

Transformation of Middle-career Teachers' Beliefs during the Development of an ICT Environment

Yasushi HIRAYAMA

Meisei University, Japan
hira.yasushi@gmail.com

Takayuki KONNO

Meisei University Japan
konno@t-konno.net

This study focuses on elucidating the transformation of teaching beliefs among middle-career teachers in public elementary schools. Interviews with six middle-career teachers and subsequent analysis of their beliefs using trajectory equifinality modeling revealed two distinct periods in the formation of their beliefs. Initially, the teachers' beliefs about teaching, rooted in direct instructional practices, were learned and formed based on the realizations gained through the infusion teaching approach. Subsequently, as they learned to employ one-to-one computing environment and engaged in educational evaluations, they began reflecting on their teaching beliefs. Through a trial-and-error process with new instructional strategies, the teachers' beliefs shifted toward constructivist instructional approaches.

Keywords: Middle-career teachers, Teachers' beliefs, Information and communications technology, Elementary school, Trajectory equifinality modeling

Introduction

Teachers' teaching beliefs influence their instructional practices and have garnered attention from researchers, who emphasize teachers' resistance to change (Calderhead, 1996; Pajares, 1992). Teachers' beliefs can undergo significant transformation within a relatively short timeframe, especially when they are receptive to change or engage in reflective practices (Korthagen & Vasalos, 2005; Yamada, 2014). The 2009 Organization for Economic Co-operation and Development (OECD) report highlighted the importance of identifying teaching materials aligning with teachers' beliefs in constructivist instructional practices and involving students in activities to foster awareness.

In Japanese elementary schools, the central teaching beliefs in the educational field are based on direct instructional practices (Yuguchi et al., 2019). However, these beliefs are expected to change due to the forthcoming changes in Japan's educational landscape, driven by the rapid development of one-to-one computing environment (Horita, 2021). This shift is viewed as an opportunity for teachers' beliefs to evolve. However, after implementing the one-to-one computing environment in Korean public elementary schools, teachers continued to adhere to traditional teaching methods (Takahashi et al., 2014). Teachers' reliance on direct instructional practices contributes to challenges in integrating information and communications technology (ICT) into classes (Ninomiya & Honda, 2004). Environmental changes alone cannot change teachers' reliance on direct instructional practices because other factors may influence their teaching beliefs. Thus, there is a need to examine how the changes in the one-to-one computing environment have impacted the teaching beliefs of Japanese teachers to uncover further factors influencing them.

The target population for this study encompassed middle-career elementary school teachers whose teaching beliefs were rooted in direct instructional practices. The OECD (2007) highlighted the importance of middle-career teachers (MCTs) in implementing reforms in school education, emphasizing their pivotal role in promoting constructivist teaching beliefs in future school contexts. We defined MCTs as "having about ten years of experience in teaching and serving as a head teacher who has engaged in school reforms with various stakeholders" with reference to Tokito and Terashima (2018).

This study focused on the evolution in teaching beliefs among MCTs in public elementary schools, particularly those who encountered a rapidly evolving ICT environment over a two-year period.

Research Design and Methods

Research cooperators and interview details

Table 1 presents the characteristics of the participants, comprising six teachers, obtained using the snowball method, including their years of experience as a teacher and head teacher. The teachers were asked to recommend other teachers who fit the study requirements.

The author's acquaintance, Teacher A, who had been the head of the grade level for several years and had been reforming the school in line with the principal's intentions, including in roles of the head of student guidance and head of research, was requested to cooperate in the research as he had previously participated in research and study groups and had a wide network of friends.

Table 1
Characteristics of the six study subjects

TEACHER	A	B	C	D	E	F
Experiences as a teacher (years)	11	10	11	15	10	14
Experience as a head teacher	Head of the grade level	Head of special operations	Head of the grade level	Head of the grade level	Head of the grade level	Head of the grade level
	Head of student guidance		Head of student guidance		Head of research	Head of research
Use of ICT in the classroom on a daily basis	Used daily in class	Used daily in class	Rarely used	Rarely used	Used daily in class	Used daily in class

Analysis method

This study employed the Trajectory Equifinality Approach (TEA), specifically the Trajectory Equifinality Model (TEM), for data analysis due to its strengths as a cognitive and visualization tool for understanding human activities.

In his systems theory, Bertalanffy (1968) argued that open systems, unlike closed systems, exhibit equifinality points where they reach the same end state despite variations in initial conditions and methods. Valsiner (2007) described this equifinality as a multilinearity of development and the phenomenon of equality.

In TEM, two types of pathways from the dual-track path to the equifinality point exist: a necessary passage point that must be traversed within a social context and a branching point for path selection, where social direction and social guidance exert influence (Yasuda et al., 2015). Furthermore, at the branching point, some pathways deselected by the cooperators may theoretically exist.

Some studies have used TEM to clarify the process leading to childcare providers' perspectives of childcare through interviews (Asai & Asai, 2017) and the specifics of teaching experiences contributing to the growth and development of MCTs, similar to this study (Tokito & Terashima, 2017). Therefore, we considered that TEM could be used to visualize the transformation of MCTs' teaching beliefs.

Analysis procedure

In this study, we followed the basic TEA procedures (Yasuda et al., 2015).

- (1) Establishing equifinality points & First interview.** Based on the study purpose, the equifinality point was set as "formation of beliefs about teaching." Each teacher was interviewed four times; the average total interview

time per teacher was 102.755 minutes. The first interview was conducted to determine their teaching beliefs at the current equifinality point. The semi-structured interviews were conducted online between March and April 2023.

During the interviews, participants were asked about the origins of their teaching beliefs, the specific teaching methods they employed, and their perspectives on the subject matter. In addition, they were asked about using one terminal per student during the two years from April 2021 to February 2023.

- (2) **Second interview and analysis, creation, and modification of TEM diagrams.** Next, based on the first interviews, teachers' beliefs in each subject area were organized. The participants were then asked to talk about their teaching experiences from their first school until they reached the equifinality point, which they considered important in forming their current teaching beliefs. Although TEA provides the necessary elements for generating a TEM-based diagram (TEM diagram), the methods to classify and analyze the responses differ depending on various factors including the research subject. This study used the modified grounded theory approach (M-GTA) of Kinoshita (2003). M-GTA is an efficient method for qualitative studies and can generate concepts closely related to the data. In addition, it was valuable in this study because some studies (Tokito & Terashima, 2017) have used TEA as a theoretical framework and clarified the specifics of teaching experiences contributing to the growth and development of MCTs using M-GTA.

Specifically, the audio recordings of the interviews were sequentially transcribed to generate concepts, examine relationships among them, and form categories. Subsequently, we checked the relevant parts against the main concepts of TEM. In this way, TEM diagrams were created for each participant.

- (3) **Integration of TEM diagrams and their final confirmation by interviews.** After a third interview was conducted, the revised TEM diagrams were individually reviewed and opinions were obtained from participants. A fourth interview was then conducted, and the TEM diagrams were further modified based on the participants' feedback.

At this stage, the TEM diagrams generated from individual informants. By overlaying the developmental history of several individuals, we intended to show the possibility of multiple paths and the diversity and commonality of individuals. The aim was to clarify the specifics of overlapping individual points under the assumption that, despite the diverse paths taken, overlapping points exist as common experiences.

The validation of the TEM diagrams through interviewee confirmation in TEA meant transview saturation, defined as the interviewees' complete agreement with each major concept used (Yasuda et al., 2015).

- (4) **Analysis, revision of TEM diagrams, and overall discussion.** A final analysis and revision of the TEM diagrams were performed, and a general discussion was given as a summary. The voice data acquired from the interviews were sequentially converted into text. The data were categorized into groups of meanings to form the smallest unit of analysis. Next, each category was coded with a heading that simply expressed its meaning, and the experiences and selection paths along the time axis were examined based on the TEM framework. In creating the resulting TEM diagram, the concept of time representing irreversibility is indicated by an arrow at the bottom to show that development is captured in irreversible time.

Results and Discussion

Table 2 presents the categories and concepts generated from the analysis of the interviews and their definitions. The details of the changes revealed by the analysis are described below. In addition, the categories are indicated by [], concepts by < >, author's assistance by / /, and when quoting remarks, they are indicated by “ ”.

The routes in Figure 1 are explained below using the categories and concepts outlined in Table 2. Figure 1 shows the teaching experience common to the six MCTs, expressed as TEM. The point at which teachers' beliefs based on direct instructional practices were formed was designated as the first equifinality point, and the point at which their beliefs rooted in constructivist instructional approaches were formed was termed the second equifinality point. In the figure, the paths are divided into left and right, but this does not indicate the level of awareness or the degree of improvement.

As shown in Figure 1, the teachers formed their teaching beliefs through class improvement when beginning their teaching careers. Therefore, the diagram is divided into three parts: first, when experiencing teaching methods based

on various the beliefs of teaching; second, socially created beliefs based on direct instructional practices; and third, based on constructivist instructional approaches by studying educational evaluation.

Phase I: Experiencing beliefs about teaching

“Becoming a college student” was classified as an obligatory passage point (OPP) because obtaining a license is essential before entering the teaching profession.

Some teachers had engaged in <Learning teaching method based on constructivist instructional approaches> when they were students: “When I was an intern, my advisor taught me how to teach math problem-solving. (Teacher B).” However, a common sentiment among the teachers was a perception that these teaching methods lectures were inadequate. Teacher C said, “I did math and other subjects during my teaching practice, but I never did Japanese... (omission)...I was like, what is Japanese? (Teacher B).” Therefore, they had never learned this teaching method and many did not fully understand the constructivist method.

Some teachers had experienced <Successful experience with teaching methods based on direct instructional practices> during their schooling. Teacher A said, “They really don’t discriminate against kids who can’t do it, they teach them... (omission)...He gave me tips for managing learning difficulties. I think it was my starting point.” Teacher A had some previous learning difficulties, and a pathway existed for him to become a teacher after experiencing the benefits of learning.

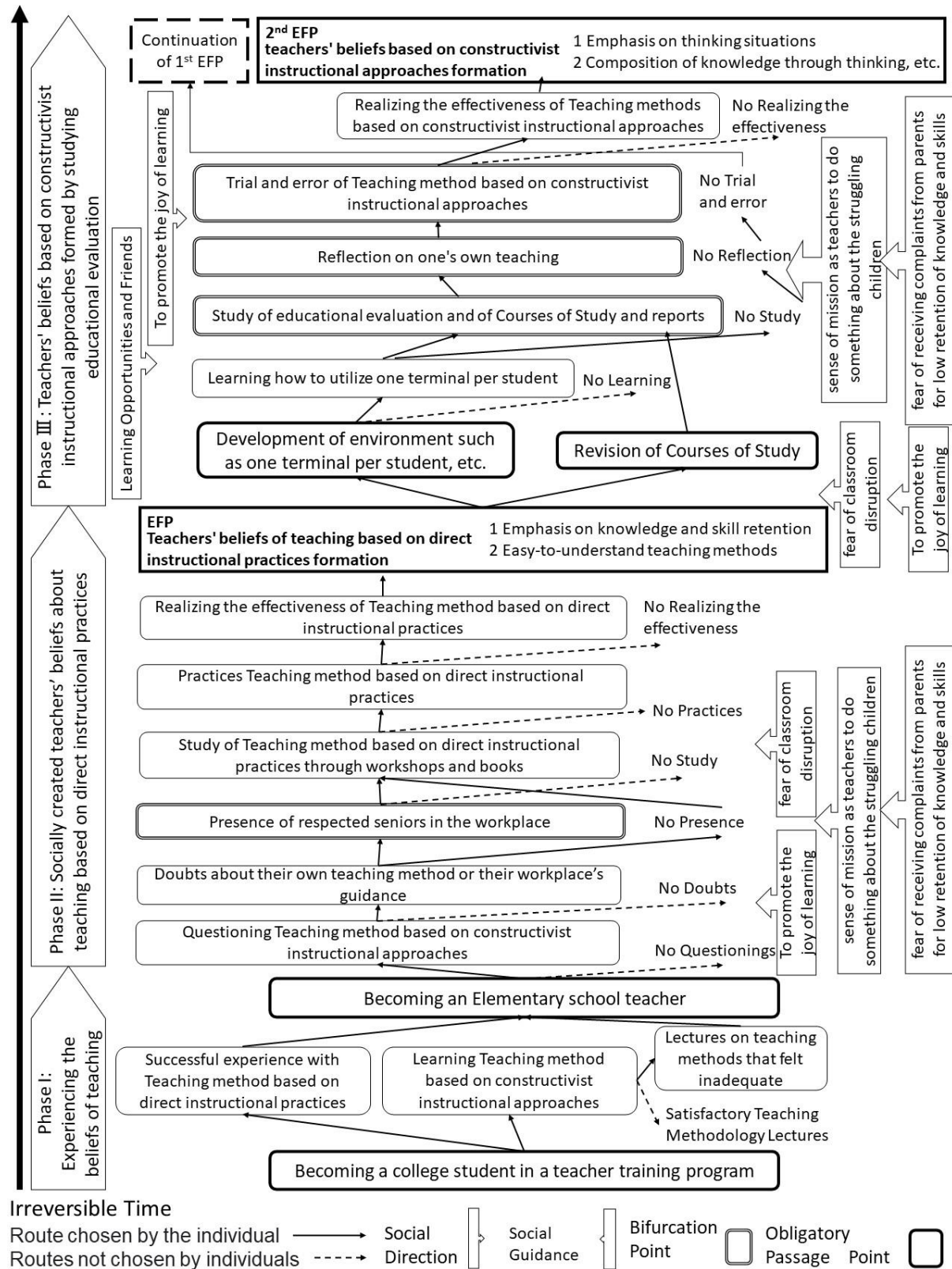
As described above, a process existed in which students experienced constructivist teaching methods, which may vary by subject. However, they became teachers with an insufficient understanding of the teaching methods themselves, including other teaching methods. The existence of successful situations where teachers adhere to beliefs rooted in direct instructional practices among them suggests that teachers’ beliefs in teaching based on direct instructional practices undergo fluctuations before the start of their teaching careers. Therefore, since we are still only at the level of having experienced both of these beliefs of teaching, we have designated this phase as the experience of teaching beliefs period.

Table 2
Categories and concepts generated from the analysis and their definitions

[category]	<concept>	Definition	applicable teachers
Successes and failures before becoming teachers	Successes of direct instructional practices	Success with teaching beliefs based on direct instructional practices in part-time work, etc.	A,B,C,D,E,F
	Lectures on teaching methods that felt inadequate	Lack of understanding of teaching beliefs based on constructivist instructional approaches	A,B,C,D,E,F
Doubts about their own or their workplace’s guidance	Questioning teaching methods based on constructivist approaches	Realizing that methods learned during college cannot help students with poor academic achievement	A,B,C,D,E,F
	Doubts about their own teaching method or their workplace’s guidance	Realizing that seniors’ guidance in the workplace cannot help children at lower academic grades	A,B,C,D,E,F
Learning and realizing the effects of direct instructional practices	Presence of respected seniors	Consulting with capable seniors for classroom management to obtain learning approaches	A,B,C,E
	Study of methods based on direct instructional practices through workshops and books	Studying the teaching method based on direct instructional practices through workshops and books	A,B,C,D,E,F
	Practicing teaching method based on direct instructional practices	Practicing teaching method based on direct instructional practices	A,B,C,D,E,F
	Realizing the effectiveness of teaching method based on direct instructional practices	Realizing the effectiveness of teaching method based on direct instructional practices through student’s performance	A,B,C,D,E,F

Responses to recent educational reforms	Learning to utilize one terminal per student	One terminal per student is introduced, and students learn how to use it through seminars and books	A,B,C,D,E,F
	Studying educational evaluation, courses of study, and reports	Learning about educational evaluation and the policies of the Ministry of Education, Culture, Sports, Science, and Technology in the wake of the revision of the courses of instruction	E,F
	Learning opportunities and friends	An invitation from a friend to learn about educational evaluation and an opportunity to relearn at the university	E,F
Realizing the effectiveness of teaching methods based on constructivist instructional approaches	Reflection on one's teaching	Reflecting on their own teaching as a result of learning about constructivist instructional approaches	E,F
	Trial-and-error process of teaching methods based on constructivist instructional approaches	Trial and error in the classroom with teachers' beliefs based on constructivist instructional approaches	E,F
	The effectiveness of teaching methods based on constructivist instructional approaches	Realizing the growth of children through teaching methods based on teachers' beliefs in constructivist instructional approaches	E,F
Factors promoting and inhibiting teachers' beliefs based on constructivist instructional approaches	Factors hindering teachers' beliefs based on constructivist instructional approaches	Realizing the difficulty of solving issues such as guaranteeing knowledge and skills and generating time for learning	A,B
	Factors promoting teachers' beliefs based on constructivist instructional approaches	Experience to gain learning opportunities and think about the education needed for students to live in the new era	E,F
Factors promoting teachers' beliefs of teaching based on direct instructional practices	Influences on teachers' beliefs about teaching based on direct instructional practices	Classroom disruption and wanting to be spared complaints from parents	A

Figure 1
Transformation of Public Elementary School Middle-career Teachers' Beliefs about Teaching



Phase II: Socially created teachers' beliefs about teaching based on direct instructional practices

Start of teaching career. Each of the six teachers began teaching careers in public elementary schools. Thus, becoming a teacher was classified as an OPP. Four began their teaching careers as lecturers a few years after graduating, and two began teaching immediately after graduating. Each of the teachers experienced transfers: Teachers A, C, D and E experienced three, Teacher B experienced two, and Teacher F experienced four.

Learn to solve own difficulties. Initially, many teachers faced the problem of < Questioning teaching method based on constructivist instructional approaches>. Teacher B said, "The problem-solving learning was easy because it was similar to how I learned, although what was done daily was different. However, the learning rate of the children was low." Further, Teacher B said, "I had doubts about problem-solving learning as a teacher." According to Teacher B, the goal of a teacher of enabling all students to improve was impossible.

All six of the teachers faced the problem where they had <Doubts about their own or their workplace's guidance>. As Teacher E stated, "Even though I was teaching, the children did not respond well... (omission)... there was a time when I wondered if there was something I could do about it." "After graduating from university, I went to a place where a girl told me that she did not understand my explanation about numbers, and that was a big trigger for me... (omission)... I was researching how to teach math, but after looking at it for a while, I wondered if it was the right thing to do." In this way, the children's reactions and those who were having difficulty learning caused doubt. To solve their difficulties, these teachers consulted with respected senior teachers in their workplaces and asked them to observe their classes. They said, "I found out that this is what I wanted to know, so... (omission)... this is the kind of class I wanted to do (Teacher A)" or "Then I was informed about a seminar in March, and I thought, yes, this is what I can do if I go here (Teacher B)." They talked about the <Presence of respected seniors in the workplace teaching> and were introduced to teaching beliefs from teachers who had adopted these teaching methods, and began to <Study teaching method based on direct instructional practices through workshops and books>. However, because they had doubts about their teaching and the teaching at their workplace, the other three teachers began to have doubts about their teaching and the teaching at their workplace, as they said, "I don't understand, so I try to learn... (omission)...I guess that is the starting point for many of them (Teacher E)". Even if there were no seniors at their workplace, they began to <Study teaching methods based on direct instructional practices through workshops and books>. The books read and discussed in the workshops focused on easy-to-understand teaching methods, such as learning Kanji characters.

Teachers' beliefs about teaching based on direct instructional practices were formed from realizing their effectiveness. All six participants implemented the teaching beliefs rooted in direct instructional practices; collectively, they recognized the effectiveness of these teaching methods. They actually practiced the <Practices teaching method based on direct instructional practices> as they stated, "The children's reactions changed when I did it the way I was taught in the seminars (Teacher F)." As a result, the teachers practiced teaching methods that they felt were effective, as in the case of Teacher B, who said, "I did not think I had changed, but the child had changed." All the teachers thought that teaching beliefs based on direct instructional practices were effective. The teachers found it easy to comprehend, especially as they witnessed the changes in the students. Coupled with their sense of duty as educators to assist children with low academic ability, they recognized the method's effectiveness.

In this way, the teachers formed beliefs based on direct instructional practices, such as emphasis on knowledge and skill retention and easy-to-understand teaching methods. Notably, teachers' doubts were probably generated by the children's reactions and seeing those who were relatively poor in academics. Given their initial motivation to impart a joy of learning and their sense of responsibility as educators to support struggling students, these methods centered on the retention of knowledge and skills, making them easily comprehensible. The books for learning were based on direct instructional practices. In addition, the courses of study during this period aimed to enhance basic fundamentals, which were emphasized at school sites as well (Mizuhara, 2017). Concurrently, Teacher B, in particular, spoke of a fear that classes would collapse and other lessons would no longer be viable and of receiving complaints from parents. Hirai (2011) noted that discussions on classroom disruption date back to before 2000. Learning from that fear was quite natural. In a sense, the teaching beliefs in this period were formed by social influences, the need for students to learn basic fundamentals, and the discourse on classroom disruption.

This process led to the development of teaching beliefs rooted in direct instructional practices, characterized by an emphasis on knowledge and skill retention, as well as the adoption of easily comprehensible teaching methods.

Phase III: Teachers' beliefs based on constructivist instructional approaches formed by studying educational evaluation

Revision of course of study and GIGA school concept. In 2017, the Ministry of Education, Culture, Sports, Science and Technology implemented the courses of study, which organized knowledge and skills; the ability to think, judge, and express; and the ability to learn as qualities and abilities to be cultivated. The revision of the courses of study was regarded as an OPP because it was a common experience for all teachers. However, teachers' perceptions of the revision differed. According to Teacher E, "I felt I had to think more carefully about what qualities and abilities to cultivate." Thus, some teachers accepted the need for the abilities mentioned in the guidelines and proceeded to study educational evaluation and courses of study and reports on their own, as well as participating in workshops. Two years later, in 2019, under the name of the GIGA school concept, one terminal per student and provisioning of high-speed Internet were launched in Japan. As per the purpose of this study, we have considered this as an OPP because all teachers experienced it. The one terminal per student was a significant change in the environment; with the coronavirus pandemic, many teachers were willing to learn to use it, including all six participants. "I want to have a class where students are meta-cognizant and can find issues... (omission) ... I learned many things as a part of that (Teacher F)," and "I became a GIGA promotion committee member and learned how to use one terminal per student." In this way, all teachers experienced <Learning how to use one terminal per student>. The MCTs accepted this change in the learning environment.

Educational evaluation and study of teaching guidelines and reports in conjunction with revising the curriculum guidelines and the GIGA school concept. Teachers E and F were learning about educational evaluation, including the revised courses of study, and the GIGA school concept in the context of Japan's educational reforms. Teachers E and F tried to learn about the background of these issues. Teacher F said, "We were doing performance tasks in the evaluation study group... (omitted)... we got a hint and tried to do it" and began to <Study educational evaluation and courses of study and reports>. As mentioned earlier, this was because the students were learning about educational evaluation, guidelines, and reports while learning to use one terminal per student. Thus, while <Learning how to use one terminal per student> was being conducted, <Learning about educational evaluation, guidelines, and reports> was simultaneously conducted.

Teachers A, B, C, and D did not conduct <Study of educational evaluation and of courses of study and reports>. Thereafter, their beliefs of teaching did not change.

The teachers' beliefs were based on constructivist instructional approaches formed based on a trial-and-error process as a result of reflection. Teachers E and F began to reflect on their teaching through <Study of educational evaluation and courses of study and reports>. As Teacher F said, "In the end, I felt that it was no longer enough to teach by rote memorization or by injecting knowledge." "I could see things from a broader perspective... (omission)...Until then, I had just been vaguely doing things. (Teacher F)". Moreover, through learning about educational evaluation, their teaching beliefs began to change, and they were able to <Reflect on one's teaching>. Then, Teacher F stated, "It was pretty good knowledge, and it felt good... (omission)... to create a place for learning and leave it to the children to some extent." As a result, they realized the effectiveness of the teaching method, "When I had the students do performance tasks, their understanding of knowledge improved, and I felt the benefits of performance assessment in social studies" (Teacher F). Through this method, teachers formed beliefs based on constructivist instructional approaches, such as emphasizing and constructing knowledge through thinking. However, some teachers did not reflect on their own teaching. For example, "In math, I am afraid that by doing something freely, I cannot guarantee learning" (Teacher A). In some subjects, Teacher A learned about constructivist teaching using the one terminal per student process. Nevertheless, in some subjects, even teachers who engaged in reflection harbored doubts regarding their ability to ensure effective learning through entirely constructivist lessons and did not attempt the trial-and-error process. In such subjects, their teaching beliefs remained unchanged.

Conclusion

TEM analysis revealed two formative periods of beliefs about teaching. In the first period, the teachers' beliefs based on direct instructional practices were formed based on the realizations gained from learning and practicing them while

teaching. This was thought to be influenced by social orientation. In the second period, when they learned about educational evaluation and instructional procedures, due to the existence of peers and opportunities to learn, along with the adoption of one terminal per student, teachers began to reflect on their own teaching and formed beliefs based on constructivist instructional approaches through trial and error. With regard to learning how to use one terminal per student, if educational evaluation and learning of the instructional guidelines were not accompanied by learning how to use the terminal in the traditional direct instructional practices, the initial teaching beliefs were perpetuated. Furthermore, even after educational evaluation and learning based on direct instructional practices, the fear that the class would fail and the desire to avoid complaints from parents discouraged trial and error in teaching methods; if trial and error did not occur, teachers' beliefs based on direct instructional practices continued to prevail. Our findings indicate that the mere presence of one terminal per student and high-speed Internet access does not inherently lead to a constructivist shift in teachers' beliefs. Instead, they must engage in learning about educational evaluation and instructional procedures and engage in their own trial-and-error processes.

To facilitate the transformation of teachers' beliefs, creating opportunities for them to learn about educational evaluation and instructional procedures within a collegial environment is crucial. Additionally, addressing concerns related to class disruptions and parental complaints that may impede the trial-and-error process is essential. The results also highlight the significance of cultivating the right mindset and addressing other pertinent factors in facilitating these practices.

This study has some limitations. First, using the snowball sampling method to include MCTs may have introduced bias in the study population. Therefore, our findings are not universally applicable to all MCTs, and further unexplored pathways may exist, which should be analyzed in future studies. Second, certain methods within the TEA can be depicted in a three-tiered structure; however, we lacked sufficient data for this purpose. Future analysis of teachers' beliefs based on constructivist instructional approaches, once they are formed, is necessary to enrich the data and shed light on the psychological dynamics of MCTs. This will enable us to present the TEM diagrams in a three-tiered structure. To this end, based on the results of this study, developing and implementing classroom improvement programs and other initiatives tailored for MCTs is imperative.

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References

- Bertalanffy, von L. (1968). *General system theory: Foundations, development, applications*. New York: George Braziller.
- Calderhead, J. (1996). Teachers: Beliefs and knowledge. In D. C. Berliner & R. C. Calfee (Eds.). *Handbook of educational psychology* (pp. 709–725). New York: Macmillan Library, Prentice Hall.
- Hirayama, Y, & Konno, T. (2023, August 16–18). A study on the transformation of public elementary school middle-career teachers' beliefs about teaching in the period when the ICT environment was beginning to improve. ICoME 2023: International Conference for Media in Education, Wenzhou University, China.
- Horita, T. (2021). Trends and challenges of digital transformation in primary and secondary education in Japan. *Japan Journal of Educational Technology*, 45(3), 261–271.
- Valsiner, J. (2007). *Culture in minds and societies: Foundations of cultural psychology*. New Delhi: SAGE Publications Pvt, Ltd.
- Kinoshita, Y. (2003). *Modified grounded theory approach*. Tokyo: Kouboundou Publishers Inc.
- Korthagen, F., & Vasalos, A. (2005). *Levels in reflection: Core reflection as a means to enhance professional growth*,

- Teachers and Teaching, 11(1), 47–71. doi:10.1080/1354060042000337093
- Ninomiya, T., & Honda, T. (2004). The learning environment in the information age: investigation and training to the teachers. *Research Journal of Educational Methods*, 29, 97–106.
- Ministry of Education, Culture, Sports, Science and Technology. (2017, April 28). National Curriculum Standards (2017-2018 Revision). Retrieved September 21, 2023, from https://www.mext.go.jp/content/20201008-mxt_kyoiku02-000005241_1.pdf
- Organisation of Economic Co-operation and Development. (2007). *Education and training policy improving school leadership volume 1: Policy and practice*. Paris: OECD Publishing.
- Organisation of Economic Co-operation and Development. (2009). *Creating effective teaching and learning environments: First results from TALIS*. Paris: OECD Publishing.
- Pajares, M. F. (1992). Teachers' Beliefs and Educational Research: Cleaning Up a Messy Construct. *Review of Educational Research*, 62(3), 307–332. doi:10.3102/00346543062003307
- Takahashi, J., Kousaka, T., Maeda, Y., Moriya, K., & Horita, T. (2014). A case study on analysis of ICT use. Teaching process and type of teaching in the introduction period of 1 to 1 tablet PC environment in a Korean elementary school. *Japan Journal of Educational Technology*, 38(3), 317–327.
- Tokito, J., & Terashima, T. (2018). The common educational experiences that school middle teachers has passed to improve themselves to conduct school innovation. *Japan Journal of Educational Technology*, 42(1), 15–29, doi:10.15077/jjet.41081
- Yamada, T. (2014). *Kyousi no seityou ni okeru biri-hu no hennka* (Doctoral dissertation). Japan: Hokkaido University.
- Yasuda, Y., Nameda, A., Fukuda, M., & Sato, T. (2015). *TEA Riron henn – hukusennkeirotouisei. apuro-ti no kiso wo manabu*. Japan: Shinnyousya.
- Yuguchi, M., Sugimoto, K., Fukuda, M., & Moriwaki, Y. (2019). Taiiku gakusyuu ni okeru kyousi no kakawari kata no hennyou: Kouseisyugitekigakusyuukann no tatiba kara. *Naruto University of Education Forum for Classroom Research*, 18, 121–127.