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Enhancing Pre-School Teachers' Professional Development using Knowledge Building during Home-Based Learning

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Abstract: Home-Based Learning has emerged as a viable alternative for teaching and learning during the COVID-19 situation but there was considerable impact on teachers' professional development, especially in pre-schools where online learning had not been implemented before on a large scale. We investigated how a pre-school teacher used knowledge building to enhance her professional development by analyzing data on the Knowledge Forum and weekly Professional Learning Community sessions during Home-Based Learning. Findings show that the teacher was able to achieve higher levels of adaptability, original design thinking as well as enhanced leadership and collaboration with other staff. We also discuss how pre-school teachers can use knowledge building to facilitate online learning and further support teachers' professional development in future work.

Introduction

The increasing affordance of technologies and pervasiveness of online learning platforms in schools has led to a gradual normalization of blended learning for most K-12 students. Although online learning tends to occur at pre-designated periods of a teaching term before teachers revert to the planned curriculum in schools when students return to schools, the ongoing COVID-19 pandemic has caused global disruption to almost all aspects of life, including ways in which students have to learn in online environments different from traditional school settings.

In Singapore, teachers and students were asked to shift towards Home-Based Learning (HBL) to ensure that students would continue to receive formal education even under such unprecedented circumstances. Although K-12 teachers possess some experience in engaging students using online platforms and resources, these conditions are, however, relatively new to pre-schools, especially when considering the students' relatively young age and ability to engage with online resources for effective learning. Further, as teachers focus on adapting their teaching practices and materials online within a short timeframe, lesser time was available for teachers' professional development during the extended period of Home-Based Learning. Therefore, the transition from traditional face-to-face teaching to conducting online lessons for pre-school students had impacted and hindered pre-school teachers' professional development.

However, Knowledge Building (KB) principles and technologies can be used to ground teachers' professional development by offering a community approach to overcoming issues. This paper investigates how KB can enhance the professional development of teachers, specifically pre-school teachers, across various platforms, such as the Professional Learning Community (PLC) sessions, the Knowledge Forum, and both online lessons and the physical classroom.

Literature Review

Blended and Home-Based Learning for Pre-Schools

Blended learning converges two different types of learning environment, specifically traditional face-to-face classroom environment and computer-mediated learning environment (Bersin, 2004; Bonk & Graham, 2012). It also offers greater synchronous and asynchronous interactions between students and teachers. In previous studies involving blended learning in elementary school settings (Lossman & So, 2010; So, Seah & Toh-Heng, 2010), findings show that online discourse contained more diverse ideas that students use to share misconceptions and raise questions compared to classroom discourse, which had more Initiation-Response-Evaluation (I-R-E) patterns. The latter study

also showed that mixed-ability and high-achieving primary school students could work towards advancing individual and collective knowledge with the design and enactment of knowledge-building communities.

The COVID-19 pandemic has forced schools and educational institutes to replace face-to-face lessons with online platforms to conduct classes. This form of Home-Based Learning (HBL) has now become part of a new normal and the following relevant literature is also nascent. The impact of HBL has been intently studied, with focus on: the use of instructional strategies to facilitate students' online learning (e.g., Bao, 2020) and explorations on the difficulties experienced by teachers due to weaknesses in infrastructure (Zhu & Liu, 2020), and insufficient technical training for teachers to transition to online learning (Zhang et al., 2020).

Some of these studies have shown that knowledge building can be used with younger students in blended learning settings, indicating that the pedagogy is not limited to older students in secondary (Cheong & Cheung, 2008) or tertiary education (Cheung & Hew, 2011) institutes. Existing research on blended learning using knowledge building within pre-schools, however, remain limited, mainly due to the dominant mode of interactions and curriculum for young students in pre-school or childcare settings. The foundations for such interactions are based on developmental theory and Reggio Emilia-inspired curriculum. The developmental theory focuses more on socializations and the development of basic numeracy and literacy skills while the Reggio Emilia-inspired curriculum focuses on the development of social and cognitive abilities (Hong, Shaffer & Han, 2017). Such a curriculum uses visual media, in the form of student drawings, to explore students current understandings, how their previous understandings are reconstructed and how they co-construct their understandings of the phenomena investigated (Katz, 1998). Another reason is due to the nature of care that has to be provided, such as provisioning for nap and mealtimes, resulting in lesser time for teachers to orchestrate both online and offline teaching for students. Furthermore, the gaps identified during the implementation of Home-Based Learning, such as the lack of pedagogical training and the impact on teachers' professional development, were not adequately addressed. This paper proposes the use of the KB as a more holistic teaching approach that incorporates a blended use of online tools and face-to-face lessons to improve students' ideas and deepen their understanding, while also ensuring teacher's professional development is not neglected.

Teachers' Professional Development and Professional Learning Communities in Pre-Schools

Professional development is crucial for ensuring that in-service teachers continuously improve their teaching practice while adapting to the changing needs of students, such as the development of 21st-century skills competencies that require teacher facilitation while still being engaged in pedagogy (Luke et al., 2005). By being involved in research-based pedagogy, active collaborations between teachers and researchers can ensure teachers' professional development of teaching practices can meet the needs of the globalized world, so that students can thrive in this fast-changing and globalised world (Ministry of Education, 2020).

The pedagogy of teaching in the local context involves rote learning where 'learners in such classrooms are reduced to passive recipients' with 'little creativity or flexibility in such approaches' which led to rigid and disciplined structure of teaching (Saravanan, 2005). Such training can produce a strong foundation for factual information and basic skills, as evidenced by good performance on international benchmarks such as the Programme for International Student Assessment (PISA, 2018), but it may also lead to a "threshold effect" (Luke, 2005; Koh, Kim & Luke, 2009). This threshold effect impacts students by constraining higher-order thinking, critical and creative thinking when highly disciplined methods of teaching limit students' access to intrinsically meaningful learning, as also shown in other studies (Cheah & Robbins, 1998; Luke et al., 2005). Such limitations may inhibit students from developing the skills and competencies needed to navigate the emerging knowledge economies. Therefore, there is a greater need for schools to shift from wholly traditional classroom towards a blended type of learning for students to acquire critical 21st century competencies to seize new and exciting opportunities in the globalised world.

The concept of Professional Learning Communities (PLCs) was introduced to pre-schools through KB as an effort to aid the deepening of teachers' collective understanding through social interactions and knowledge construction. The PLCs are designed with the assumption that individual and collective pedagogical understandings are deepened through social interactions and discourse that fosters the collective construction of knowledge. Within the PLCs, teachers share lesson plans, challenges and teaching strategies to resolve arising problems and refine lesson plans. Through constant collaboration with others to improve ideas, teachers can continuously engage in reflective discourse to develop a common understanding (Laferrriere, Lamon & Chan, 2006).

Knowledge Building and the Knowledge Forum

Knowledge Building (KB; Scardamalia & Bereiter, 2006), as a non-linear approach to teaching and learning, proposes a vision of the classroom as a knowledge creation organization. When implemented in our context, KB's 12 principles

(Scardamalia, 2002) provide teachers a space for discussions, share diverse and authentic ideas, allow students to take responsibility of their ideas and democratize knowledge to be pervasive within and outside of school. The Knowledge Forum (KF) is used as an online environment that supports asynchronous knowledge building communication through sharing of ideas and knowledge in the PLC with the use of scaffolds.

Based on limited research on how blended learning can be implemented in pre-schools and improve the professional development of pre-school teachers, this paper investigates how a pre-school teacher was able to enhance her professional development through the use of knowledge building across several teaching and learning platforms. We ask the following research question to guide our study: How do pre-school teachers use knowledge building to enhance their professional development during blended and Home-Based Learning?

Methods

Participants and Settings

The participants in this study include six teachers, two of whom are the English and Chinese language teachers involved in face-to-face teaching but are new to knowledge building. The other three teachers had a cycle's worth of experience in the development of a psychologically safe environment, where they engaged with the form teachers in respectful and turn-taking behaviours, to design and coordinate lesson plans. The last teacher, with four months of experience in engaging her students in Knowledge Building (KB) was also involved, together with the three teachers, in the PLC and conducted knowledge building using KF.

Data Collection and Processing

As this study is part of a larger and ongoing research on pre-school teachers' professional development, we decided to specifically focus on the HBL period and the subsequent physical classroom lessons. The study aimed to examine how pre-school teachers enhanced their professional development during HBL. The English teachers' data were collected from three sources across 2 months, namely, the physical classroom where teachers conduct their lessons, the PLC where teachers congregate to share and discuss, and from the Knowledge Forum. The English teachers' data was selected for the analysis in this paper as she was involved in the entire HBL cycle, as compared to the Chinese teacher who could only attend certain parts of the cycle and provide partial data. The PLC sessions were conducted via Zoom, a video conference application, and recorded as videos, which consist of teachers self-reporting summaries of happenings in the classroom or during lessons. This dataset from the PLC sessions also comprises of suggestions and feedback from teachers on how future lesson plans can be improved, imagined, and better implemented, alongside several mentions of problems that arose during lessons. The teachers' discussions and knowledge building on the KF was based on the theme of "Our Amazing Body System".

Procedures and Data Analysis

Data collected from this study was firstly coded according to a Teaching Practice framework proposed by Kim (2019). Referencing Kim (2019) and York-Barr and Duke's study (2004), we identified four components of teaching practice necessary to inform teachers' professional development in PLCs and the KF- adaptability, design thinking, teacher leadership, and teacher collaboration. Sub-components for design-thinking and teacher leadership were adapted from their papers, while the other sub-components for adaptability and teacher collaboration were generated by us to code the teacher's adaptation of practice to suit online learning and collaboration through knowledge building. The adaptation of lessons based on parents' involvement was included in the analysis as pre-school students may require more external assistance during the learning process and they often lack the ability or finesse to conduct research or perform certain student activities alone.

The principles of KB can map onto the framework with adaptability aligning with 'improvable ideas' where teachers are constantly working on improving their lesson designs through feedback shared by others, from parents or their peers. The component of design thinking maps onto several principles like 'real ideas, authentic problems' and 'epistemic agency' where teachers would think out-of-the-box to make lessons relatable to the students. This involves giving students more ownership in the learning process so that students' ideas take centre-stage in inquiry. The principle of 'community knowledge, collective responsibility' embodies teacher collaboration where teachers share responsibility for the advancement of knowledge in the teacher's classroom and for their professional development. Lastly, the principles of 'symmetrical knowledge advancement' and 'pervasive knowledge building' reflects teacher leadership where teachers synchronize lessons for a more in-depth inquiry for students and collaborate with parents to encourage building of knowledge outside of school. We propose Table 1 as a new framework that guides future

analyses on how pre-school teachers and, to a certain extent, other teachers can enhance their professional development during blended learning or HBL.

Table 1: Coding Scheme for Teachers' Professional Teaching Practice, adapted from Kim (2019) and York-Barr and Duke (2004).

Components	Sub-components	Scale	Description
Adaptability	Adapting lessons based on feedback from parents' involvement	Low	Difficulty in adapting lessons based on the response of parents' involvement in Knowledge Building.
		Medium	Adapts future lessons based on the response of parents' involvement in Knowledge Building.
		High	Adapts and adjusts the ongoing lesson based on the response of parents' involvement in Knowledge Building.
	Adapting lessons based on feedback from PLC sessions	Low	Difficulty in adapting and incorporating feedback given during the PLC sessions in her lessons.
		Medium	Adapts feedback given during the PLC sessions in future lessons.
		High	Adapts and incorporates feedback given during the PLC sessions within an ongoing lesson.
Design Thinking	Think creatively	Low	Difficulty in generating creative and original activities for lessons.
		Medium	Develops original activities for upcoming lessons.
		High	Constructs and develops original activities in the ongoing lesson or amid ongoing situations.
	Experimenting with solutions	Low	Difficulty in experimenting with solutions.
		Medium	Experiments with existing and proven solutions.
		High	Generates original solution to address problem and experiment with it and adapt it accordingly based on feedback received from experimenting.
Teacher Collaboration	Teacher collaboration within a class	Low	Discusses ideas without the intention to implement; Raises problems without providing solutions; Struggles to coordinate lessons within a class.

		Medium	Discusses ideas and implementation of ideas for the upcoming lesson.
		High	Large degree of involvement with other teachers in classroom work to facilitate the lesson.
	Teacher collaboration between classes	Low	Discusses ideas without the intent to implement; Raises problems without providing solutions; Struggles to collaborate with other classes.
		Medium	Discusses ideas, strategies with implementations for the upcoming lesson.
		High	Large degree of involvement with teachers from other classes in designing classroom work to facilitate lessons.
Teacher Leadership	Coordination and management	Low	Discusses without any intent of coordinating lessons; Struggles to coordinate lessons.
		Medium	Develops an upcoming lesson plan that is coordinated between teachers.
		High	Develops future lesson plans that are relevant and coordinated between teachers.
	Contributions to the profession of teachers	Low	Struggles to develop or discuss strategies for teachers' professional development.
		Medium	Develops solutions that would help teachers in the short-term.
		High	Redesigns and develops solutions that aid teachers and their practice in the long-term.
	Parent and community involvement	Low	Presents parents with the students' work; Struggles to involve parents in Knowledge Building.
		Medium	Uses online tools to involve parents in building knowledge with their child in their own time.
		High	Develops activities to actively involve and engage parents to use Knowledge Building in the ongoing lesson.

Findings and Discussions

To answer the research question: “How do pre-school teachers use knowledge building to enhance their professional development during blended and Home-Based Learning?”, we coded the collected data using the coding scheme proposed in Table 1. The dataset containing PLC sessions consists of a total of seven sessions, which were divided into two groups, namely the first half (1st to 3rd session) and second half (4th to 7th session), to showcase potential shifts in the components of the teacher’s professional development throughout the study. The sub-components identified from the proposed framework were then analyzed and aggregated into an overview (see Figure 1) to present the different shifts during the teacher’s professional development.

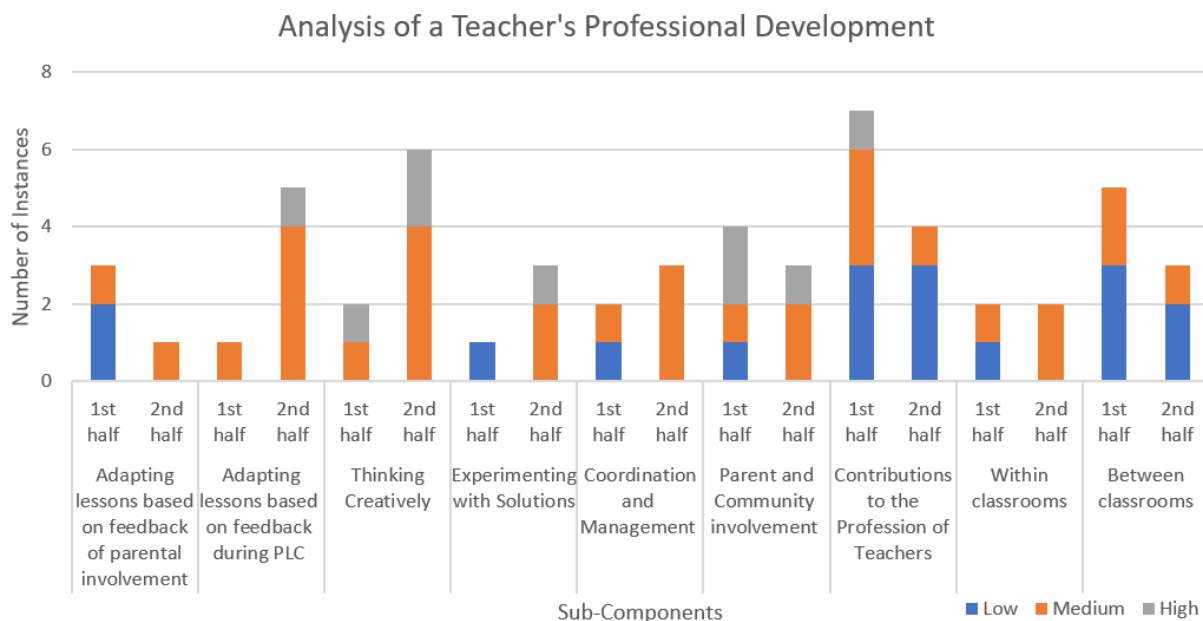


Figure 1. An overview of the different scales of sub-components displayed by the teacher across multiple PLC sessions and KF discourses.

From Figure 1, we identified several significant shifts of sub-components, from a lower to a higher level, as the teacher sought to enhance her professional development using knowledge building. After the following analyses, we have also identified examples of each sub-component in Table 2.

Adaptability – Feedback from Parental Involvement and PLC

First, there was a small shift in the teacher’s adaptability based on feedback of parental involvement and a relatively higher shift in the teacher’s adaptability based on feedback during the PLC.

During the PLC sessions, teachers discussed about the aim of the teaching cycle was to introduce and involve parents in knowledge building. However, there was uncertainty over how to continue with the lessons when only several parents indicated their interest to participate, after considering that the planned lessons require significant commitment and effort. The teachers eventually suggested that parental involvement can be perceived to be supplementary in nature instead. Following this feedback, the teachers continued to develop activities that were less demanding on the parents, and this level of activity resulted in a more moderate medium scale. Thereafter, weekly meetings were also held to continue providing the teacher with support, in the form of constant encouragement from non-teaching staff on how to involve parents in KB throughout the HBL period.

The feedback and ideas from the PLC sessions had also influenced the teachers’ development of lessons. During the weekly meetings, both teaching and non-teaching staff provided third-person perspectives on a pool of ideas and resources that can be used for upcoming lessons, along with insights into how these ideas can be developed, even though this effort may not be transparent to the teacher who has to constantly engage the students during HBL. This has led the teacher to be able to achieve a higher level of adaptability for her lesson, with the continuous support and stream of ideas for use in subsequent lessons.

Design Thinking – Thinking Creatively and Experimenting with Solutions

A significant and higher shift was detected in the teacher's design thinking from the first to second half of sessions. The increase in creative thinking was due to the encouragement doled out during the PLC sessions, especially with regards to how parents can be continuously involved in KB discourse at home and also when assisting in the development of closer connections to topics that were discussed between the individual lessons. Further, the teacher's shift to a higher level of creative thinking was evidenced by an occasion when the teacher took advantage of the ongoing novel COVID-19 crisis to facilitate students' understanding of the pandemic and also discussed the benefits and use of masks with the students.

The teacher also displayed a shift towards higher levels of experimenting with solutions. The teachers discussed ways to help students connect what they had learnt during HBL and what can be brought into the physical classroom, with the suggestion of a Wonder Wall so that students can view the ideas that were shared online. In addition, the teacher experimented with a variety of solutions and provided students with the opportunity to exercise agency in their learning, by allowing students to decide the activity they want to conduct in order to facilitate deeper understanding of an assigned topic.

By following knowledge building as an idea-centric approach for teaching, the teacher constantly innovated and thought of creative ways to encourage students to inquire and generate ideas in the classroom. As the sessions progressed throughout the study, the teacher also became more creative in developing activities that would allow students to integrate their experiences and be open to experimenting with solutions to overcome unexpected challenges during learning.

Teacher Leadership – Coordination and Management, Parent and Community Involvement, and Contributions to the Profession of Teachers

Shifts towards higher levels of teacher leadership were identified, especially in the sub-components of coordination and management, and parent and community involvement. However, we detected a lower shift within the sub-component of contributions to the professions of teachers.

This trend could be explained with what was observed in the earlier PLC sessions, where the teacher discussed how the activities suggested on the KF can be sequenced and organized into a lesson plan. As the session progressed, the coordination and management of lessons became more organic with the teacher focusing on what students were trying to share and was able to better coordinate lessons based on how they could support the children in the development of ideas. Thereafter, lesser time and emphasis was needed for the sequencing of lessons and during the PLC sessions, the teachers were able to also share resources and exchange ideas to aid the teacher in managing lessons based on student ideas.

An explanation for the lower shift in the parent and community involvement may be due to the teachers' discussion and queries on how to involve parents in knowledge building. As teachers received feedback from parents in the subsequent lessons, a "Knowledge Building Time" document was developed to further encourage parent participation in knowledge building, and following the distribution of the document, the teacher had lesser time and resources to conduct her work, leading to a reduced sharing of parents' participation during the PLCs.

A lower shift and decreased number of contributions to the professions of teachers was also detected as the teacher was new to knowledge building and therefore, she was more susceptible to gaining advice from the more experienced teachers than being the one to provide valuable advice to others in her progress to support her professional development. However, as teachers in the study became more familiar and accustomed to the knowledge building approach, lesser supporting contributions were then offered by the teachers.

Teacher Collaboration – Collaboration with Teachers Within and Between Classes

Finally, there was a shift towards higher levels of collaboration with teachers within a class, but there was a decrease in transitioning to higher levels in teacher collaboration between classes.

The initial low levels in teacher collaboration within the classroom was due the teacher adoption of the KB approach, thus resulting in more discussions and lesser coordination of lessons. Through the weekly exchange in updates and lesson plans, the teacher was better able to identify similarities in the topic that was covered in the classroom, resulting in more coordination between the resources shared and the teachers' lesson plan on the same system with minimal overlap in the content covered. As a result, the teacher became more open to sharing her upcoming lessons and the resources for coordination.

The amount of teacher collaboration between classes decreased, likely due to the increase in teacher commitments that led to fewer discussions with teachers across classes. Moreover, as the teacher became more familiar with the KB approach, she could then develop idea-centric activities and lessons that require lesser support from other teachers to facilitate and help conduct her lesson.

Table 2: Examples of quotes from PLC transcripts for each of the sub-component

Components	Sub-Components	Quote from PLC transcripts	Our interpretations
Adaptability	Adapting lessons based on feedback from parental involvement	<i>Parents have not done the KB activities...so...I thought of trying out the experiments in the lessons itself...</i>	Adaptation of future lesson plans based on feedback given on parents' lack of involvement.
	Adapting lessons based on feedback from the PLC	<i>I took into consideration all the ideas that were thrown...</i>	Feedback and ideas shared during the PLC was accounted for to produce a revised lesson plan for the upcoming class.
Design Thinking	Thinking Creatively	<i>For the lesson this morning, we discussed more on viruses. So we built onto the- the mask making so this time we discussed on virus...</i>	Original way of connecting the activity of building of mask to the ongoing pandemic.
	Experiment with Solutions	<i>So, I showed them both videos and I said '...Which of the experiment do you think will better help you understand or answer your questions'.</i>	Teacher experimenting with the release of teacher agency by allowing students to decide on the activity to facilitate their understanding.
Teacher Leadership	Coordination and Management	<i>Maybe we can split the area in two...one of us could teach one portion and then... cross-over ... and then in the end, it can just come together.</i>	Development of upcoming lessons between two teachers in the same class.
	Parent and Community Involvement	<i>I actually started off...something small that the kids need to pre-prepare before the lesson...</i>	Development of activity where parents are involved in knowledge building with their child.
	Contribution to the Profession of Teachers	<i>If lao shi (Chinese teacher) wants...she can use the left-hand side, the empty side to let them do a translation... So it's like a two-in-one English Chinese book...</i>	Teacher contributed by offering a strategy to increase the connection between lessons.

Conclusions and Future Work

This paper sought to demonstrate how a PLC, when infused with knowledge building principles and integrated with the Knowledge Forum, supported pre-school teachers in online professional development during HBL. This study has helped teachers within a community to explore ideas and the teachers were able to also explore their individual roles as knowledge builders. We were able to conduct analysis of data extracted from the classroom lessons, school's PLC sessions, and KF posts, and proposed a new framework for professional teaching practice, based on adaptations from prior coding schemes. The results from this study has shown that knowledge building aided a shift to higher scales for components of professional teaching practice, such as teacher's adaptability, design thinking and certain aspects of leadership and collaboration. These components also helped enhance a teacher's professional development, especially during crises such as a pandemic, where teachers are forced to alter their practice within short timeframes.

A possible explanation for the initiative's success may be due to the reduced face-to-face interaction with students. Before the pandemic, teachers had the luxury to manage happenings in the classroom. However, with such direct

interactions taken away, teachers had to rely more on connecting with parents during the online lessons, and so teachers were more attentive to their students' ideas. Therefore, the teachers had to be more adaptable to feedback given and engaged in design thinking to solve problems that arose. Furthermore, teachers used the weekly meetings to update the other teachers on their progress and to seek advice on how to facilitate advancement of knowledge in the classroom. Thus, the teachers' professional development was enhanced during Home-Based Learning. To ensure that the teachers' professional development can be continued and further improved using knowledge building, future avenues of research will include comparisons of the maintenance of teachers' professional development, between schools that are engaged in knowledge building and schools that implement other forms of strategies and pedagogies.

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