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Examining the changes in the self-efficacy and pedagogical beliefs of preservice teachers in Japan

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With the outbreak of the COVID pandemic, preservice teachers have experienced an unprecedented situation and faced various kinds of issues due to uncertain learning and teaching environments. As a result, they felt insecure and disappointed about their teaching performance during student teaching. Self-efficacy to teach and pedagogical beliefs are crucial elements that influence preservice teachers' teaching performance during student teaching and their professional development in the early stage. This study adopted a quantitative research method to examine the changes in the self-efficacy and pedagogical beliefs of preservice teachers after student teaching during the initial teacher education stage in the Japanese context and how preservice teachers' self-efficacy and pedagogical beliefs changed during the COVID-19 pandemic. A sample of 133 preservice primary teachers in a university in Western Japan was recruited in this study. Two structured surveys were used to collect the data, and factor analyses and paired *t*-tests were fitted. This study verified the validity and internal consistency of two surveys in the Japanese context. The results showed that the Japanese preservice teachers' self-efficacy made a steeper change after student teaching. Their pedagogical beliefs increased significantly, however, yielded a small effect. The results suggested that student teaching is an essential source of influence on preservice teachers' self-efficacy and pedagogical beliefs. This study contributes to the meaningful application of theories developed in the West to Japan by highlighting the Japanese educational context. This study provides implications for effectively reinforcing preservice teachers' self-efficacy and pedagogical beliefs through developing deeper reflection skills, thus supporting them to overcome various challenges in their future teaching careers.

KEYWORDS

Japanese context, pedagogical belief, preservice teacher, teacher efficacy, teacher education

1 Introduction

Building self-efficacy to teach and pedagogical beliefs during the initial teacher education stage play a decisive role in improving preservice teachers' teaching practices and shaping their early professional development, especially when facing unprecedented situations (e.g., the COVID-19 pandemic). Teacher efficacy, which is adopted as a measure of teachers' teaching confidence, is positively associated with teachers' teaching effectiveness (Hoy and Spero, 2005; Nie et al., 2013) and students' learning performance (Palardy and Rumberger, 2008; Bruce et al., 2010; Kim and Seo, 2018). A higher sense of efficacy would arouse preservice teachers' enthusiasm (e.g., Hernández-Barco et al., 2021; Shao, 2023), stimulate their initiatives (e.g., Chan et al., 2023), motivate the efforts they put into teaching (e.g., Karakaş and Erten, 2021; Kula, 2022), and promote their utilization of coping strategies (e.g., proactive and reflective coping strategies) to address challenges in a more effective and adaptive manner (Samfira and Paloş, 2021). Preservice teachers with a higher level of teacher efficacy would also boost students' confidence in learning and help students achieve better learning achievement when they practice teaching during student teaching.

Pedagogical beliefs reveal teachers' perceptions of their pedagogical knowledge, skills, and abilities (Loughran, 2013; Sheridan, 2016). Pedagogical beliefs have been regarded as an essential influential factor in shaping how preservice teachers transfer their knowledge to help students understand it better and how they make teaching decisions to carry out appropriate pedagogical and instructional approaches (Mansour, 2009; Alghazo et al., 2023). Preservice teachers' beliefs in their teaching abilities acquired during the teacher preparation stage are significantly associated with their beliefs in the importance of teaching knowledge (e.g., pedagogical knowledge, classroom organization knowledge, and knowledge of students) (Fives and Buehl, 2008). The development of pedagogical beliefs would be the driving force for preservice teachers to achieve better teaching performance during student teaching in the initial teacher education stage.

However, in the transition period to becoming teachers, it was found that preservice teachers' teaching practices were not always consistent with their beliefs. Some researchers explain that when faced with pressure and challenges, a preservice teacher's actions to deal with teaching problems stem mainly from their teaching beliefs (Wiehl et al., 2017; Gottein, 2020). Teacher beliefs can sometimes be dysfunctional due to perfectionistic and rigid demands for everything to be perfect and at high standards (Samfira and Paloş, 2021). This conflict between instruction beliefs and teaching behaviors makes it difficult for preservice teachers to carry out specific pedagogical instructions to meet their ideal teaching visions in authentic classroom situations (Mahlios et al., 2010; Tarman, 2012).

Since the uncertain situation brought about by the COVID-19 pandemic, preservice teachers have experienced lots of issues with course learning (e.g., less interaction with lecturers in class, refrained from collaborative learning activities) and student teaching (e.g., reoriented practicum schedule, reduced teaching practice opportunity) due to the changed learning and teaching environments (Mohamad Nasri et al., 2020; Hill, 2021; Özüdoğru, 2021). They felt insecure about achieving their teaching goals and

were disappointed in their teaching performance during student teaching (Sepulveda-Escobar and Morrison, 2020; Al Abiky, 2021). Thus, enhancing preservice teachers' self-efficacy and pedagogical beliefs has become essential in improving their professional teaching competence to address various difficulties and challenges in their future teaching careers.

In a number of research in the field of efficacy beliefs among preservice teachers in Japan, a few studies have examined in-service teachers' efficacy beliefs during the COVID-19 pandemic. For instance, in Lee and Ogawa (2021) study, English teachers showed a higher self-efficacy in their abilities to implement pedagogical instructions and technology in online teaching. In contrast, they were unconfident in providing efficient time management when teaching online. Fujita et al. (2021) found that the teachers who showed positive attitudes and a sense of crisis tended to adopt more interactive instructions during online mathematics lessons. However, not much research has been done on the changes in the self-efficacy and pedagogical beliefs of preservice teachers after student teaching during the initial teacher education stage in Japan. And how preservice teachers' self-efficacy and pedagogical beliefs changed during the COVID-19 pandemic still needs future study.

The initial teacher education stage is considered a crucial phase for preservice teachers as it strongly impacts the formation of perceptions and beliefs about teaching in the early stage of professional learning (Flores and Day, 2006; Wuryaningsih et al., 2019). Understanding self-efficacy and pedagogical beliefs would also throw light on teaching competency and pedagogical knowledge among preservice teachers. Therefore, this study aimed to examine the changes in the self-efficacy and pedagogical beliefs of preservice teachers before and after their student teaching in the Japanese context.

2 Preservice teacher preparation in the Japanese context

Since the 21st century, the Japanese government has implemented a series of teacher education reforms to improve the overall professional competence of primary and secondary school teachers. In 2006, the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT), which is known as *Monbukagakusho* in Japan, enacted the revision of *the Basic Act of Education* (The Ministry of Education, Culture, Sports, Science and Technology of Japan [MEXT], 2006a). This document unveiled a new era of Japanese education and emphasized the need for preservice teachers to become lifelong learners. In 2007, MEXT adopted *the Revision of the Educational Personnel Certification Law* to change the traditional tenure system of teacher qualifications (The Ministry of Education, Culture, Sports, Science and Technology of Japan [MEXT], 2007). With the goal of achieving a high quality of teacher training through reforming teacher education and the teacher license system, this document was issued to help preservice teachers acquire the latest professional knowledge and skills to keep pace with the times by taking certificate renewal courses.

A new teacher evaluation system has also been implemented by the majority of prefectures in 2006 to improve teacher

qualifications (The Ministry of Education, Culture, Sports, Science and Technology of Japan [MEXT], 2006b). Followed by the requirement of developing collaborative learning ability to improve teachers' teaching performance (The Ministry of Education, Culture, Sports, Science and Technology of Japan [MEXT], 2011), MEXT issued a report that encourages the enhancement of teachers' autonomous learning ability (The Ministry of Education, Culture, Sports, Science and Technology of Japan [MEXT], 2015a). These are also the competencies that preservice teachers need to possess, thus improving their teaching competence to cope with various challenges in future teaching.

Developing preservice teachers' practical teaching competence has also attracted close attention during the initial teacher education programs. MEXT proposed a teacher education curriculum model that focused on enhancing the professional practice skills of preservice teachers in 2004, and reformed the structure of the teacher education curriculum framework at the undergraduate level in 2006 (The Ministry of Education, Culture, Sports, Science and Technology of Japan [MEXT], 2006c). The new curriculum is aimed at strengthening the management of student teaching among preservice teachers. It requires preservice teachers to undergo introductory education and pre-internship orientation before starting student teaching. In contrast, universities can also estimate a preservice teacher's readiness for the student teaching by making a comprehensive deliberation of his/her academic level and actual performance. Then, universities would make a decision as to whether to postpone or suspend this preservice teacher's student teaching according to the evaluation.

To equip preservice teachers with the professional knowledge and teaching skills they will need for their future teaching, the Japanese government established a program entitled *Practical Seminar for the Teaching Profession (Kyoshokujissenenshu)* in 2008 (The Ministry of Education, Culture, Sports, Science and Technology of Japan [MEXT], 2008). It establishes an integrative model that combines preservice teacher education and continuous professional development. Moreover, it attempted to strengthen preservice teachers' teaching skills through various activities, such as teacher role-play, inquiry-based learning within teams, lesson study, micro-teaching, and fieldwork. In addition, some primary and secondary school teachers are also invited to give their guidance, thus helping preservice teachers better understand the actual situation of primary and secondary schools.

In response to the appeal of the central government to strengthen preservice teachers' professional practice skills, many universities have implemented a staged curriculum of educational practice by interspersing the educational practice courses throughout the entire teacher education program at the four-year undergraduate level. For example, in the primary preservice teacher education curriculum at a university in Western Japan (Faculty of Education, 2022), preservice teachers are offered opportunities to observe lessons in the local primary schools during their freshman year. In their sophomore year, they can experience a variety of teaching activities with the acquired basic teaching knowledge and skills through course learning. During the teaching preparation stage from their junior year, preservice teachers are required to communicate and have discussions with in-service teachers at a primary school about specific cases while guiding pupils' learning. In this way, preservice teachers are expected to gradually improve their teaching abilities and achieve a better

teaching performance during the five-week teaching practice in their senior year. At the same time, they can also meet the requirements of the university.

Recently, some counter-measures of the teacher education reform were put forward to enable preservice teachers to have a deeper understanding of authentic teaching situations in primary and secondary schools. For instance, in the document entitled *the Criteria for Accreditation of Teacher Education Programs* (The Ministry of Education, Culture, Sports, Science and Technology of Japan [MEXT], 2022), preservice teachers are required to regularly participate in practical teaching activities in primary and secondary schools to fully understand the behavioral and psychological traits of teenagers, such as assisting primary and secondary school teachers in tutoring students inside the classroom and instructing extracurricular reading for primary and secondary school students beyond the classroom. Consequently, preservice teachers can achieve quality teaching in their future student teaching.

3 Self-efficacy toward teaching

Numerous researchers have developed teachers' self-efficacy in a wide range according to different cognitive perspectives. Bandura (1977, 1997) defined self-efficacy theory as an individual's belief in his/her ability to organize and carry out actions to reach his/her desired teaching goals. Dembo and Gibson (1985) defined teacher efficacy as the belief that a teacher thinks his/her teaching ability is positively related to students' learning. Guskey and Passaro (1994) proposed that teachers' self-efficacy refers to teachers' beliefs or conviction that they can influence how well students learn, even those who may be difficult or unmotivated. Tschannen-Moran et al. (1998) considered that teacher efficacy is affected by the specific cultures and contexts in schools. They described teachers' self-efficacy as teachers' beliefs in their capabilities to successfully organize and perform a specific teaching task in a specific context. Teachers who show higher self-efficacy are devoted themselves to teaching and have a positive willingness to carry out teaching reform, whereas the teachers with lower self-efficacy lack teaching enthusiasm and have negative attitudes toward teaching reform (Hoy and Woolfolk, 1993; Guskey and Passaro, 1994).

While it has been demonstrated that personal efficacy plays a dominant role in teachers' teaching behaviors, external factors may affect teachers' sense of efficacy. Bandura proposed social cognitive theory and believed that individual behavior is affected by the interaction among cognition, behavior, and social factors (Bandura, 1997). Two hypotheses are proposed in Bandura's social cognitive theory: one is the triadic theory of learning which indicates that personal behavior, personal factor, and environmental factors have dynamic interactions; the second hypothesis is that people have subjective initiative and intentional ability. People can be self-organized, positive, self-regulated, and self-reflective of the external circumstances (Bandura, 1986) rather than "just the products of them" (Bandura, 2006). Therefore, self-efficacy profoundly influences preservice teachers' subsequent thoughts, emotions, and behaviors when their teaching behaviors interact with personal impact factors (e.g., personal belief) and external impact factors (e.g., classroom environment and school climate).

Malmberg et al. (2004) further probed this area by considering teachers' sense of action-control (i.e., agency beliefs)

(Skinner, 1995, 1996; Little, 1998), which is defined as teachers' beliefs that their actions are the crucial factor in determining the outcomes. They believed that the teacher is the agent that acts in a certain way to realize students' achievement. Based on the literature on teacher competence, teacher efficacy, pedagogical theories, and classroom organization, Malmberg and Hagger (2009) stated two broad dimensions of teacher agency beliefs: supportive agency beliefs and instructional agency beliefs. The former refers to personal teacher efficacy (PTE; Gibson and Dembo, 1984; Guskey and Passaro, 1994) on the emotional support of the students and teacher involvement. It is related to the quality of teachers' involvement in supporting students' learning and teacher-student interactions. The latter refers to PTE on teaching and learning organization. It is related to how teachers organize and create effective teaching-learning environments that benefit students' achievement. They proposed that the teachers who believe that the teaching outcome largely depends on their actions usually have more positive beliefs and a stronger sense of agency than teachers who do not.

Abundant evidence has shown that teacher efficacy plays an essential role in sustainably motivating teachers' improvement of their teaching competence and developing their professionalism levels (Ferguson and Bråten, 2022; Spittle et al., 2023). Skaalvik and Skaalvik (2007) found that teacher efficacy affects teachers' motivation, teaching behavior, and teaching practice. The results showed that teachers with higher efficacy had more confidence in helping the most difficult students than those who showed lower efficacy. In Poulou (2007) study, preservice teachers' perceptions of their teaching competence successfully predicted their teaching efficacy in instructional strategies and classroom management. As an individual impact factor of personal motivation, self-efficacy is well-represented in teachers' agency in their teaching efforts and persistence in completing the expected teaching goals (Klassen and Tze, 2014). Preservice teachers with stronger agency beliefs usually have more positive perspectives toward their teaching capacities (Li and Huang, 2023). Therefore, they desire to influence students' learning and are more willing to become teachers. Ultimately, this type of teacher is more likely to achieve effective teaching and gain a satisfying teaching performance.

Besides teaching practice during student teaching, preservice teachers' self-efficacy is also influenced by the learning experience during the initial teacher education stage. Some researchers demonstrated that the mastery experience could provide strong support for improving students' learning efficacy (Britner and Pajares, 2006). A longitudinal study demonstrated that preservice teachers' instructional agency beliefs increase over time, and their supportive agency beliefs maintain high during the teacher education period (Malmberg and Hagger, 2009). Tazaki and Yonezawa (2013) found that the experience of preservice teachers participating in activities at the beginning of their undergraduate study positively shaped their efficacy beliefs in the following years. Subsequently, the improved efficacy beliefs positively affected their teaching practice in student teaching.

4 Pedagogical beliefs

According to literature, pedagogical beliefs refer to preservice teachers' confidence in effectively implementing their general pedagogical knowledge (Shulman, 1987; Voss et al., 2011) and teaching skills and behaviors (Gess-Newsome et al., 2017). It is important to note that pedagogical belief is a distinctive attribute of the teaching profession (Fives and Buehl, 2008) and plays a crucial role in facilitating effective teaching (Van de Grift, 2007). Numerous studies have recognized its substantial influence in shaping the teaching behaviors of preservice teachers (Belbase, 2012; Muhtarom et al., 2019). Pedagogical belief can be understood as a mental construct that encompasses teachers' understanding of teaching, assumptions or propositions about pedagogy, and pedagogical attitudes and values (Borg, 2003; Lee, 2006; Philipp, 2007; Denny, 2009). It reveals the dynamic thinking process of teachers in making teaching decisions with their knowledge and skills concerning students, learning, classroom, and subject contents (Richardson, 2003; Loughran, 2013). For instance, pedagogical belief exerts a notable impact on the instructional strategies employed by pre-service teachers, the objectives they establish for their classes, and the variety of classroom activities they utilize to actively engage students.

Preservice teachers' pedagogical beliefs are shaped by internal and external factors. On the one hand, preservice teachers' pedagogical beliefs are influenced by their professional knowledge and practical experience (Dossey et al., 2006; Gove et al., 2011; Waring and Evans, 2015). The pedagogical beliefs of preservice teachers had been developing with continuous transformation and improvement of their individual learning experiences in the learning activities from their own primary and secondary education to university education (Lo, 2021; Reynolds et al., 2022). It was found that preservice teachers' pedagogical beliefs are affected by the coursework they took in teacher education programs (Bahr et al., 2013; Macugay and Bernardo, 2013) and the teaching experience they had in student teaching (Barnyak and Paquette, 2010; Mak, 2011; Han et al., 2017). On the other hand, the pedagogical beliefs of preservice teachers are influenced by external factors, such as the learning environment (Ogan-Bekiroglu and Akkoç, 2009; Swars et al., 2009), past good experience due to positive influence from their teachers (Swars et al., 2007; Liu, 2012), and social-cultural context (Chan, 2010; Polat, 2010; Kahn et al., 2014).

Many empirical studies have shown that teachers' beliefs about their knowledge and teaching skills greatly impact their instructional choices in teaching practice. For example, Kember and Kwan (2000) found that whether teachers perceived teaching as a process of transmitting knowledge or facilitating students' autonomous learning was embodied in using different teaching approaches in class (e.g., teacher-centered or learner-centered teaching approaches). Boesdorfer and Lorsbach (2014) showed that a teacher's choice of inquiry-based teaching methods in class was closely related to his/her beliefs about constructivist teaching and learning approaches, which means learning new knowledge through reconstructing prior knowledge.

5 Research questions

Based on the above literature, self-efficacy to teach and pedagogical beliefs affect preservice teachers' teaching performance and professional learning. Therefore, this study aimed to examine

the changes in self-efficacy and pedagogical beliefs of preservice teachers after student teaching in Japan. The research questions of this study are as follows:

1. What are self-efficacy and pedagogical beliefs that preservice teachers bring into their student teaching?
2. How do preservice teachers' self-efficacy and pedagogical beliefs change after student teaching?

6 Methodology

This study adopted a quantitative research method to explore preservice teachers' self-efficacy and pedagogical beliefs before starting their student teaching and how their self-efficacy and pedagogical beliefs changed after finishing student teaching. This study has undergone an ethics review at the authors' university.

6.1 Participants

A convenience sample was drawn from Japanese preservice teachers at a university in Western Japan. Since this study aimed to the changes in the self-efficacy and pedagogical beliefs of preservice teachers before and after student teaching, those preservice teachers who were about to begin their student teaching were considered as suitable candidates for recruitment into this study. The selection of participants was based on the curriculum of preservice teacher education program offered by this university. Specifically, only preservice teachers in their junior year, who satisfied the predetermined requirements, were eligible to participate.

A total of 160 questionnaires were distributed to preservice teachers (26.40% males and 73.60% females) as part of this study. The number of responses received varied, and further elaboration on this matter were provided in the subsequent section. The majority of all participants were in the primary education study. They were assigned to three affiliated primary schools of the university in the cities in Western Japan according to their major during their student teaching. All participants were introduced to the research aim and the research procedure before collecting the consent forms. All participants joined voluntarily and the information related to the participants has been anonymized.

6.2 Instruments

Two questionnaires were adopted in this study. *The Questionnaire of Self-efficacy* was modified from the questionnaire on Action-control Beliefs, which well reflected the domains of teacher efficacy (Malmberg and Hagger, 2009). According to previous literature, classroom organization skills have been identified as essential in creating effective learning environments (Fives and Buehl, 2008; Skiba et al., 2016). Therefore, classroom organization-related items were split from the original domain of "instructional agency beliefs" as a separate dimension. The

Questionnaire of Self-efficacy contains twenty-one items that were categorized into three dimensions: Emotional Support (items 1–6), Instructional Support (items 7–13), and Classroom Organization (items 14–21). A 6-point Likert scale, varying from strongly disagree to strongly agree, was used to measure the degree of preservice teachers' beliefs in their ability on how well they can do during student teaching. Alpha's Cronbach (1951) for the entire questionnaire showed a high level of reliability, α = 0.93.

The Questionnaire of Pedagogical Beliefs was used to assess preservice teachers' beliefs about their abilities in implementing their pedagogical knowledge. This questionnaire contains nineteen items that were extracted and modified from the model of effective teaching behavior (Van de Grift, 2007) and the TPD@Work survey (Evers et al., 2016) designed to measure teachers' professional development activities. To understand preservice teachers' beliefs on implementing teaching behaviors inside and beyond the classroom, two dimensions were classified in The Questionnaire of Pedagogical Beliefs: Pedagogical Beliefs in After-class Skills (items 1–9) and Pedagogical Beliefs in In-class Skills (items 10–19). A 6-point Likert scale was used to measure the level of different items varying from strongly disagree to strongly agree. Alpha's Cronbach (1951) for the entire questionnaire showed a high level of reliability, α = 0.90.

The original English version questionnaires was translated into Japanese by one of the co-authors in advance. Then, the Japanese versions of the questionnaires were sent to another co-author who is an expert in teacher education and educational psychology fields and a Japanese researcher without any prior knowledge of this study. Both the two researchers verified the accuracy of the Japanese translations and clarity of the items.

6.3 Data collection and analysis

The data for this study was obtained through online surveys using electronic questionnaires. These questionnaires were distributed via the online system of Microsoft Forms in July and August of 2022. All participants, who voluntarily consented to participate in the study, were asked to fill out the questionnaires of self-efficacy and pedagogical beliefs before student teaching as the pre-test and afterward as the post-test. The links of questionnaires of the pre-test and post-test were dispatched to the participant separately, and each questionnaire was expected to take approximately 15 min to complete. During the data collection period, participants were sent multiple reminders through email and diverse social media platforms to improve response rates and minimize non-response bias.

A total of 133 questionnaires were retrieved in the pre-test, and fifty-seven were retrieved in the post-test. The data analysis for addressing the research questions was conducted using the statistical software package SPSS 28.0. At the first step, principal axis factoring (PAF) analyses were used to examine the validity and internal consistency of the two questionnaires based on the data from 133 preservice teachers who responded to the pre-test. At the second step, paired samples t-tests were adopted to measure the changes in the self-efficacy and pedagogical beliefs of preservice teachers after student teaching based on the data from fifty-seven preservice teachers who responded to the post-test.

7 Findings

7.1 Factor analyses of the questionnaires of self-efficacy and pedagogical beliefs

To explore the factorial structure of the items involved in *the Questionnaire of Self-efficacy* in Japanese preservice teachers, a PAF analysis was performed with oblique rotation, incorporating all indicators present in the questionnaire. The sampling adequacy for the analysis was verified through the Kaiser–Meyer–Olkin (KMO) measure, in which KMO = 0.91. The KMO value for each individual item was greater than 0.80, which is well above the threshold of 0.50 (Kaiser and Rice, 1974). Bartlett's test of sphericity, χ^2 (210) = 1,456.58, $p < 0.001$, indicating that the correlation structure was adequate for factor analysis. Four factors had eigenvalues greater than Kaiser's criterion of 1 (Kaiser and Rice, 1974; Field, 2018). The four-factor model solution explained 61.58% of the total variance in combination. However, the results showed that only one variable (item 5) was included in factor 4. With a cut-off point of 0.40, the variables which factor loadings were less than 0.40 should be removed (Guadagnoli and Velicer, 1988; Osborne et al., 2008). The results showed that the factor loadings of three variables (items 2, 9, 13) were lower than the cut-off point, indicating these three variables need to be removed in this study. Additionally, the factor loadings of three variables (items 1, 4, and 6) in factor 3 showed negative results, which were not assumed to be negatively related to preservice teachers' self-efficacy in this study. According to the factoring correlation matrix, the correlation coefficients (r) between paired factors were 0.48, −0.51, and 0.27.

According to the inflections showed in the scree plot, a two-factor model could also be justified for retention. Therefore, we ran the PAF analysis again by forcing a two-factor solution. The two-factor solution accounted for 50.61% of the variance, which is acceptable (Samuels, 2017). While this solution explained less of the variance in combination, the items were kept maximally and loaded on the two factors were more clearly. The eigenvalues of the two factors after rotation were equalized (7.65, 6.84, respectively). The results showed that the factor loading of only one variable (item 13) was less than the cut-off point of 0.40. Moreover, these two factors showed a higher inter correlation ($r = 0.69$). Then we reran the PAF analysis with the two-factor solution after removing item 13: "I can help the most difficult students to learn." The total explained variance increased to 51.79%. Therefore, the two-factor solution was selected as the best fitting model for our data.

According to the PAF results, the remaining items were classified into two factors. Two separate domains in the original design: "emotional support" and "instructional support," were combined into factor 1, named *Emotional and Instructional Support*, with an eigenvalue of 8.64, accounting for 43.20% of the variance. Item 3: "I can be sensitive to students' needs," which was involved in the domain "emotional support" in our original design, was combined with other items and loaded on factor 2 with an eigenvalue of 1.72, accounting for 8.59% of the variance. This factor was named *Classroom Organization*. In sum, the items of *the Questionnaire of Self-efficacy* were categorized into two domains based on the two-factor model: *Emotional and Instructional Support* (items 1–11) and *Classroom Organization* (items 12–20). The results showed high reliability for each domain

TABLE 1 Factor loadings of the items of the questionnaire of self-efficacy ($n = 133$).

Items	Factors	
	1	2
1. I can motivate students.	0.85	−0.13
2. I can awaken students' curiosity.	0.81	0.01
3. I can engage the students.	0.79	−0.05
4. I can make students think about their thinking.	0.78	−0.13
5. I can deepen students' insight into their tasks at hand.	0.74	0.05
6. I can support students.	0.68	0.03
7. I can promote students' reasoning and problem-solving skills.	0.64	0.09
8. I can link new concepts and ideas to students' background knowledge.	0.55	0.01
9. I can provide feedback that leads to deeper understanding.	0.51	0.16
10. I can identify where students make mistakes and redirect them.	0.47	0.20
11. I can encourage students.	0.42	0.08
12. I can adjust lessons according to the level of individual students.	−0.07	0.78
13. I can maintain classroom rules and discipline.	−0.25	0.76
14. I can pace the learning tasks well.	0.20	0.65
15. I can maximize time on learning tasks.	0.06	0.63
16. I can differentiate between students.	0.02	0.61
17. I can structure my teaching in a coherent way.	0.05	0.61
18. I can set clear expectations for students' work.	0.10	0.51
19. I can set appropriate learning targets for students.	0.26	0.50
20. I can be sensitive to students' needs.	0.31	0.43
Eigenvalues	8.64	1.72
Percent of variance explained	43.20%	8.59%
Alpha reliability coefficients	0.90	0.87
Factor correlations		
1	–	0.69
2	0.69	–

($\alpha = 0.90$, $\alpha = 0.87$, respectively). Table 1 shows the rotated factor loadings of two-factor model by using the PAF analysis in the final version of *The Questionnaire of Self-efficacy*.

Subsequently, a PAF analysis was performed with oblique rotation, incorporating all indicators present in *the Questionnaire of Pedagogical Beliefs*. The Kaiser–Meyer–Olkin (KMO) measure verified the sampling adequacy for the analysis, *KMO* = 0.88. The KMO value for each individual item was greater than 0.75. Bartlett's test of sphericity, χ^2 (171) = 1,128.36, $p < 0.001$, indicating that the correlation structure is adequate for factor analysis. Four factors had eigenvalues greater than Kaiser's criterion of 1 (Kaiser and Rice, 1974; Field, 2018), explaining 61.38% of the total variance in combination. However, the results showed that only one variable (item 5) was included in factor 4. The factor loadings of five

TABLE 2   Factor loadings of the items of the questionnaire of pedagogical beliefs (*n* = 133).

Items	Factors	
	1	2
1. Record the teaching problems I encountered for my learning purposes.	0.87	−0.19
2. Observe other teachers' lessons to improve my teaching performance.	0.86	−0.24
3. Store students' previous learning outcomes for teaching purposes.	0.76	−0.03
4. Reflect on the reasons for my failures or successes in teaching.	0.73	0.06
5. Document my learning experience and thoughts in professional learning activities.	0.65	0.05
6. Modify teaching approaches based on colleagues' comments for improving lessons.	0.60	0.02
7. Log my instructional details for the improvement of my teaching practice.	0.45	0.26
8. Adjust my teaching methods according to students' responses.	0.42	0.20
9. Ask students to constructively comment on other students' answers/ viewpoints.	−0.24	0.75
10. Motivate students to think about the strengths and weaknesses of certain approaches.	−0.13	0.69
11. Encourage students to ask one another questions.	−0.15	0.61
12. Ask students to comment on the solutions they gave to problems or questions.	0.15	0.60
13. Ask students to think about how they could improve their learning.	0.15	0.59
14. Give students opportunities to correct their own work.	0.17	0.56
15. Explicitly provide instructions in problem-solving strategies.	−0.07	0.54
16. Ask students to comment on other students' viewpoints.	0.23	0.54
17. Encourage students to explain their understanding of topics to one other.	0.14	0.54
18. Ask students to comment on his/her own answers/ viewpoints.	0.27	0.50
Eigenvalues	6.89	2.14
Percent of variance explained	38.26%	11.91%
Alpha reliability coefficients	0.86	0.86
Factor correlations		
1	–	0.60
2	0.60	–

variables (items 7, 9, 10, 15, 16) were less than the cut-off point of 0.40.

According to the points of inflection showed in the scree plot, a two-factor model could also be another factor solution. To retain variables as many as possible, we reran the PAF analysis by forcing a two-factor solution. This solution explained 49.67% of the total variance, which was less than the four-factor solution. Nevertheless, the factor loading of only one variable (item 9) was less than the

cut-off point of 0.40. And the inter-correlation coefficients between these two factors was high (*r* = 0.60). Then, we ran PAF again with the two-factor solution after item 9 was removed: "gather information for analyzing and evaluating feedback from students." The total explained variance increased to 50.17%. Therefore, the two-factor solution was select as the best model to explain our variables. According to the PAF results, the categorization of remaining items was kept the same as our original design, which was divided into two domains based on the two-factor model: *Pedagogical Beliefs in After-class Skills* (items 1–8) and *Pedagogical Beliefs in In-class Skills* (items 9–18). The former factor had an eigenvalue of 6.89, accounting for 38.26% of the variance. And the latter one had an eigenvalue of 2.14, accounting for 11.91% of the variance. The results showed high reliability for each domain (α = 0.86, α = 0.86, respectively). Table 2 shows the rotated factor loadings of two-factor model by using the PAF analysis in the final version of *the Questionnaire of Pedagogical Beliefs*.

7.2 The changes in self-efficacy after student teaching

Upon validating the questionnaires, a paired samples *t*-test was conducted to compare the self-efficacy of Japanese preservice teachers between the pre-test and post-test (see Table 3). Generally, either the self-efficacy of the Japanese preservice teachers in the pre-test or the post-test was above the average score (M = 3.00). The total mean score of the self-efficacy of Japanese preservice teachers was higher in the post-test (M = 4.00, SD = 0.55) than that in the pre-test (M = 3.52, SD = 58). And they showed a higher sense of self-efficacy in each domain in the post-test (M = 3.98, SD = 0.56; M = 4.03, SD = 0.61; respectively) than that in the pre-test (M = 3.50, SD = 0.63; M = 3.55, SD = 0.66; respectively). Additionally, their self-efficacy in the domain of *Classroom Organization* was slightly higher than that in *Emotional and Instructional Support* in each test.

The results showed that the self-efficacy of Japanese preservice teachers in the post-test was significantly higher than that in the pre-test [*t*(56) = 6.42, *p* < 0.001 (one-tailed), Cohen's *d* = 0.85]. There was a significant difference in *Emotional and Instructional Support* between the two tests with a moderate effect [*t*(56) = 5.83, *p* < 0.001 (one-tailed), Cohen's *d* = 0.77]. The result showed that the self-efficacy in *Classroom Organization* was also significantly different between the two tests with a moderate effect [*t*(56) = 5.98, *p* < 0.001 (one-tailed), Cohen's *d* = 0.79].

7.3 The changes in pedagogical beliefs after student teaching

Consistently, Table 4 presents the comparisons between the pre-test and post-test results of pedagogical beliefs among Japanese preservice teachers. Generally, the Japanese preservice teachers' pedagogical beliefs show a similar changing trend with their self-efficacy. The pedagogical beliefs of Japanese preservice teachers in the pre-test and post-test were well above the average score (M = 3.00). The total mean score of pedagogical beliefs of Japanese preservice teachers was higher in the post-test (M = 5.12, SD = 0.44)

TABLE 3 The changes in the self-efficacy after student teaching.

Domains	Pre-test (n = 57) M (SD)	Post-test (n = 57) M (SD)	t	Cohen's d
Emotional and instructional support	3.50 (0.63)	3.98 (0.56)	5.83***	0.77
Classroom organization	3.55 (0.66)	4.03 (0.61)	5.98***	0.79
Total	3.52 (0.58)	4.00 (0.55)	6.42***	0.85

***$p < 0.001$ (one-tailed).

TABLE 4 The changes in pedagogical beliefs after student teaching.

Domains	Pre-test (n = 57) M (SD)	Post-test (n = 57) M (SD)	t	Cohen's d
Pedagogical beliefs in After-class skills	5.49 (0.43)	5.61 (0.36)	2.49**	0.33
Pedagogical beliefs in in-class skills	4.64 (0.61)	4.73 (0.62)	1.12	0.15
Total	5.02 (0.46)	5.12 (0.44)	1.96*	0.22

*$p < 0.05$, **$p < 0.01$ (one-tailed).

than that in the pre-test (M = 5.02, SD = 0.46). Their pedagogical beliefs were higher in the post-test in each domain (M = 5.61, SD = 0.36; M = 4.73, SD = 0.62; respectively) than that in the pre-test (M = 5.49, SD = 0.43; M = 4.64, SD = 0.61; respectively). Moreover, in each test, they showed higher *Pedagogical Beliefs in After-class Skills* than their *Pedagogical Beliefs in In-class Skills*.

The results showed that there was a significant difference in pedagogical beliefs of Japanese preservice teachers between the pre-test and post-test [$t(56) = 1.96$, $p < 0.05$ (one-tailed), Cohen's $d = 0.22$]. Japanese preservice teachers' *Pedagogical Beliefs in After-class Skills* significantly increased in the post-test [$t(56) = 2.49$, $p < 0.01$ (one-tailed), Cohen's $d = 0.33$], although the analysis yielded a minimal effect. However, no significant difference was found in the domain of *Pedagogical Beliefs in In-class Skills* between the two tests [$t(56) = 1.12$, $p > 0.05$, Cohen's $d = 0.15$].

8 Discussion

This study explored the changes in the self-efficacy and pedagogical beliefs of preservice teachers after student teaching in Japan. The results of the PAF analyses confirmed the validity of *the Questionnaire of Self-efficacy* and *the Questionnaire of Pedagogical Beliefs* in terms of factorial structure and internal consistency in the Japanese context. Interestingly, according to the PAF results of *The Questionnaire of Self-efficacy*, the original domains of "emotional support" and "instructional support" were loaded on the same factor. The results suggest that preservice teachers perceived the emotional and instructional support unitary in the Japanese context. This might be because of the influence of the Confucian-Heritage culture, in which maintaining a positive teacher-student relationship is particularly regarded as an important factor in promoting students' achievement in daily teaching (Tweed and Lehman, 2002). In a recent study about teachers' perceptions of first-grade students' socio-emotional behavior at primary schools across countries, the results showed that Japanese teachers focused more on students' learning achievement and problematic behavior than Finnish and Spanish teachers (Pirskanen et al., 2019). It seems that Japanese preservice teachers in this study are more likely to

create a harmonious interrelationship in class to facilitate students' engagement and achievement.

The results of paired t-tests showed that the self-efficacy and pedagogical beliefs of Japanese preservice teachers significantly increased in the post-test after their student teaching. The results suggested that the authentic teaching experience during the student teaching period is an essential source of influence on Japanese preservice teachers' self-efficacy and pedagogical beliefs, although the length of student teaching is short in Japan. It could be related to the results of the Teaching and Learning International Survey (TALIS) in 2018, which showed Japanese teachers got the highest scores on teaching motivation and making teaching their first choice of career, compared with the teachers in other countries (Organization for Economic Co-operation and Development [OECD], 2020). It is noted that Japanese preservice teachers got more assistance from the established mandatory system of teacher training, involving formal courses in the teacher education programs in universities (e.g., micro-teaching and practicum preparation) and the continuous teacher training at the beginning phase after entering teaching profession (e.g., apprenticeship induction model) (Howe, 2008; Takagi, 2015). Moreover, researchers found that mastery experience served as the strongest independent source in predicting Japanese teachers' self-efficacy (Yada et al., 2019). In this study, the author speculated that Japanese preservice teachers' self-efficacy had been enhanced with improved teaching performance through teaching practice in authentic classrooms during student teaching.

The results suggested an effect of contextualization, which means that teacher efficacy could be affected by the specific culture and context (Tschannen-Moran et al., 1998; Lin and Gorrell, 2001). In this study, the author deduced that the learning environment the Japanese preservice teachers studied in and the school context they worked in were positive and supportive during their student teaching (e.g., supportive mentor, relaxed school culture). In a supportive environment, preservice teachers could gain confidence and reshape their efficacy beliefs during student teaching (Flores and Day, 2006; Simsar, 2016; Zhao and Zhang, 2017). Influenced by collectivist culture, supports and feedback from colleagues and schools are conducive to teachers' self-efficacy in the Japanese context (Thompson and Dooley, 2019; Yada et al., 2019).

Nevertheless, the changing trend of the self-efficacy of Japanese preservice teachers was more obvious than their pedagogical beliefs, although their pedagogical beliefs were higher than the self-efficacy. The results showed that preservice teachers' pedagogical beliefs reached higher initial scores while increasing less over time. In contrast, the scores on self-efficacy started at a lower level but significantly rose after student teaching. In line with previous longitudinal studies, preservice teachers made a steeper change over time if they had lower scores initially (Malmberg and Hagger, 2009; Maulana et al., 2015). We assumed that these preservice teachers' self-efficacy would be reached the same level as pedagogical beliefs if they can have a longer student teaching.

According to the results of pedagogical beliefs, preservice teachers' *Pedagogical Beliefs in After-class Skills* significantly increased after student teaching, whereas *Pedagogical Beliefs in In-class Skills* did not significantly change. The results suggested that preservice teachers tended to hold higher beliefs in using relevant pedagogical knowledge to improve their teaching performance beyond class rather than in class. Usually, preservice teachers have adequate time to reflect on their teaching practice and consider better solutions to solve the problems in teaching after class. However, it might be difficult for them to make appropriate teaching decisions promptly (Moore, 2003; Oo et al., 2021) and adjust their teaching methods flexibility based on the students' needs in class (Dee, 2010; Nepal et al., 2021) during their student teaching.

The findings also suggested that the experience gained through student teaching is not enough for preservice teachers to enhance their pedagogical beliefs if their pedagogical knowledge is insufficient to support their teaching practice. An empirical study showed that preservice teachers without teaching experience tended to have less pedagogical knowledge (Voss et al., 2011). However, teaching experience does not directly influence the development of pedagogical knowledge (Abd-El-Khalick, 2006; Friedrichsen et al., 2009). Therefore, it is essential to support preservice teachers to enhance their pedagogical beliefs by promoting deeper PK and advanced teaching skills through critical reflections on their learning and teaching.

The Japanese government put forward a proposal entitled *Developing the Qualifications and Competencies Needed for Teachers in This Era* (The Ministry of Education, Culture, Sports, Science and Technology of Japan [MEXT], 2015b). The proposal encourages teachers to develop the ability of autonomous learning and teaching innovation, thus becoming capable of overcoming various difficulties with unexpected situations and remaining dedicated to the teaching profession in the era of uncertainty. In-depth reflection skills are indispensable to support preservice teachers to better understand teaching and explore teaching innovation (Wang et al., 2023). According to an empirical study, Japanese beginning teachers reflected on and improved their teaching practice and generated new insights through interactions with their trainers and peers in teaching research seminars (Yamasaki et al., 2021). This study also found that these Japanese beginning teachers showed a strong willingness to deepen their learning and become lifelong learners by participating in this teacher training program.

Furthermore, we noticed that the number of retrieved questionnaires in the post-test has dropped by more than half. The reason could be that the preservice teachers who participated

in the survey after student teaching might show more confidence than other peers who did not, because they had a stronger knowledge base and gained a better teaching performance during student teaching. It is known that successful learning and teaching experiences during the initial teacher education stage made preservice teachers feel more confident in their knowledge, skills, and abilities to teach than the other peers (Temiz and Topcu, 2013; Pfitzner-Eden, 2016; Clark and Newberry, 2019).

9 Conclusion

The current study examined the changes in the self-efficacy and pedagogical beliefs of preservice teachers after student teaching in the Japanese context. The results showed that the Japanese preservice teachers' self-efficacy and pedagogical beliefs significantly increased after student teaching, suggesting that student teaching is crucial in enhancing preservice teachers' professional beliefs in the Japanese context. The current study also verified the validity and internal consistency of *the Questionnaire of Self-efficacy* and *the Questionnaire of Pedagogical Beliefs*, which developed based on Western theories in terms of the Japanese context.

This study provides a fresh understanding of the changes in the self-efficacy and pedagogical beliefs of preservice teachers over the period of student teaching in the Japanese context, especially during the COVID-19 pandemic. It provides guidance for teacher educators on what aspects they need to support preservice teachers during the initial teacher education stage, thus developing preservice teachers' professional competence to address various challenges and uncertain situations in their future teaching careers. For example, it would be an effective approach in fostering preservice teachers' reflective thinking skills by integrating more reflective practice and activities in teacher education programs. Engaging in reflective thinking would enhance their self-efficacy and pedagogical beliefs, as it would facilitate a deeper understanding and mastery of the knowledge acquired during their teacher education.

This study provides evidence of adopting Western theories in exploring the Japanese preservice teachers' self-efficacy and pedagogical beliefs. By highlighting the Japanese context of the initial teacher education, this study contributes to the meaningful adaptation of theories and frameworks developed in the West to Japan. Moreover, this study builds a bridge between Western and Japanese literature in teacher education.

There are still some limitations in our research so far. The results showed that the rising rate in pedagogical beliefs of Japanese preservice teachers was relatively slow. This study implies reinforcing preservice teachers' pedagogical beliefs by encouraging them to have deep reflections on their teaching behaviors during student teaching. Future studies could adopt relevant teacher training programs to enhance Japanese preservice teachers' efficacy beliefs through developing their reflection skills and examine whether and how their efficacy beliefs could be strengthened.

The results of the PAF analysis of the items involved in *the Questionnaire of Self-efficacy* suggested a two-factor model, which was different from the three-factor model in our original design, suggesting the interpenetration of the Japanese preservice

teachers' self-efficacy in the emotional and instructional support based on the Japanese educational context. It implies cultural diversity in affecting preservice teachers' self-efficacy toward teaching. Future studies would conduct interviews to explore a deeper understanding of preservice teachers' perspectives on their knowledge, abilities, and teaching skills by considering different cultures and contexts.

Additionally, the current study exclusively focused on exploring the modifications in self-efficacy and pedagogical beliefs among preservice teachers situated in Western Japan, with a limited sample size. Only preservice teachers with certain characteristics participated in this current study. Future research would recruit a larger sample size covering more representative teacher education programs in both Eastern and Western Japan.

Data availability statement

The original contributions presented in this study are included in this article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by the Research Ethics Review Board of Hiroshima University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

YW: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft. TY: Conceptualization, Methodology, Supervision, Writing – review & editing. AY: Conceptualization, Methodology, Supervision, Writing – review & editing. JK: Conceptualization, Resources, Writing – review & editing. YL: Writing – review & editing. YK: Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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