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Understanding Teacher Agency of Novice Teachers in the Context of Project-Based Learning (Pjbl)

Haili Liang[1], Tianwu Guo[2], Chunli Zhang[3]

Abstract

The study explores the novice mathematics teachers' agency in the context of Project-based Learning (PjBL) in China, which is central for ensuring the sustainability and professional development of novice teachers. Previous research has discussed the experiences of newer teachers, much less attention was paid to novice mathematics teachers' agency. Research on how novice teachers support the varying needs of students from the inception of their careers is relatively recent. In this paper, novice teachers expressed concerns about the course requirements of PjBL, found lesson planning time consuming, and had a limited number of professional development opportunities. Nonetheless, novice teachers typically did not proactively seek assistance, and this exacerbated their feelings of pedagogical isolation. Nevertheless, the novice teachers in this study also indicated a willingness to take risks and experiment with PjBL in different ways. These different ways signaled their own beliefs about teaching, as well as accommodating the needs of diverse students, which is often what experienced teachers specialize in. Our study highlights the need for teacher education programs to ensure ongoing support and mentoring for new teachers, and to assist new teachers in articulating their needs and seeking support of other experienced teachers or experts.

Keywords: *Project-Based Learning, Novice Teachers, China, Teacher Agency.*

Introduction

Teacher agency, according to Sang (2020), refers to the ability of teachers to direct their own professional growth and contribute to the quality of education in a purposeful and constructive manner. Teacher agency is a key element in sustaining teacher professional development (Huang, 2021). However, as Ashton (2021) noted, teacher agency is a relatively unexplored issue in the study of teacher professional development, especially for novice teachers. It is essential to focus on novice teachers since their early career experiences shape their future actions and influence their self-efficacy and career longevity (Zhukova, 2018; Fantilli & McDougall, 2009). Therefore, understanding the agency of novice teachers and how they deal with the challenges of new teaching practices, such as PjBL, is essential for their professional development and broadens our comprehension of teacher agency (Ahmad & Shah, 2022).

Around the world, novice teachers are normally expected to handle the same variety of classroom teaching responsibilities as their more experienced colleagues (Fantilli & McDougall, 2009). Similarly, in China, novice teachers frequently report an increasing workload (Liu & Onwuegbuzie, 2012). According to Liu and Onwuegbuzie (2012), significant factor contributing to this is the growing complexity of teaching. For instance, Mathematical Curriculum standards increasingly emphasize the development of students' 21st century skills, such as critical thinking, problem-solving skills, and creativity (Ministry of Education of the People's Republic of China, 2020, 2022). Consequently, novice teachers must address a diverse array of needs and varying ability levels within a single classroom.

Project-Based Learning (PjBL) is an instructional approach that involves students in investigating real-world problems and obstacles (Tally, 2015). PjBL promotes students' active learning, fostering deep grasp of subject matter and developing important 21st-century skills like problem-solving and creativity. However, numerous research has reported challenges in implementing PjBL for teachers (Handrianto & Rahman,

[1] Faculty of Education, Beijing Normal University, No. 19, XinJieKouWai St., Beijing 100875, China, Email: hely_l@163.com
[2] School of Economics and Management, East China Normal University, 3663 North Zhongshan Road, Putuo District, Shanghai 200050, China., Email: 51264419171@stu.ecnu.edu.cn
[3] Faculty of Education, Beijing Normal University, No. 19, XinJieKouWai St., Beijing 100875, China, Email: 97070@bnu.edu.cn, (Corresponding Author)

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2018). For instance, PjBL requires teachers to conduct extensive planning, designing appropriate tasks, and continuous instructional adjustments. In addition, the balance between guiding students to learn and supporting students' autonomy is crucial, but many teachers lack the professional development and support they need, which can result in teachers feeling stressed or isolated. (Zhenyu, 2012).

Many studies have discussed the difficulties teachers face when implementing project-based learning (PjBL), yet the literature on teacher agency in this context is scarce. Understanding agency of teachers is important to empower teachers to make choices that are proactive, responsive to new policies, and practices (Cong-Lem, 2021). This study aims to address this gap by examining novice teachers' agency, investigating the affordance and constraints on their agency in PjBL, and provide insights and recommendations for enhancing novice teachers' agency and PjBL.

Literature Review

Project-Based Learning

Project-based learning (PjBL), according to Kokotsaki (2016), is a form of student-centered instruction designed to promote active learning, critical thinking, and collaborative skills by engaging students in exploring real-world problems and tackle challenges. It is considered as a specific type of inquiry-based learning in which authentic questions provide a learning context that engage students in meaningful learning experiences (Al-Balushi & Al-Aamri, 2014). However, teachers face significant challenges during the implementation of PjBL. One of the main challenges is the extensive pre-lesson planning required for PjBL (Aldabbus, 2018). According to Aldabbus (2018), teachers must design projects that are not only engaging and educational, but also feasible within the constraints of the classroom environment. This involves the creation of the driving questions, the constant adjustment of the teaching and learning process, and balancing the need to support student autonomy while guiding them through the learning task. This additional complexity can be overwhelming for new teachers who are still primed with classroom management and basic teaching skills (Tally, 2015). Additionally, the shift from traditional teaching methods to PjBL requires teachers to fundamentally shift their role from knowledge providers to facilitators (Harris, 2014). This shift requires teachers to perceive students' confusion and provide them with support and guidance in a timely manner during their self-directed learning process, which can be particularly challenging for novice teachers who may still be at the stage of developing their self-confidence and expertise in the classroom (Blair, 2008).

In addition, Designing "authentic tasks" in a PjBL setting is a collaborative effort that needs merging knowledge from diverse disciplines and employing different approaches (Liang et al., 2024). In other words, teachers need to collaborate with each other to design and implement PjBL. However, novice teachers are often required to prepare and conduct lessons independently and may not know how to turn to more support (Le Maistre & Paré, 2010). Therefore, just as Zepeda and Mayers (2001) noted, novice teachers may experience a variety of emotions during the implementation of PjBL, including loneliness, uncertainty, confusion, and excitement. More importantly, teachers implementing PjBL need to be better able to cope with the inevitable day-to-day uncertainties during the classroom teaching and be more willing to take risks in the instruction (Aldabbus, 2018). In this regard, research has shown that experienced teachers do better than new teachers as a result of their growing teaching experience (Caspersen & Raaen, 2014).

In China, although PjBL is strongly advocated in the Mathematics Curriculum Standards (Ministry of Education of the People's Republic of China, 2020, 2022), its practical implementation in everyday classrooms remains limited. This limitation is mainly due to the numerous challenges faced by the front-line teachers, including but not limited to the lack of lesson resources (Aldabbus, 2018), insufficient training (Liu, 2019), and the rigid structure of traditional assessments (Berry, 2011). Hence, only a small percentage of teachers are willing to integrate PjBL into their daily teaching practice. This situation indicated the huge gap between policy intentions and the realities of the educational environment. Therefore, to ensure the sustainable development of PjBL in China, it is crucial to understand teachers' agency during their design and implementation process. In other words, identifying the factors that impede or promote teacher agency

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is essential to better support teachers to increase their capacity to implement PjBL.

Teacher Agency

In the last decade, the concept of teacher agency and its implications for educational reform have received greater attention (Orland-Barak, 2017; Toom et al., 2015). Teacher agency refers to the ability of teachers to use their judgment and discretion to adapt instruction and curriculum to meet the diverse and evolving needs of their students (Priestley et al., 2015). It has also been used to characterize "teachers' intentional and constructive guidance of their own professional growth and their colleagues' growth" (Calvert, 2016, p. 4). More importantly, "teacher agency" has been used to reflect the true potential of teachers to assist in the promotion and development of educational policy (Atkin, 1994).

Prior research has indicated that, while agency is highly individualized and reflected in the actions taken and implemented by teachers in response to pedagogical challenges, these acts are also the result of an interaction between the individual's efforts and specific social contexts and conditions (Priestley et al., 2015). Based on this, there are three main areas of the previous research. First, much of the research focused on the manifestations and characteristics of teacher agency in the context of curricular and educational reforms. These studies revealed the complexity of teacher agency in a variety of situations and contexts (e.g. Pyhältö et al., 2014). According to Vähäsantanen (2013), teachers' backgrounds and the contexts in which they interact with students have an impact on how their agency is expressed. To put it another way, the agency of teachers varies greatly depending on the context. Additionally, scholars were interested in both the internal implicit activities, such as self-reflection and the external explicit behaviors of teachers' agency when examining the manifestations of teachers' agency (Bandura, 2006). Second, some studies focused on the affecting factors of teachers' agency, which aim to create a supporting environment conducive to the practice of teachers' agency (e.g., Connolly et al., 2018; Molina, 2016). For instance, Molina (2016) examined important aspects, including external and internal ecological aspects, that influenced the teachers' agency. However, this study was discussed for all teachers, without focusing on novice teachers. Third, some studies also concentrated on the practical importance of teachers' agency in responding to educational reform and promoting teacher career development (Priestley et al., 2012; Patrick et al., 2016). For example, Xerri & Vella Briffa (2018) emphasized the role of teachers' agency in education reform and concluded that constructing a balanced ecological environment between teachers' agency and the external environment could better ensure the beneficial backwash effect of teachers' teaching.

In conclusion, as Eteläpelto et al. (2015, p. 662) point out, there is a paucity of research on the agency of novice teachers beyond the studies mentioned above, and we would like to gain a more thorough understanding of how these teachers "perceive their professional agency" during the formative years of teaching. The goal of this work is to close this gap. In an effort to analyze teacher agency in terms of the constraints and supports they face at work, prior research has identified strong relationships with other educators and collaboration as essential tools for new teachers to use when establishing and utilizing their professional agency in the face of challenges in the classroom. However, little is known about novice teachers' agency in PjBL contexts and the affordances and constraints of teacher agency in implementing PjBL.

To address the research gap, the current study aimed to investigate the teacher agency of mathematics novice teachers when implementing STEM PjBL, including their manifestations and influences. Specifically, the research questions in the current study are as follows:

RQ1: How do novice teachers perceive and enact their professional agency in the context of PjBL?

RQ2: What are the affordances and constraints experienced by teachers in enacting their agency in project-based learning environments?

Methodology

Settings and Participants

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The current study was one aspect of a year-long collaboration between a Beijing university and Guangzhou. The project's goal was to forge a collaboration between the local district and the university to improve PjBL teaching and learning for students in grades 7-9. The current research was conducted at the beginning of this project. To investigate teachers' agency when implementing PjBL, after receiving ethical approval from the research organization, mathematics teachers with fewer than five years of teaching experience who are currently implementing PjBL in middle schools were invited to engage in semi-structured interviews. Table 1 describes the eight people who volunteered to be interviewed for this study. Every participant used a pseudonym of T1 to T8. Due to the limited sample size, the findings of this study are not generalizable. However, these statistics still provide insight into novice teachers' experiences teaching PjBL, contributing to a better understanding of teacher agency.

Table 1. Basic Information of the Eight Participants

Name	Age	Teaching experiences (years)	Teaching Grades
T01	27	2	8
T02	25	1	8
T03	26	2	7
T04	28	4	7
T05	24	1	8
T06	28	4	8
T07	25	2	8
T08	26	3	9

Data collection and method

In the current study, semi-structured interviews were conducted to investigate the participants' professional agency in teaching project-based learning, as well as their abilities and limits in carrying out their agency. The questions asked in interviews were open-ended, encouraging teachers to express their experiences and ideas in their own words. Interviews were performed using an online platform (Tencent Conference) and lasted 30-50 minutes, with an average of 40. The participants were contacted to schedule the interviews, which were often done after school or during lunch breaks.

Data Analysis

At the end of the semi-structured interviews, all data were transcribed by one of the doctoral students. The two doctoral students then undertook an inductive thematic analysis according to the process outlined by Braun and Clarke (2006), i.e. familiarizing themselves with the data, coding the data, searching for themes, and then reviewing the themes. In terms of practice, this meant listening to the original interviews multiple times and working closely with the interview transcripts to highlight and code data related to teacher agency in the context of PjBL and the affordances and constraints that teachers had expressed. Obviously, this process was iterative and time-consuming, as coding took place in a process of continuous development, review and revision (Clandinin & Connelly, 2000). Examples of some of the codes identified include project design freedom, student feedback, collegial support, resource availability, time management, pedagogical approaches, teaching beliefs, and parents' expectations. Four themes emerged from a lengthy review of the concepts and ideas, which represent a deeper and more nuanced comprehension of the data, taking into account both the affordances and constraints of a particular perspective or theme, as well as divergences and convergences between different participants. The inter-coder reliability coefficient of Cohen's Kappa was 0.83 (>0.7), demonstrating good reliability

The first theme, 'Project Design and Implementation Freedom,' covers aspects related to the autonomy teachers have in designing and implementing projects and how this impacts their teaching effectiveness. The second theme, "Impact of Student Engagement," refers to how student engagement and feedback influence teachers' instructional decisions and practices in project-based learning. The third theme, "Support from Colleagues and Experts," includes collaborative efforts among teachers, as well as support

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from experienced faculty or researchers at the university, all of which enhance teacher agency. The fourth and final theme, Parental Stress and High-Stakes Examinations, explored how parental stress and high stakes exams impacted teachers' ability to successfully implement project-based learning, and the stress these factors caused. Throughout the analysis, the primary focus was on presenting participant data as accurately and honestly as possible (Elo et al., 2014).

Findings and Discussions

Project Design and Implementation Freedom

For T1, T2, and T3, a significant challenge in preparing and executing project-based learning was their ability to integrate a cohesive interdisciplinary perspective. T1 mentioned the difficulty of the lack of structured or prescriptive guidelines for PjBL implementation:

"There's a lot of uncertainty about what should be included in the projects. There aren't many guidelines on integrating different disciplines, real-world problems, and driving questions… having the freedom to design anything can sometimes feel overwhelming."[T1].

This gap between the policy level and the practice level meant that teachers had to invest a lot of time in designing math content that was appropriate for their students. T2 found this to be the most challenging part of their job, especially when crafting authentic driving questions:

"The hardest part for me right now is creating driving questions that are both authentic and engaging. Without a structured framework, it's really difficult to ensure I'm designing a "real" authentic task, covering the necessary subject content, especially when combining different subjects."[T2]

In addition to the lack of prescriptive course descriptions, teachers all reported limited resources for designing project-based learning. This was a big constraint, as limited resources meant that teachers needed to write their own course designs. For instance:

"There's always a lot of last-minute scrambling… And if you have had experience designing and developing PjBL courses, you may have accumulated some resources. Even if you don't have all the resources, you might be able to produce them more quickly ..... In other words, if you've done something like task design in PjBL before, you can build on it." [T4]

"*However, if you're new to this, the main challenge is the lack of teaching materials. As a new teacher, you also haven't taught this type of program before ..... You also have to figure out for how to integrate different subjects with mathematics in PjBL, which takes a lot of time.*" [T5]

All teachers agreed that creating resources and preparing lessons for project-based learning was very time-consuming and was often done outside of class time.

"*Working at school was intense, and with project-based learning, I had to develop a project plan at home using extra time, which was personal time. It was really hard work.*" [T6]

"*Even searching the internet, there isn't much available, certainly not enough to drastically reduce my workload. And even when I did find something, I had to adjust it ..... Planning for a project-based course can take more time than planning for a traditional regular course, which means using personal time to complete the plan. I often work evenings and weekends.*" [T7]

In addition, T5 mentioned that they were frustrated when the time spent developing teaching resources could not transfer into efficient teaching and learning:

"*It can be very discouraging if I spend the whole weekend creating resources that don't work well in the classroom, even though I spent all that time creating it.*"[T5]

However, some of these teachers could reflect on their prior teaching experiences and consider the

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curricular freedom and flexibility they possessed as an affordance that enabled them to design lessons to meet the needs of their students in their PjBL instructional practices.

For instance, T4, who has been teaching PjBL for three years, noted that while designing project-based learning activities was challenging, often requiring the integration of multiple disciplines, persistent efforts in creating such curricula led to the development of teachers' "creative" thinking. She stated:

"*Although designing PBL activities isn't easy and requires integrating knowledge from different disciplines, continuously working on similar courses helps us, like the students, to develop creative thinking. Over time, I've accumulated experience in designing authentic driving questions and creative in designing tasks based on real contexts familiar to students.*"[T4]

Similarly, T5 reflected on how her experience with PBL allowed her to gradually develop strategies for effective assessment:

"*Initially, students' assessment in PjBL was daunting due to the content's uncertainty. However, I realized that involving students in designing their evaluation methods significantly enhances their autonomy. This approach not only eases my workload but also empowers students.*"[T5]

Other teachers also found the flexibility in PjBL design beneficial for fostering student interest and engagement. T6 mentioned:

"*Designing PBL tasks allows me to start from students' interests and integrate relevant academic content. For example, I've been able to embed mathematical concepts into themes that naturally interest students, which greatly boosts their enthusiasm.*"[T6]

These examples illustrate how teachers' decision-making is influenced by their contexts and environments, in line with socio-cultural perspectives on teacher agency (Priestley et al., 2013; Tao and Gao, 2017). On the one hand, the lack of structured guidelines and resources creates significant barriers that prevent teachers from fully exercising the autonomy and freedom that less prescriptive approaches can provide. This may be more of a common challenge for less experienced teachers than for more experienced teachers (Goodwin, 2012) . According to White (2018, p. 197), "there are constraints and affordances that make certain actions possible, others probable, and still others impossible" in any given setting. For the novice teachers in the current study, they tended to view a great deal of planning as the only viable option and often paid a personal price for it. In this case, this necessity-driven agency was a predictable outcome for novice teachers (Hamid & Nguyen, 2016). These findings suggest that less prescriptive curricula and materials should not be assumed to be advantageous for beginning teachers, especially given the complexity of project-based learning.

However, the interview data described above also emphasized the dynamic and multifaceted nature of teacher agency (Hiver & Whitehead, 2018). Based on their previous experiences, some teachers found that the freedom and flexibility of the PjBL program could be beneficial, which enable them to make decisions regarding their teaching practices that satisfied the needs of their students. Some teachers even considered the design and implementation of PjBL as a way to develop their own competencies (e.g., teachers' creativity). In this way, this challenging experiences seemed to enhance their ability to take ownership of the teaching process. While it is well established that early teaching experiences are critical in shaping the behaviors of future teachers (Avalos, 2016), this research provides deeper insights into how novice mathematics teachers' agency develops and is influenced by prior cumulative teaching experiences or teaching beliefs in the context of PjBL.

Impact of Student Engagement

Coladarci (1992) argues that a stronger sense of responsibility and commitment to students influences the teaching practices of some teachers, also in the case of project-based learning (PjBL). T1 expressed pride in seeing students' group collaboration and peer communication skills improve, challenging the stereotype that Chinese students lack these abilities by fear of making mistakes (Roskams, 1999). T1 noted:

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"I feel proud when I see my students working together and communicating effectively in groups. It defies the common misconception that Chinese students aren't good at collaboration."[T1]

For T2, student initiative in extending their learning beyond the classroom based on driving questions set in PBL provided significant motivation. To design a better driving question, T2 would often seek collaboration with colleagues from other disciplines to enhance the interdisciplinary nature of PjBL projects. For instance, when creating a math-themed project about elevators, T2 consulted with an experienced physics teacher:

"*When students take the initiative to explore topics further on their own, it motivates me. To create better interdisciplinary PBL projects, I actively seek help from other subject teachers.*"[T2]

Unlike T2, who would seek for help of other teachers, other teachers would adapt their design of PjBL based on their views of teaching. For instance, T4 valued the perspective of teaching should based on students' interest, hence when he observed a keen interest in astronomy among his students, T4 integrated astronomical concepts with math, designing engaging driving questions:

"*My students' interest in astronomy led me to combine it with math in our PBL tasks. This approach has significantly increased their engagement.*"[T4]

Similarly, T6 also emphasized the importance of being adaptive and flexible in planning and teaching based on the need of students: "*Each class is unique, so what worked this year might need to be adjusted next year due to differences among just a few students.*" T6 places a strong emphasis on student-centered pedagogy and frequently solicits feedback from her students to improve her teaching methods. She noted that:

"*I discovered that my students learn more effectively through hands-on activities and verbal communication rather than writing in dealing with driving questions. They are more oral learners, so it's essential to engage them with interactive tasks and discussions.*" (T6)

However, not all feedback was positive. T5 faced challenges when students showed reluctance in participating and group work was superficial, impacting T5's sense of agency and motivation:

"*It's disheartening when students don't engage in discussions or put effort into group work. It affects my motivation and makes me question my teaching strategies.*"[T5]

The data presented highlight how teacher agency and actions in project-based learning are shaped by their context (Priestley et al., 2013; Tao & Gao, 2017). For these teachers, the positive responses from students enhanced their sense of agency, encouraging them to adapt and innovate in their teaching practices. Conversely, lack of student engagement posed significant challenges, sometimes dampening their motivation. For instance, T4 found that the specific characteristics of her students (keen on astronomy) supported her efforts to enhance student collaboration and communication skills, an opportunity that might not exist in other settings. Other teachers (e.g., T6) were influenced by a mix of their teaching philosophies and the need to adapt to student feedback, which shaped their instructional choices. T2, for example, sought interdisciplinary collaboration, which enriched her PjBL projects. These examples demonstrate that teachers exercised their agency in unique and individualized ways to tackle the challenges of project-based learning. This is consistent with Tao and Gao's (2017) findings that experienced teachers demonstrate agency in curriculum change in diverse and individualized ways. The present study showed that novice teachers also demonstrated agency in an individualized manner. In addition, the study emphasized the nonlinear development of novice teachers. Although novice teachers were still grasping the requirements of interdisciplinary programs and viewed the time required to plan and create resources as a constraint, they also demonstrated the kind of agency in classroom decision-making typically seen in more experienced educators.

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Support from Colleagues and Experts

Collaborating with colleagues or with external experts was critical for the professional growth of these novice project-based learning (PjBL) teachers (Tempera & Tinoca, 2024). T1 valued her group leader's (beike zuzhuang) support: "*My beike zuzhang is amazing and backs me on anything I want to do*." However, T1 felt unsupported specifically for PBL: "*I haven't had much guidance, and I've been figuring things out on my own for the past three years*."

T2 shared a similar experience. While her beike zuzhang offered "great ideas," the beike zuzhang's lack of PBL experience left T2 feeling "isolated from usual sources of ideas found in training and from expert teachers."

T3 and T4 felt isolated as the only PBL practitioners at their schools. T3 said, "*Being the only PBL teacher here, there's little feedback… no one to share ideas with*." T4 added, "*It's tough without colleagues who understand PBL… having someone to discuss challenges with would help*."

This sense of isolation is common among new teachers and is linked to high attrition rates (Sleppin, 2009; Buchanan et al., 2013). While literature often mentions new teachers' uncertainty about seeking help (van der Wal et al., 2019), these teachers felt there was no one to approach due to their unique PjBL roles in their schools.

Even some of these teachers had received PjBL training, they still think that helpless: "*Professional development programs are often too general and do not address the specific challenges we face in PBL*," said T5. "*Most training focuses on the theoretical knowledge of PjBL and lack practical experience on how to design and implement good PjBL*." added T6.

T8 added that the sense of isolation sometimes led to a lack of persistence in implementing PBL: "*Some teachers start with enthusiasm but eventually abandon PjBL due to the lack of support and clear guidance*." This feeling of loneliness was exacerbated by the novelty of PBL in China (Zhenyu, 2012), making it hard to find experienced collaborators or mentors.

Hence, most of the teachers expressed a need for specific and practical support. T1 and T3 wanted "tried and true strategies," T5 wished to "see how others do it," and T7 needed resources to identify "suitable authentic tasks for different grade levels."

Notably, these teachers tended to rely on their own constant trial and error: for example, T3 said, "It was fundamentally trial and error" and "I hadn't found the best way to do PjBL yet".T6 noted, "I changed things as I went along ..... In year three I changed everything from year one and year two because over time I got to know PjBL better and I knew I could do it better".T8 added that the process of trial and error was "making mistakes, reflecting on them, thinking 'how can I do it differently next time', and then practicing.

Trial and error is a common strategy for new teachers, involving acceptance of imperfect solutions and reflection, which is vital for long-term teaching survival (Castro et al., 2010). These data underscore the complexity of novice teacher agency. As seen in the theme 'Impact of Student Engagement,' novice teachers exhibit agency in unique ways. According to Caspersen & Raaen (2014), the willingness to take risks and try different methods that align with their own teaching beliefs and the needs of their students is often seen in more experienced teachers. Castro et al. (2010) noted that while these attempts show teachers' problem-solving skills, "trial and error" often involves solving problems alone, which can further isolate teachers. Although these teachers wanted more support and professional development, it was only actively sought by T2 teachers. Ongoing support is not always realistic in busy schools, and colleagues may not know what new teachers need. Therefore, it is important for new teachers to seek out mentors, secure resources, and form alliances (Callahan, 2016).

Unlike other teachers who described their "Trial and error" of different approaches, T5 focused more on her uncertainty without external support. She repeated several times that uncertainty impacted her confidence and self-efficacy.

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"*I don't think I knew what I was doing in my first year, so the overall insecurity and anxiety was very strong. I think it lowers teachers' self-confidence ..... Maybe more experienced teachers might have more creative ideas ..... But this is my first time with PjBL, and I can't find out how to do it better.*"[T5]

In her opinion, her teaching was not successful, her students were less engaged, and she did not seem to know how to improve her teaching in this situation. However, when talking about what advice she would give to a new teacher in her situation, she said,

"*I would like to encourage teachers to make connections with other PjBL educators or experts in the field ..... I think new teachers need to be brave enough to talk to people inside and outside the school that can offer specific design and instructional guidance.*"[T5]

As a result, despite the fact that T5 could clearly define help-seeking tactics which she believed to be beneficial to other beginner instructors (Castro et al., 2010), she could not follow her own advise or reflect on it in order to demonstrate greater agency in her teaching setting. Analyzing the gaps between views and actions of novice teachers is a promising area in the future, as it could provide additional insights into the teacher agency and the constraints that novice teachers encounter while exercising their agency in implementing project-based learning.

Parental Pressure and High-Stake Examinations

The implementation of Project-Based Learning (PjBL) in Chinese classrooms has highlighted the significant impact of cultural and cognitive factors on teachers' practices (Zhenyu, 2012). In a system heavily influenced by exam-oriented education, teachers in China are challenged by the need to balance innovative teaching methods with traditional expectations (Liu, 2023). This theme provides insight into how teachers' cultural perceptions affect their implementation of PjBL, especially under the pressure of parental expectations.

Despite recognizing that PjBL helps students develop critical thinking and collaborative skills, T8, a ninth-grade teacher, felt the burden of parental expectations, especially from parents of ninth-grade students who were preparing for high school entrance exams:

"*Parents of my 9th graders are concerned. Entrance exams focus on closed-ended questions, and they are concerned that the skills developed through PjBL will not help their children succeed on these exams."* [T8]

T2 echoed similar sentiments, emphasizing having resistance from parents in his interview. He said,

"*Some parents don't understand the reason of implementing PjBL. They merely think that it disrupts the progress of regular curriculum and that it would be better to spend their time drilling high school exam questions.*"[T2]

A number of teachers mentioned the conflicting pressures of education reform and traditional expectations. For example, T6 noted that "*education reforms encourage us to innovate, but traditional examination systems and parental expectations hold us back. It is obvious that this is a process that requires constant balancing*".

Despite facing these challenges, some teachers, such as T3, choose to adhere to their beliefs in student-centered education:

"*I strongly believe in the long-term benefits of PjBL. While traditional tests focus on rote memorization, PjBL involve students in inquiry-based learning, which could foster their problem-solving skills, and are critical to students' future success.*"[T3]

Despite intense pressure from parents, T8 reflected on the cultural perspective by mentioning how deeply entrenched the exam culture is in China." *With such an entrenched test-oriented mindset, turning to PjBL felt like rowing a boat against the current. However, I see the value of PjBL and try to find the balance*," he adds.

Similarly, other teachers utilized different approaches to balance the PjBL and social pressure. For instance,

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T4 mentioned that incorporating test-related content into the PjBL curriculum is one of the strategies for closing the gap. He expressed: "*I try to incorporate key exam topics into our PjBL curriculum. This allows students to develop 21st century skills while preparing for the exams.*" And T7 took a proactive approach to address parents' concerns. "*I meet with parents regularly to explain the benefits of PjBL and how it complements exam preparation. In this way, transparency helps in gaining their support*," he says.

However, not all teachers are steadfast. T5, For example, is skeptical about the sustainability of PjBL under such pressure. She admitted in the interview that, "*I am now wondering if it is worth continuing PjBL if it does not meet parents' expectations in China.*"

This theme further indicates the complex dynamics between innovative teaching methods and traditional educational expectations as documented in Priestley et al. (2013) and Tao and Gao (2017). In other words, teachers' cultural perceptions greatly influence their implementation of PjBL as they respond to the pressures of parental expectations and the demands of a test-oriented system. While some teachers adapted by attempting to incorporate traditional test content into PjBL, others were faced with the dilemma of whether or not to adhere to this innovative approach in the face of resistance. For most of the novice teachers, although they were aware of the gap between what they taught in PjBL and what was required on the high school exams, and of the challenges between developing students' 21st century skills in PjBL and achieving high scores on the traditional exams, they persisted in their pedagogical beliefs and used their initiative. In other words, they maintained a student-centered teaching beliefs advocated by PjBL and overcome these limitations through strategies such as communicating with parents and better integrating math knowledge into PjBL. This is consistent with Paniagua and Sánchez-Martí's (2018) research that, novice teachers tend to undertake innovative teaching that support students' active learning since they normally bring enthusiasm and idealism to education, and often dissatisfied with the existing traditional teaching approaches.

Conclusions

The results of this study offer a deeper understanding of the complexity of novice teacher agency in the context of project-based learning (PjBL). The results support the ideas that teacher agency is shaped and affected by specific contexts and conditions, and that it is complex, dynamic, and individualized in nature. The main challenges faced by the novice teachers in China included that teachers had to develop an in-depth understanding of the design and implementation principles of project-based learning, develop curriculum resources, prepare students to take high school entrance exams, and address parental concerns towards PjBL. In the absence of specific guidelines, these teachers spent a great deal of personal time searching and designing PjBL teaching resources. This situation illustrates teacher agency, but it also reflects the personal cost that teachers must pay. However, there were some teachers who felt that PjBL's flexible curriculum guidelines provided them with an opportunity to customize their lesson plans and resources to meet the needs of their students. This highlights how the same factor can be seen as both a constraint and an affordable factor.

The results also show that novice teachers are willing to take risks when implementing PjBL (e.g., students may not do well on high school entrance exams, the effort they may put into designing a PjBL lesson may not be proportional to the effectiveness of the instruction, etc.) and try out different approaches that fit their teaching beliefs and the needs of their students. This behavior was common among experienced teachers, suggesting that novice teachers' development was nonlinear. Although constrained by the demands of PjBL curriculum and resource development, they still used their own approaches to make instructional decisions that responded to the complexity of the situation.

One of the important aspects of the study was the pressure from parents and the exam system. Teachers, especially those who teach ninth graders, are under intense pressure from parents who fear that students will focus on the PjBL instead of traditional high school entrance exam preparation. Some parents are still skeptical of the value of PjBL, preferring to subject their children to more traditional, test-oriented learning. Despite these difficulties, teachers in this study remain committed to implementing PjBL, believing in its

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long-term benefits, such as developing critical thinking and collaborative skills. They respond to these pressures by integrating traditional test content into the PjBL program, balancing 21st century skill development and exam preparation. This approach requires considerable effort and innovative strategies to achieve both goals.

Another significant conclusion was that all participants desired further professional development and support from knowledgeable others, or else they would feel isolated during the implementation of PjBL. However, among the eight new teachers in this study, only T2 actively sought assistance from experienced teachers. T5 recommended new teachers to be "brave" and seek help from more experienced teachers or experts, but she, like the other participants, was unable to do so and failed to perceive this as a flaw during her own PjBL practice.

To conclude, the current research has several implications for supporting novice teachers' professional development in ongoing teacher education programs. It highlights the need for focused support in understanding and implementing PjBL. Furthermore, sharing experience in planning and implementing is essential for assisting teachers in delivering PjBL courses and combining PjBL with traditional exam preparation, minimizing feelings of isolation while deciding and carrying out decisions concerning teaching innovations. Last but not least, novice teachers need to be helped to recognize and articulate their professional support needs, foster sustainable development, enhance teacher agency, and improve teaching quality over time.

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