students. Additionally, a teacher's belief significantly shapes their specific pedagogical approach.

[1] Universities provide teacher-training programs, including The Education University of Hong Kong, The Chinese University of Hong Kong, and The University of Hong Kong.

Mathematics education encompasses more than the mere transmission of knowledge; it involves a complex interplay of beliefs, practices, and experiences that shape teachers' approaches to teaching and learning. The hands-on experience gained during the practicum is especially important for future mathematics teachers as it allows them to apply the theory they have learned. This practical application is a key part of their teacher education journey, which helps them become in-service teachers. During this period, various factors are believed to influence the beliefs, perceptions, and practices of pre-service teachers, which ultimately can affect their effectiveness in future teaching roles (Borg, 2015; Cochran-Smith & Zeichner, 2009; Korthagen, 2010; Ronfeldt & Reininger, 2012).

In recent years, there has been an increasing emphasis on the importance of teachers' beliefs within the educational landscape. Sabarwal, Abu-Jawdeh, and Kapoor (2022) discussed the beliefs held by teachers regarding their roles, efforts, and students' learning processes, asserting that these beliefs may lead teachers to adopt instructional strategies that reinforce existing gaps in student capabilities and resources rather than address them. They contend that teacher beliefs mediate teacher effectiveness and student outcomes. York (2005) indicated that beliefs regarding teaching and learning substantially influence instructional practices, student engagement, and academic results. Such beliefs are frequently formed and solidified for pre-service teachers during their practicum experiences, where they engage with the dynamics of

real-world classrooms. The practicum bridges pedagogical theory and classroom realities, allowing pre-service teachers to apply their knowledge in authentic educational contexts. However, these experiences can also pose challenges and reshape their beliefs, influenced by various contextual factors, including mentor guidance, institutional culture, and classroom interactions.

Definition

Teacher beliefs can be broadly defined as teachers' implicit assumptions about students, learning, classrooms, and subject matter (Kagan, 1992, p. 65). More categorically, Fives & Buehl (2012, p. 471) stated that teachers' beliefs are generally defined as preconceptions and implicit theories that influence teachers' expectations, judgments, and decisions about their students, curricula, and instructional practices. These beliefs are based on teachers' deeply held norms, values, and attitudes. It is essential to believe in teaching and learning as teacher beliefs play a critical role in conceptualizing teaching tasks and organizing the knowledge and information relevant to those tasks (Kagan, 1992, p. 73).

Objectives of the Study

The overarching aim of this investigation is to explore the beliefs of mathematics pre-service teachers during their practicum by identifying and analyzing influential factors such as mentor support, observed pedagogical strategies, and the prevailing school culture. The study seeks to understand how these beliefs evolve throughout the practicum experiences, focusing on significant incidents that may either facilitate or hinder this evolution. Moreover, it evaluates the impact of various practicum settings on pre-service teachers' confidence and efficacy in teaching mathematics, examining how different contexts contribute to their professional growth. Finally, the research aims to provide evidence-based recommendations for teacher education programs, enhancing support for pre-service mathematics teachers in developing positive beliefs and effective teaching practices.

Research Question

Given the purpose taken for the study and the status of the pieces of literature as briefly reviewed above, the research question of this study is:

How Does Practicum Reinforce or Change Mathematics Pre-service Teachers' Beliefs on Teaching and Learning in Hong Kong?

Significance of the Study

Investigating the factors that influence learning during this crucial phase is essential for enhancing teacher education programs and improving the quality of mathematics instruction in educational institutions. The significance of this study is amplified by its potential contributions to both theoretical frameworks and practical applications within the field of mathematics education. By exploring the determinants that shape pre-service teachers' beliefs, this research can guide teacher education programs in identifying the key components that foster positive teaching beliefs and effective instructional methodologies.

Moreover, delineating the dynamics of belief formation during the practicum can empower educators to develop more effective mentorship initiatives and practicum experiences that are responsive to the needs of aspiring mathematics teachers. This, in turn, may enhance mathematics instruction in schools—an outcome critical for improving student learning outcomes in a subject often perceived as challenging.

Additionally, this study adds to the broader discourse on teacher beliefs by scrutinizing the pre-service phase of teacher development. As the field of mathematics education evolves, the insights derived from this research can inform future policies and practices to enhance teacher preparedness and foster student success in mathematics.

In conclusion, the practicum constitutes a pivotal stage in the professional development of pre-service mathematics teachers, significantly influencing their beliefs about teaching and learning. By systematically examining the factors that affect these beliefs, this research seeks to enrich the field of mathematics education and contribute to ongoing efforts to enhance teacher preparation. As educators strive to cultivate a new generation of mathematics teachers who exhibit confidence, reflectiveness, and effectiveness in their practice, an in-depth understanding of belief formation during the practicum becomes increasingly essential. This study aims to bridge the gap between theoretical principles and practical applications, ensuring that pre-service teachers are adequately equipped with the knowledge, beliefs, and competencies required to facilitate meaningful learning experiences.

Literature Review

This study is to investigate the relationship between practicum and pre-service teachers' beliefs. Therefore, defining the meaning of beliefs and practices in Hong Kong is crucial.

Teachers' Beliefs

As mentioned by Rokeach (1872), a belief is defined as any proposition that begins with the phrase "I believe that" (as cited in Ertmer & Ottenbreit-Leftwich, 2010). Pajares (1992) mentioned that teacher belief systems comprise many interacting, intersecting, and overlapping beliefs (as cited in Ertmer & Ottenbreit-Leftwich, 2010). Turner et al. (2009) suggested that teachers' beliefs are often influenced by enduring attitudes, common sense, and previous experience in education rather than research-based knowledge of learning and motivation. Examining their characteristics, content, and expression is essential because teachers' beliefs significantly impact the development of how they teach and what students learn.

Practicum and Beliefs of Pre-service Teachers

Numerous studies highlighted the critical role of practicum in shaping teaching beliefs among pre-service teachers. The practicum experience provides opportunities for pre-service teachers

to observe and interact with experienced educators, which helps shape their understanding of effective instructional practices and classroom management strategies and exposes effective pedagogical strategies (Darling-Hammond, 2021; Grossman et al., 2009). Grootrnboer (2006) had similar perspectives and described that practicum has the power to shape and determine affective views about mathematics. Practicum affects the teaching style of teachers; for instance, Lerman (2001) suggested how practicum encounters pre-service teachers' prior beliefs and promotes the development of more inclusive and student-centered teaching approaches. These studies emphasized that practicum is an excellent chance to prepare education teachers from pre-service teachers to in-service teachers as it facilitates student teachers to reform their beliefs and form teaching styles in their styles. It can be concluded that practical experience is essential for all pre-service teachers.

Specifically, Mouza and Columbia University Teachers College (2002) discussed an established connection between beliefs and actions and the teacher change process. They suggested the ideas outlined in the practical knowledge movement. The findings of Scott (2005) suggested that pre-service teachers' beliefs are influenced by factors such as theoretical connections to practical examples, recent teaching experiences, and shared experiences of friends and family members who are teachers. In short, these are the possible factors that may reinforce or change pre-service teachers' beliefs during practicum. The factors that affect the

application of theoretical connections to practical examples may be affected by the learning experiences of the pre-service teachers. It can be shown in their first teaching experiences and reinforced in the further practicum or teaching experiences.

Mathematics Pre-service Teacher Training in Hong Kong

In Hong Kong, the Education Bureau (2015) emphasizes the importance of developing problem-solving and higher-order thinking skills. The government expects teachers to find the most suitable way for students to learn the most with the use of technologies, teaching methods, and others. However, Hong Kong pre-service teachers agree that the role of mathematics teachers is to transmit mathematical knowledge and to verify that learners have received this knowledge, which is the teacher-centered approach. In the study of Lo and Anderson (2010), they investigated the mathematical beliefs of pre-service teachers with 210 participants who had enrolled in a four-year Bachelor of Education (Honours) (Primary) Program and majoring in mathematics; they found that for one traditional belief statement, a decreasing number of interviewees across the study stages supported the statement “right answers are much more important in mathematics than how you get them.” This indicates that the pre-service teachers’ beliefs in the previous study contradicted the curriculum.

Therefore, research indicated that programs should be developed to focus on improving instructional strategies and aim to shift teachers' beliefs about teaching and learning (Desimone, 2009). Desimone suggested that with reflective practices, teachers can critically assess their own beliefs and experiences, leading to a deeper understanding of their instructional choices. He also noted that programs that encourage collaboration among teachers from the same grade level or subject area are more likely to be effective as they foster shared learning and support. For instance, the practicum program provided by the Education University of Hong Kong includes a reflective e-portfolio and presentation, which provide pre-service teachers the opportunity to discuss their teaching and learning beliefs with peers and supervisors (EdUHK SPFEO, 2025), aiming for the reflection to help pre-service teachers revisit their practicum, in order to reinforce or reshape their beliefs about teaching and learning.

Research Gaps

The literature review conducted earlier highlighted a significant gap in research concerning the beliefs of pre-service teachers. Most studies focus mostly on the beliefs themselves while lightly focusing on the underlying factors that shape them. Dwyer, Ringstaff, and Sandholtz (1990) emphasized that implementing change in education requires teachers' practices and beliefs. This process does not involve abandoning existing beliefs but gradually replacing

them with more relevant ones. Beliefs are shaped by experiences in evolving circumstances, which forms the context for this change. It is more likely for successful growth of new beliefs and practices while working with colleagues and administrators who actively support fundamental change.

This study aims to fill the gap by examining how practicum experiences influence pre-service teachers' beliefs about teaching and learning. By focusing on this aspect, the research intends to provide valuable insights into how various experiences during practicum can alter or reinforce these beliefs. By analyzing the specific triggers and factors that influence teaching beliefs during practicum, schools can create more effective strategies and interventions that cater to the unique challenges faced by these future educators, ultimately enhancing their preparedness and effectiveness in the classroom.

Research Design

This project aims to explore how practicum reinforces or changes mathematics pre-service teachers' beliefs about teaching and learning. To achieve this, a qualitative research design utilizing in-depth interviews was adopted to gain a deeper understanding of the participants' perspectives and experiences.

Methodology

"Qualitative research allows for an in-depth exploration of complex phenomena, capturing the richness and nuances of human experiences that may not be easily quantified" (Creswell & Poth, 2018, p. 47). While conducting the interview, the sequence of questions was controlled, and follow-up questions were asked to gather data and adjusted to better suit the participant and the context. "The personal interaction and rapport established during in-depth interviews can foster a sense of trust and openness, leading to more authentic and detailed data" (DiCicco-Bloom & Crabtree, 2006, p. 315). One-on-one in-depth interviews allow the interviewee to build rapid relationships and connections as well as trust with the interviewers, enabling the participants to be less guarded and feel comfortable expressing their thoughts, feelings, and experiences with their true stories. Researchers emphasize that additional qualitative analysis will utilize data from interviews and lesson plan analyses to validate the findings and examine how contextual factors influence respondents' mathematical beliefs.

Due to its ability to deliver in-depth knowledge of complex phenomena and capture the lived experience of students and teachers, quantitative research has become a widely used methodology for different areas of study, such as education (Smith, 2019; Brown, 2020). It echoes the study because the data collected on different pre-service teachers' experiences needed to be combined under specific themes.

Data Collection

Depending on the participants' preferences, data was collected through one-on-one interviews with the mathematics pre-service teachers, either in person or via conference platforms (Zoom/WhatsApp). Each interview was expected to last approximately twenty to thirty minutes, and with consent, it was audio-recorded and used for further analysis.

The participants who joined the in-depth interviews were mathematics pre-service teachers studying at the Education University of Hong Kong (EdUHK) because only this university offers primary mathematics education programs in Hong Kong. Students studying in EdUHK are required to complete two practicums as part of their graduate requirements and become qualified teachers. Therefore, all interviews have completed at least one practicum. Purposive sampling was used to recruit a diverse sample of participants based on factors such as age, gender, previous teaching experience, and program year.

Before the interview, the Education University of Hong Kong approved the ethical review. Finally, 13 participants joined the interview. This sample size is usually sufficient to achieve data saturation in qualitative interview studies (Guest et al., 2006). To ensure interviewees' confidentiality, Interviewees A to M were used to represent these 13 interviewees; the data collected were saved on a password-protected USB drive rather than a cloud-based storage system. All data will be securely deleted after the Honours Projects are completed and submitted.

Table 1.

Study Participants

Interviewee	Gender	Year of Study	Grade Teaching in 1st Practicum	Grade Teaching in 2nd Practicum
A	Female	4	P. 1, P. 2	/
B	Female	4	P. 2, P. 4, P. 5 (Share class with Supporting Teacher)	/
C	Female	4	P. 2, P. 3 (Teaching with supporting teacher)	/

D	Male	4	P. 6	/
E	Female	4	P. 1	/
F	Male	5	P. 3, P. 5	P. 2, P. 3
G	Female	5	P. 3	P. 2, P. 4
H	Male	5	P. 3	P. 4
I	Female	5	P. 2, P. 3	P. 2, P. 3
J	Female	5	P. 3, P. 4	P. 3, P. 5
K	Female	5	P. 1	P. 2, P. 4
L	Male	5	P. 3, P. 4	P. 3, P. 4
M	Female	5	P. 1, P. 3	P. 2, P. 4

Data Analysis

Data collected from 13 interviewees was subjected to rigorous data analysis procedures. The interviews were transcribed verbatim, and the transcripts served as primary data for analysis. The transcripts of 13 interviews were sent to the respective interviewees, allowing them to add and make changes to make sure the data was based on real-life stories. All data will be securely deleted after the Honours Projects are completed and submitted.

As repeat themes and data will be collected, thematic analysis will be used. According to Braun & Clarke (2006), thematic analysis provides a systematic framework for organizing and interpreting qualitative data, enabling researchers to derive meaningful and relevant findings. It allows for identifying recurring themes, patterns, and relationships within the data, facilitating the generation of new knowledge and theoretical insights.

The analysis will be conducted through thematic analysis to facilitate the organization and management of data. Clarke & Braun (2017) claimed that,

> Thematic analysis is flexible in terms of research question, sample size and constitution, data collection method, and approaches to meaning generation. It can be used to identify patterns within and across data in relation to interviewees' lived experiences, views and perspectives, and behavior and practices; 'experiential' research which seeks to understand what interviewees think, feel, and do. (P. 297)

According to Nowell et al. (2017) (as cited in Braun and Clarke, 2006), the first step is getting familiar with the collected data. So, all data collected should be read through at least once before beginning coding. The second step is to have ideas about what is in the data and what is interesting about them, involving the initial production of codes from the data, a theorizing activity that requires to keep revisiting the data. Then, search for, review, define, and name

themes. “A theme is an abstract entity that brings meaning and identity to a recurrent experience and its variant manifestations. As such, a theme captures and unifies the nature or basis of the experience into a meaningful whole” (DeSantis & Ugarriza, 2000, p. 362). When a theme is proposed, it signifies concepts linking substantial data portions. At last, a report is produced.

Throughout the analysis, interpretive rigor was carefully considered to ensure the accuracy of the findings on the interviewees' experiences and perspectives. By employing these rigorous data analysis methods, the project aimed to uncover valuable insights into the triggering factors that shape primary mathematics pre-service teachers' beliefs about teaching and learning during practicum.

Research Findings

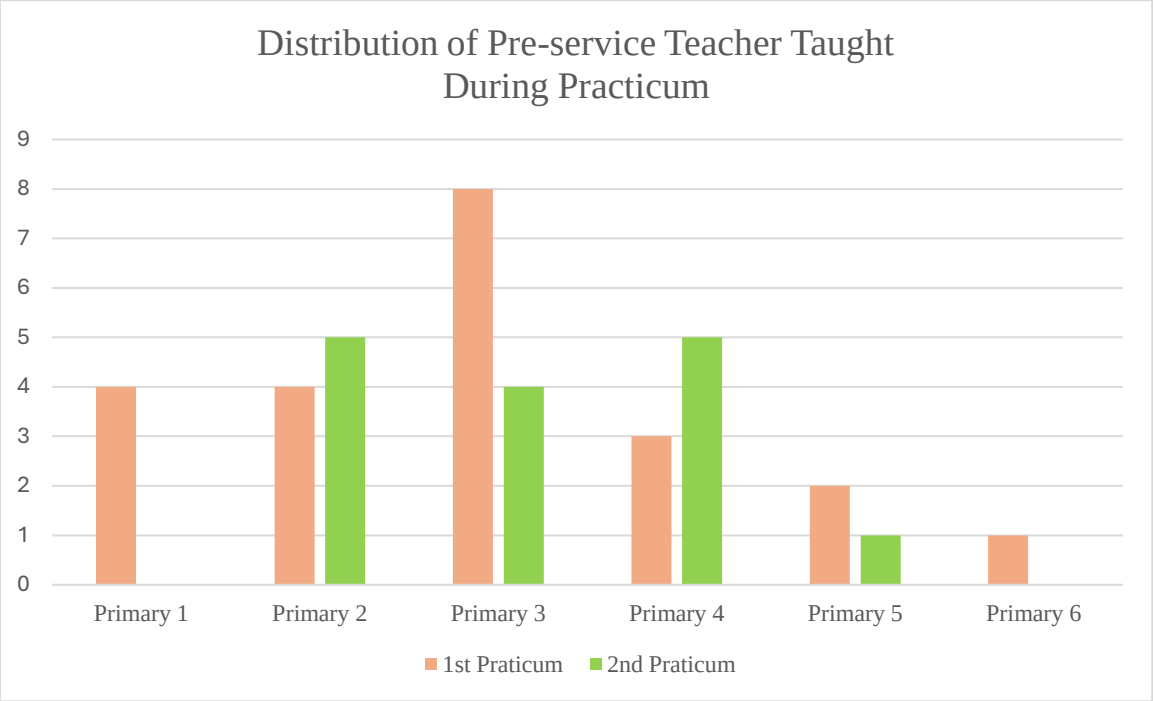
This section presents the research findings on the impacts of practicum on mathematics pre-service teachers' beliefs on teaching and learning. The analysis is organized into themes that emerged from qualitative data collected through interviews and observations. Each theme below highlighted specific challenges and support faced by pre-service teachers, and provided insight into their experiences and development during practicum. It is aimed at exploring the relationship between practicum and beliefs on teaching and learning.

Participants' Mathematics Education Background

As mentioned above, a total of 13 interviewees joined the project, and all are from the Bachelor of Education (Honours) (Primary) – Mathematics at EdUHK. In between, five interviewees are now studying year 4 and have one practicum experience; eight interviewees are studying year 5 and have completed two practicums. When analyzing the mathematics education background of the interviewees, it was found that all interviewees mainly taught Primary 2-4 and were not usually given a chance to teach Primary 6. The interviewees' practicum experiences covered a variety of age groups and teaching contents, covering more than 80% of the primary syllabus.

Figure 1

Distribution of Pre-service Teacher Taught during Practicum



Motivations That Influence Participants' Thoughts

Before discussing the interviewees' beliefs on teaching and learning, they share their motivations for becoming teachers.

Table 2

Motivations That Influence Participants' to Become a Teacher

Interviewee	Motivations
A	- Secondary teacher

	Able to feel the passion of teaching
B	- Primary teacher Engaged students through fun mathematics teaching
C	- No special reason
D	- Secondary teacher Helped in learning and changed her life
E	- Teaching experiences Had a chance to tutor primary students during secondary school
F	- Teaching experiences Had chances to tutor secondary classmates and lower-form students
G	- Primary teacher Held party when the class got A grade and loved having interesting teachers - Sharing Sharing of teacher life from secondary senior
H	- Primary teacher Had deep talk and changed from a naught student to one who obeys school laws - Teaching experiences Went back to hisalma mater and taught mathematics makeup class after graduation
I	- Teaching experiences Experienced in tutoring and teaching extra-curricular classes while studying for my last degree
J	- Secondary teacher The teacher did not give up on any students, even those with bad results or attitude - Want to be a teacher while being a kid

K	- Secondary teacher The teacher was someone who follows rules and maintains boundaries but also gets along well with everyone - Want to be a teacher while being a kid
L	- Primary teacher The teacher made mathematics funny and easy to understand, increased students' learning motivation
M	- Belief Teaching is a meaningful job - Reflection Teacher is a stable job

According to the analysis, the interviewees' motivations mostly relate to their own learning experiences. They generally mentioned that meeting excellent primary and secondary school teachers profoundly impacted their career choices. Having teaching experiences is also a way to motivate one to become a teacher. This is related to the findings of Scott (2005), who suggested that pre-service teachers' beliefs are influenced by factors such as theoretical connections to practical examples, recent teaching experiences, and shared experiences of friends and family members who are teachers. Interviewees' school life and their teachers greatly impacted their future work choices.

The Formation and Practice of Core Beliefs

When asked about their core beliefs about mathematics teaching, interviewees clearly expressed their views on two main dimensions, including teaching methods and relationships with their students.

Table 3

Beliefs of Interviewees Before Practicum

Interviewee	Beliefs before practicum		
	Teaching	Relationship with students	Others
A	Teach students the way of thinking rather than how to get the answer	Build friendly relationships	/
B	- Teach in interesting ways - Make students like mathematics and discover the charm of mathematics	Accompany students to grow	/
C	- Everyone understands clearly	- Build friendly relationships	/
D	- Learn with joy - Focus on teaching examination skills	/	/
E	- Tutoring class	/	/
F	- Fully master learning objectives - Are able to teach their classmates	/	/
G	- Enjoy learning	/	/

	mathematics - Learn with joy		
H	- Enjoy learning mathematics - Learn with joy - Strong foundation in mathematics - Ask questions if they do not understand	- Build friendly relationships - Accompany students to grow - Help establish positive values	/
I	- Believe children are unique and suit with different teaching methods	/	/
J	/	- Accompany students in facing difficulties	/
K	- Learn something	/	/
L	- Master and love mathematics - Teaching is well-organized with clear explanations and a step-by-step problem-solving process - Students learn well if they follow the lesson	/	/
M	/	/	- Treat everyone fairly

Given the analysis, the differences in the interviewees' backgrounds reflected the challenges of teaching at different grade levels and also enabled them to learn during their practicum how to teach students in accordance with their aptitude and adjust the teaching content according to the student's level, which is an important part of mathematics education. This not only shows that the interviewees care about the way of transferring teaching knowledge, but

interviewees also attach importance to establishing teacher-student relationships. They believe teachers play a key role in children's growth and hope to accompany students through their growth journey. It is the same as what Tomlinson (2001) stated:

> learning, along with our best knowledge of what makes learning happen, are nonnegotiables in a classroom where a teacher sets out to make each learner a captive of the mystery and power of knowing about the world in which those learners will live out their lives. (p. 9)

Impact of Practicum on Participants' Teaching and Learning Beliefs

During the interviews, each interviewee reflected on their teaching experiences and shared their initial beliefs on teaching and learning before the first practicum, all of the interviewees mentioned that their beliefs had been reinforced or changed.

Table 4

Affecting Interviewees' Beliefs about Teaching and Learning by Motivation

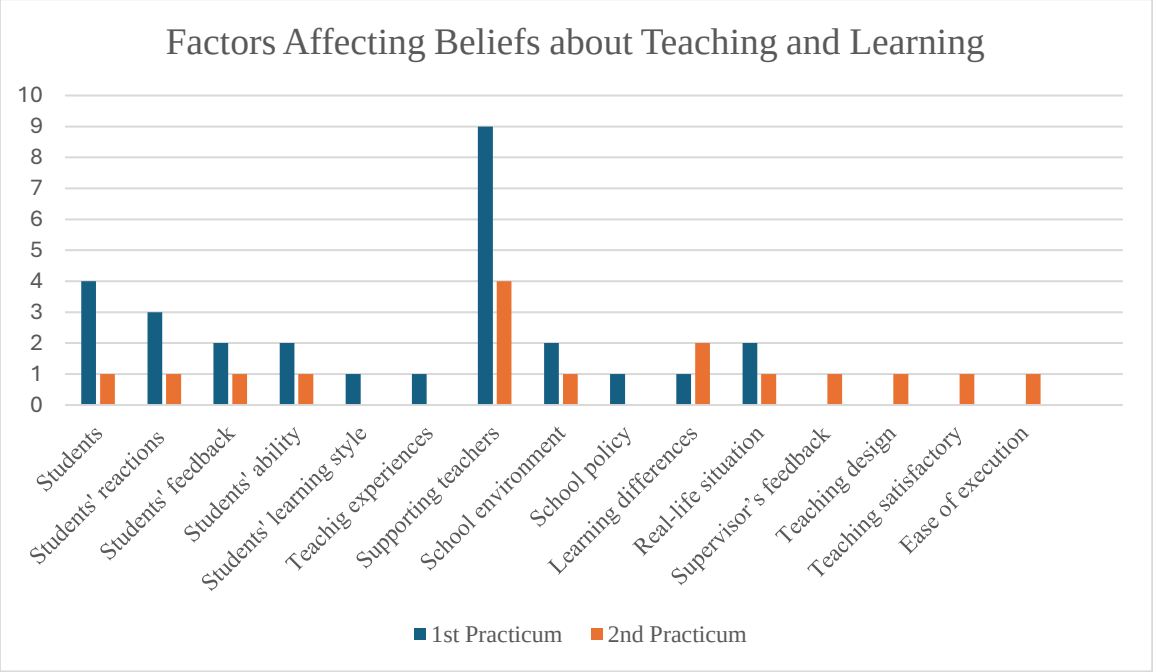
Interviewee	Beliefs			
	1st Practicum		2nd Practicum	
	Reinforced	Changed to	Reinforced	Changed to
A	✓	- Need rules	/	/
B	✓	/	/	/
C	✓	/	/	

D	✓	- Teach according to students' own learning style	/	/
E	/	- Teach according to students' own learning style, learning differences, and school policy	/	/
F	/	- Lower the standard of expectation of the learning level of students	✓	/
G	✓	- Discover students' learning difficulties through teaching	✓	/
H	✓	/	✓	/
I	✓	/	✓	/
J	✓	/	✓	/
K	/	- Need rules	✓	/
L	/	- Teach according to students' own learning style	✓	/
M	/	- When students struggle to follow the learning schedule, instead of pressuring them to learn, it is better to show concern for their daily lives	✓	/

From the interviews, it can be concluded that beliefs are reinforced or altered regardless of how the first practicum is conducted. This observation highlighted that pre-service teachers identified as interviewees F to M will ultimately only reinforce the beliefs formed during the first practicum. In terms of teaching, at first, only interviewee I believed in teaching according to students' own learning styles. After the first practicum, interviewees D, E, and L added these beliefs and continued to reinforce them in the second practicum.

Figure 2

Factors Affecting Beliefs about teaching and learning



From the above table and chart, it is clear that supporting teachers has the strongest impact on pre-service teachers. Most interviewees likely encountered at least one caring and experienced supporting teacher. It examine the finding of Scott (2005), these teachers helped the interviewees examine their teaching methods and provided valuable feedback. However, in cases where supporting teachers did not pay attention or refused to give feedback, such as with interviewees B and C, the experiences were less beneficial. Interviewees stated they would like to have a caring, supporting teacher in the next practicum so as to learn more about teaching.

In their second practicum, interviewees began to make decisions based on their own beliefs rather than solely relying on their supporting teachers' advice. For example, one of interviewee J's supporting teachers suggested that she "give up" on students with poor results, stating that those students could seek help from a tutor. However, interviewee J disagreed with this approach and chose to stick to her belief in supporting students facing difficulties rather than following what supporting teachers did to their students.

To conclude, the focus points in the two practicums are different. In the first practicum, interviewees were mostly influenced by the students and teaching style of the practicum schools; in the second practicum, interviewees mainly focused on developing their own teaching style and recognizing their role as teachers.

Impact of Practicum Experiences on Participants' Future Teaching Practices

Among the answers of interviewees, practicum experiences have a significant impact on four dimensions. The first dimension is related to the adjustments to teaching methods. Specifically, interviewees stated that during their practicum, they learned how to respond flexibly to students' needs and to adopt more interactive and hands-on teaching methods. Interviewee L stated that he plans to focus more on his students' individual learning needs. He intends to adopt more interactive and practical teaching methods to help them better

understand mathematics. Additionally, he aims to reflect on and enhance his teaching techniques to increase teaching efficiency and student engagement.

The second dimension is related to classroom management. Interviewees are mainly aware of the importance of setting and following rules during lessons to keep them running smoothly. They believe that discipline is a higher priority than teaching.

The third dimension is related to building relationships with students. Interviewees generally prefer establishing friendly relationships with students before or during their practicum. Even after encountering disciplinary issues with students, they continue to believe in the importance of building relationships by designing diverse teaching activities and showing genuine care for students' academic and personal lives. Interviewee J expressed a desire to support her students in facing challenges, even if it means giving her personal time after work. Interviewee M noted that the practicum offers a valuable opportunity for pre-service teachers to learn how to connect with students and define the relationships they want to cultivate.

The last dimension is related to the responsibility of teachers. Interviewees expressed that they better understood a teacher's responsibilities and the nature of their work. They

emphasized the challenge of balancing teaching duties with administrative tasks, which they had not anticipated before starting their practicum. Interviewees H and K shared similar views, noting that while they would like to support their students, it is also crucial for students to seek help when needed. They concluded that a teacher serves not only as a bridge between students and the school but also as a link between parents and the school. This connection is essential for fostering students' growth with the support of their parents.

Discussion

This study of pre-service primary mathematics teachers found that the experiences of interviewees during their practicum profoundly influenced their teaching beliefs and practices. These results demonstrate the diversity of teachers' beliefs and underscore the importance of social, cultural, and personal contexts in shaping those beliefs. This section will provide an in-depth interpretation of these findings, explore their significance for educational practice, and engage them in dialogue with relevant literature.

Influence of Background Education on Teaching Beliefs

The findings show that the interviewees' educational background significantly impacts the formation of their teaching beliefs. Many interviewees were inspired by teachers in primary school, which continued to influence their educational philosophies. This is consistent with the research of Turner et al. (2009), who pointed out that enduring attitudes, common sense, and previous educational experiences often influence teachers' beliefs. Interviewees' recollections revealed that positive teachers had influenced them during their learning process, which led them to aspire to become inspiring and accompanying mentors in the future.

For example, six interviewees experienced interesting teaching methods while studying in primary schools, which helped them consolidate their teaching skills and deepen their understanding of mathematics teaching. In the literature, Shulman (1986) proposed the concept of "pedagogical knowledge," emphasizing that teachers need to have the knowledge, teaching methods, and a deep understanding of learners' characteristics, which was confirmed in our study.

The impact of teacher-student relationship on teaching

In this study, the interviewees consistently emphasized the importance of the teacher-student relationship. During their practicum experiences, they recognized that teachers should serve as facilitators of student learning rather than merely transmitters of knowledge. Take interviewees C, H, L, and M as examples. They constantly explored how to establish a good teacher-student relationship during their internship. In practice, this not only helps them understand students' needs but also enhances students' engagement and motivation to learn.

Additionally, the relationship between supporting teachers and pre-service teachers also significantly influenced the interviewees' beliefs about teaching and learning. As Scott (2005) pointed out, positive teacher-student relationships substantially impact teachers' beliefs. This aligns with the interviewees' observations about how a caring and experienced supporting

teacher benefited them during their practicum. For example, Interviewee H had a strong relationship with his supporting teacher during his first practicum and noted that they would regularly have lunch together, even more than a year after the practicum had ended.

Practicum experience and its impact on beliefs

The practicum experience played a central role in shaping and evolving the interviewees' teaching beliefs. Generally, the interviewees regarded the internship as an important stage in their professional growth. The challenges they faced during this process prompted them to reflect on their teaching methods. Darling-Hammond (2021) and Grossman et al. (2009) noted in their studies that practicums help shape an understanding of effective instructional practices and classroom management strategies, exposing future teachers to effective pedagogical techniques. Many interviewee

s in this study demonstrated deep reflection and adjustments to their own teaching methods when confronted with challenges during their internships. For example, interviewees G, H, and L explored the storytelling approach, using characters or themes that resonated with students to capture their attention and enhance learning motivation.

Furthermore, reflections with cooperating teachers and supervisors during the practicum encouraged interviewees to consider better teaching strategies. Sharing and discussing experiences with classmates and lecturers helped pre-service teachers revisit their practicum experiences, allowing them to analyze their teaching practices and learn from others' experiences. This finding aligns with Smyth's (1993) research, which emphasized the need for teachers to enhance the quality of their interactions with students through reflection. Interviewee H commented that it is beneficial for pre-service teachers to understand the culture and environment of different schools. For instance, interviewee A expressed dissatisfaction with her practicum experience and decided not to pursue a teaching career after graduation. However, interviewee H suggested that conversations and sharing among pre-service teachers can help them realize the diversity in schools; it may simply be a matter of finding a school that aligns with their teaching beliefs. This point echoes literature reminding educators to continually reflect and adjust their teaching practices to meet the evolving needs of their students and changing educational contexts.

Dealing with diversity and challenges

The study's results indicate that the interviewees faced challenges during their practicum, particularly due to student diversity, including learning abilities and styles. For instance, interviewee H noted that he needed to seek adaptive teaching methods to accommodate the

needs of different students. The findings of Bonner and Jiang (2017) highlight that teachers must adopt flexible teaching strategies when addressing diversity in the classroom. The beliefs expressed by the interviewees during the interviews further emphasize the importance of adaptability in teaching approaches to meet the unique needs of each student, which aligns with the objectives of this study.

Suggested improvement

This study hopes to contribute to the professional development of primary school mathematics teachers and promote improvements in future educational policies and practices.

First, in terms of preparation before practicum, the connection between pre-service teachers and practicum schools is crucial, as highlighted by Interviewee K. The university should provide suggested questions and essential information for pre-service teachers to bring to their initial meetings with practicum schools. This preparation will enable them to gather key details about the teaching syllabus, instructional methods, and specific student needs—especially for those with special education requirements—helping them better prepare for their practicum experiences.

Interviewees B, C, D, E, F, H, K, L, and M all expressed a desire to learn more about the actual teaching environment, rather than merely observing the "designed" and "perfect" lessons. It would be beneficial for the university to offer more opportunities for pre-service teachers to participate in or observe real lessons. This exposure would help them develop skills for managing diverse student needs and for quickly adapting lesson plans in response to unexpected situations during class.

Second, in terms of the range of practicum, interviewees A, D, and E suggested that practicums should be longer and offer more opportunities. However, it is challenging for universities and schools in Hong Kong to offer these additional practicum opportunities. As an alternative, the university could provide more chances for students to engage in microteaching sessions with experienced frontline teachers, allowing them to receive valuable feedback and advice.

Third, for preparation for teaching, aside from classroom management skills and strategies for addressing learning diversity, Interviewee M recommended that the university offer more courses on teaching mathematics. According to the interviewees, among the major courses provided by the university, only two are focused on teaching methods (Department of

Mathematics and Information Technology, 2025). This is insufficient for covering all topics in primary mathematics.

Conclusion

This study provides insight into the key factors that impact the beliefs of teaching and learning of primary mathematics pre-service teachers. This research result not only expands on the formation of teachers' beliefs but also provides a basis for the optimization of teacher training courses. Focusing on practicum helps better understand the dynamic belief formation process. At the same time, the research results also provide a reference for designing a more targeted practicum. By in-depth understanding of the critical factors that affect interns' beliefs, more scientific training strategies can be formulated to improve the professional quality of intern teachers.

However, this study also has some limitations. Due to the small-scale interview method, it is not easy to generalize to all pre-service teachers. Future research can combine questionnaire surveys or other methods to expand the research scope and samples and improve the generalizability of the conclusions. At the same time, the long-term impact of changes in interns' beliefs and their relationship with actual teaching practices can also be further explored. Future research could further explore how these teachers develop their teaching beliefs in different cultures and educational systems. This will contribute to a more comprehensive understanding of how teachers' professional identities evolve in the context of globalization and technological development. Through in-depth research, we can further

improve the theoretical framework and provide more robust support for improving the professional quality of pre-service teachers.

Reference

Brown, J. (2020). Qualitative research in education: Capturing lived experiences. *Educational Studies Review*, 18(3), 76-92.

Bonner, P. & Jiang, Y. (2017). Voices From Urban Classrooms: Teachers' Perceptions on Instructing Diverse Students and Using Culturally Responsive Teaching. Education and Urban Society. 50. 001312451771382. 10.1177/0013124517713820.

Borg, S. (2015). *Teacher cognition and language education: Research and practice*. Bloomsbury Publishing.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101.

Cochran-Smith, M., & Zeichner, K. M. (Eds.). (2009). *Studying teacher education: The report of the AERA Panel on Research and Teacher Education.* Routledge.

Curriculum Development Council. (2015). *Ongoing Renewal of the School Curriculum – Focusing, Deepening and Sustaining Updating the Mathematics Education Key Learning Area Curriculum (Primary 1 to Secondary 6).* https://www.edb.gov.hk/attachment/en/curriculum-development/renewal/Brief_ME%20KLA_E.pdf

Curriculum Development Council. (2017). *Mathematics Education Key Learning Area Curriculum Guide (Primary 1 – Secondary 6).* https://www.edb.gov.hk/attachment/en/curriculum-development/kla/ma/curr/ME_KLACG_eng_2017_12_08.pdf

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). Sage Publications.

Clarke, V., & Braun, V. (2017). Thematic analysis. The Journal of Positive Psychology, 12(3), 297–298. https://doi.org/10.1080/17439760.2016.1262613

DiCicco-Bloom, B., & Crabtree, B. F. (2006). The qualitative research interview. *Medical Education*, 40(4), 314-321. https://doi.org/10.1111/j.1365-2929.2006.02418.x

Dwyer, D. C., Ringstaff, C., & Sandholtz, J. H. (1990). *The evolution of teachers' instructional beliefs and practices in high-access-to-technology classrooms: First–fourth year findings.* Apple Classrooms of Tomorrow (ACOT) Report #8. Apple Computer, Inc. https://wildej.pbworks.com/f/rpt08.pdf

Darling-Hammond, L. (2010). Teacher education and the American future. Journal of Teacher Education, 61(1-2), 35-47.

Desimone, L. M. (2009). Improving Impact Studies of Teachers' Professional Development: Toward Better Conceptualizations and Measures. *Educational Researcher*, *38*(3), 181–199. https://doi.org/10.3102/0013189X08331140

DeSantis L., Ugarriza D. (2000). The concept of theme as used in qualitative nursing research. Western Journal of Nursing Research, 22, 351–372. doi:10.1177/019394590002200308

Department of Mathematics and Information Technology. (2025). Bachelor of Education (Honours) (Primary) - Mathematics. The Education University of Hong Kong. Retrieved March 15, 2025, from https://www.eduhk.hk/mit/en/bedpri

Education Bureau. (2022). *Teacher training & qualifications*. Retrieved April 14, 2024, from https://www.edb.gov.hk/en/teacher/qualification-training-development/qualification/teacher-training-qualifications/index.html

Education Bureau. (2023). *Teacher registration.* Retrieved April 14, 2024, from https://www.edb.gov.hk/en/teacher/qualification-training-development/qualification/teacher-registration/index.html

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher Technology Change: How Knowledge, Confidence, Beliefs, and Culture Intersect. *Journal of Research on Technology in Education*, 42(3), 255–284. https://doi.org/10.1080/15391523.2010.10782551

EdUHK SPFEO. (2023). *About Field experience (FE) of EdUHK.* Retrieved April 14, 2024, from https://www.eduhk.hk/spfeo/placement-schools/about-field-experience-fe-of-eduhk/

EdUHK SPFEO. (2025). *Structure of field experience.* Retrieved May 15, 2025, from https://www.eduhk.hk/spfeo/information-for-block-practice-2/

Fives, H., Buehl, M. M., Graham, S., Urdan, T., Royer, J. M., Zeidner, M., Harris, K. R., & Graham, S. (2012). Spring cleaning for the "messy" construct of teachers' beliefs: What are they? Which have been examined? What can they tell us? *In APA educational psychology handbook, Vol 2: Individual differences and cultural and contextual factors* (pp. 471–499). American Psychological Association. https://doi.org/10.1037/13274-019

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field methods*, 18(1), 59-82. https://doi.org/10.1177/1525822X05279903

Grootenboer, Peter. (2005). The impact of the school-based practicum on pre-service teachers' affective development in mathematics. *Mathematics Teacher Education and Development*. 7.

Grossman, P., Hammerness, K., & McDonald, M. (2009). Redefining teaching, re-imagining teacher education. *Teachers and Teaching: Theory and Practice*, 15(2), 273-289.

Kagan, D. M. (1992). Implications of Research on Teacher Belief. *Educational Psychologist*, 27(1), 65–90. https://doi.org/10.1207/s15326985ep2701_6

Korthagen, F. A. (2010). Situated learning theory and the pedagogy of teacher education: Towards an integrative view of teacher behavior and teacher learning. *Teaching and teacher education*, 26(1), 98-106.

Lerman, S. (2001). Cultural, Discursive Psychology: A Sociocultural Approach to Studying the Teaching and Learning of Mathematics. *Educational Studies in Mathematics*, 46(1/3), 87–113. http://www.jstor.org/stable/3483241

Lo, W. Y., & Anderson, J. (2010, July). *Beyond the curriculum: The mathematical beliefs of pre-service primary teachers in Hong Kong* [Conference session]. 33rd annual conference of the Mathematics Education Research Group of Australasia, Fremantle.

Mouza, C., & Columbia University Teachers College. (2002). *Understanding teacher change a study of professional development in technology integration.* Thesis (Ed.D.)--Columbia University Teachers College, 2002.

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods*, *16*(1), 1–13. https://doi.org/10.1177/1609406917733847

Nurjannah, S., & Kusnandi. (2021). Literature study: The role of abstraction ability to strengthen students' early knowledge in mathematics learning. *Journal of Physics: Conference Series, 1806*(1), 12064. https://doi.org/10.1088/1742-6596/1806/1/012064

Ronfeldt, M., & Reininger, M. (2012). More or better student teaching? *Teaching and Teacher Education*, 28(8), 1091-1106.

Smith, A. (2019). Exploring complex phenomena through qualitative research. *Journal of Educational Research*, 42(2), 123-145.

Scott, A. L. (2005). Pre-service Teachers' Experiences and the Influences on their Intentions for Teaching Primary School Mathematics. *Mathematics Education Research Journal*, 17(3), 62-90.

Smyth, J. (1993). Reflective Practice in Teacher Education. Australian Journal of Teacher Education. 18. 10.14221/ajte.1993v18n1.2.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4-14.

Tomlinson, C. A. (2001). *How to differentiate instruction in mixed-ability classrooms* (2nd ed.). Association for Supervision and Curriculum Development.

The Chinese University of Hong Kong Faculty of Education. (2016). *ELED website*. Retrieved April 14, 2024, from https://www.fed.cuhk.edu.hk/~ede4343/teach/

The Education University of Hong Kong. (2024). *Bachelor of Education (Honours) (Primary) - Mathematics*. Retrieved April 14, 2024, from https://www.eduhk.hk/mit/en/bedpri

Turner, J., Christensen, A., & Meyer, D. K. (2009). Teachers' Beliefs about Student Learning and Motivation. *In International Handbook of Research on Teachers and Teaching* (pp. 361-371). https://doi.org/10.1007/978-0-387-73317-3_23

The University of Hong Kong Faculty of Education. (2024). *Professional practicum.* Retrieved April 14, 2024, from https://web.edu.hku.hk/sup-partners/professional-practicum

Appendix

Interview questions

1. Can you describe your background in mathematics education? For example, which year are you studying, what times of practicum, and which class did you teach during practicum?

請你介紹你的數學教育背景，如讀幾年級、實習次數和實習期間教甚麼年級？

2. What motivated you to pursue a career in teaching primary mathematics?

是什麼促使你從事小學數學教學工作？

- For example, your student's life or some important people?
- 例如你的學生生活或有些重要的人？
- How do the elements or factors sharpen your teaching and learning beliefs?
- 這些元素或因素如何塑造你的教學信念？

3. Could you remember your core beliefs about teaching mathematics before practicum, such as your expectations, judgments, and decisions about your students, curricula, and instructional practices?

你記得你實習前對數學教學的核心信念是什麼，如你對學生、課程和教學實踐的期望、判斷和決策？

- Can you share examples of practicing your teaching and learning beliefs during your practicum?
- 可否分享實習期間有關教與學信念實踐的例子？

4. Did your beliefs about teaching change due to your practicum experience?

你對教學的信念是否因為你的實習經驗而改變？

- What challenges did you face during your practicum that impacted your beliefs, any specific experiences or factors?

- 在實習期間遇到的哪些挑戰影響了您的信念？有任何具體經驗或因素嗎？

5. What factors change or reinforce your teaching and learning beliefs?

哪些因素改變或強化了您的教學信念？

- What factors had the most significant impact on your teaching and learning beliefs?

哪些因素對你的教學信念影響最大？

- For instance, students reaction and needs, peer influence, mentorship, real-world experiences, challenges faces, feedback and reflection, and etc.

- 例如學生的反應和需求、同儕影響、原任指導、現實世界的經驗、面臨的挑戰、回饋和反思等。

6. In terms of the answer to Q.5 根據上一題決定因素

How did your mentor's or others' feedback affect your beliefs about teaching and learning?

你的導師或其他人的回饋如何影響你對教學和學習的信念？

7. How will your practicum experience influence your future teaching practice?

你的實習經驗對你未來的教學實踐有何影響？

8. What aspects of your practicum would you like to change or improve for future teachers

你希望為未來的教師改變或改善實習的哪些方面？

- How do you plan to continue developing your beliefs about teaching and learning mathematics in the future?

- 未來你打算如何繼續發展你對數學教學的信念？

9. Looking back, what do you wish you had known before starting your practicum?

回顧過去，你希望在開始實習之前了解什麼？

10. Anything you would like to share?

你有甚麼想分享的嗎？