

## Design Principles

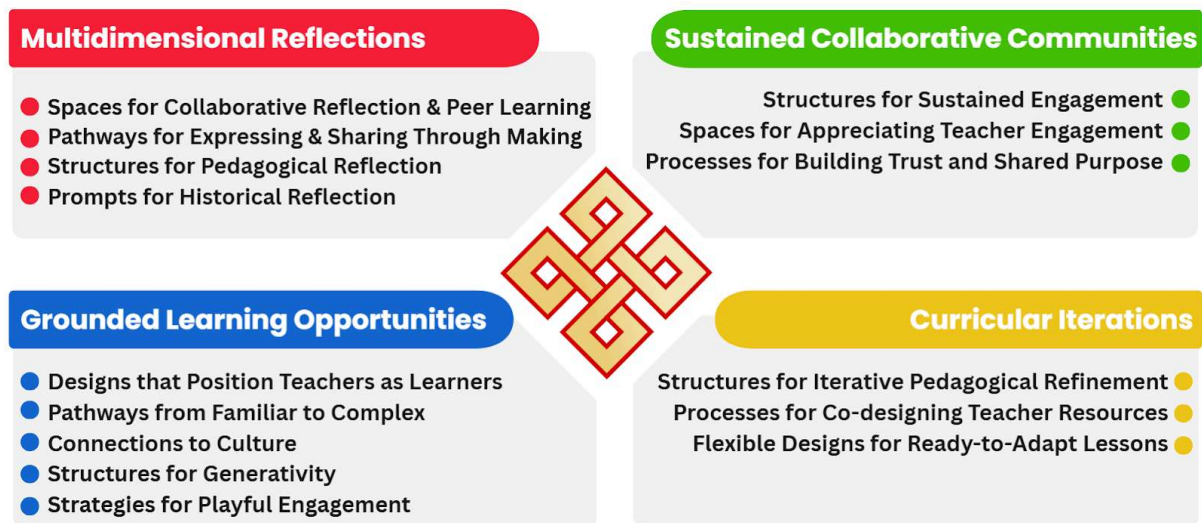


Figure 11: Design principles and their corresponding elements

By attending closely to teachers' experiences and sustained engagement with the same teachers, the principles gradually emerged from practice rather than theory alone. These principles serve as a framework for designing teacher PLCs that are grounded in research, collaboration, sustained engagement, and cultural contexts. Moreover, we want to reiterate that these principles are not final, they are meant to be adapted, modified, iterated, and refined to fit different contexts, environments, and learning communities.

### *Principle 1: Grounded learning opportunities*

| P1   | Grounded Learning Opportunities            |
|------|--------------------------------------------|
| P1.1 | Designs that Position Teachers as Learners |
| P1.2 | Pathways from Familiar to Complex          |
| P1.3 | Connections to Culture                     |
| P1.4 | Structures for Generativity                |
| P1.5 | Strategies for Playful Engagement          |

## P1.1

## Designs that Position Teachers as Learners

**Explanation**

Asking teachers to imagine being students learning content while also holding onto the perspective of what teaching in new ways can entail.

**Connections to Theory**

As Duckworth (2006) mentions “First, teachers themselves must learn in the way that the children in their classes will be learning,” we wanted teachers to gain first-hand experience with hands-on, playful, and curated activities mirroring how their students might learn. The design element emphasizes the importance of positioning teachers in the role of learners, allowing them to experience the processes of exploration, inquiry, and reflection first-hand before translating them into classroom practice rather than only observing or discussing pedagogical strategies (Gerard et al., 2011). Further, inviting teachers to be learners themselves in novel arrangements of technology, activity, and reflection has been shown to deeply impact how they begin translating these practices into their teaching.

**Examples**

**P IV** For Sarada, a math teacher, programming was a new concept. She attended Arduino coding sessions facilitated by Karkhana teachers alongside her students, exemplifying the shifting roles in making spaces where teachers become co-learners. Her role transformed from knowledge authority to that of an adult explorer, embracing learning alongside students. This environment empowered students to take initiative in their own learning and even guide teachers like Sarada, highlighting the mutual growth that occurs when both teachers and students navigate new concepts together, as learners.

**P I** When we introduced Novel Engineering, an integrated approach that uses classroom literature as a starting point for open-ended engineering design challenges, teachers used simple electronics like coin cell batteries, LEDs, and motors to prototype solutions based on the story of bunnies invading a farmer’s garden. While many proposed familiar fixes like lighting up LEDs or building motorized gates, Anita reimagined the task by attaching a spoon from her kitchen to a motor, creating a rattling sound to scare off the bunnies (Figure 12). This inventive use of household items highlighted for others that learning could extend beyond the provided kit to everyday use, found materials. Teachers later transferred this insight to their students, encouraging resourcefulness and creativity in their own learning environments during the COVID-19 pandemic.

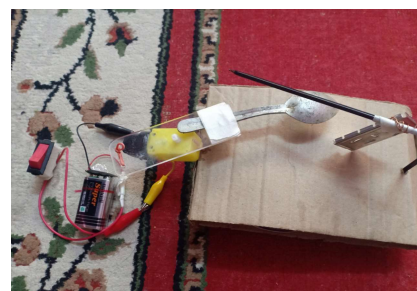


Figure 12: Anita’s Novel Engineering solution

**Implications**

PD should invite teachers to inquire, experiment, and reflect as active learners rather than passive recipients of training.

**P1.2****Pathways from Familiar to Complex****Explanation**

Scaffolding experiences that begin with familiar practices and accessible entry points, then progressively building towards more complex pedagogical approaches, materials, and instructional structures.

**Connections to Theory**

This design element emphasizes supporting teachers' learning through a gradual structured progression of experiences (Gravel et al., 2022). It begins with activities, skills, or materials that are accessible and recognizable, building on participants' familiarity and comfort. Once this foundation is established, new layers of complexity are gradually introduced.

**Examples**

**PI** Teachers engaged in a progression of making activities that started with simple tasks using familiar, easily accessible materials and gradually introduced more complex skills along with new materials. They moved from paper-based projects (Thaumatrope, Pop-up cards) to paper engineering (Automata), explored basic electronics (LEDs, coin cells), then making things move using motors and found materials (Novel Engineering), and finally advanced to creative digital practices such as stop-motion animation (GIF Maker) and block-based coding (Scratch).

**PIV** Teachers were first introduced to the concept of a making space and shown examples of how such spaces are used. They began by prototyping their schools' making spaces with familiar, easy-to-use materials such as cardboard and LEGO blocks. These prototypes were then shared with an architect, who transformed them into a 3D model, helping teachers visualize the evolving space. Finally, teachers participated in creating the space itself as some enthusiastically painted the walls, while others arranged tables, chairs, and activity stations according to the making space design. This transformation is depicted in Figure 13. This progression unfolded alongside structured opportunities for collective reflection. During the first two quarters, teachers met for eight workshops facilitated by Karkhana members where they identified available spaces, clarified priorities, designed 3D models, and explored the values and operational structures of a making space. Reflection extended beyond these formal sessions as teachers shared photos and updates in a WhatsApp group, visited one another's sites, and engaged in ongoing dialogue supported by Surya, who conducted regular school visits and meetings. Through a values-based activity, teachers articulated personal and making space values and discussed how these shaped their pedagogical choices. They then co-developed multi-year plans using a Results-Based Management (RBM) framework and integrated these into the school calendar. In this way, the work evolved from hands-on prototyping to deeper reflection, collective planning, and long-term institutionalization, illustrating a deliberate movement from the familiar to the complex.

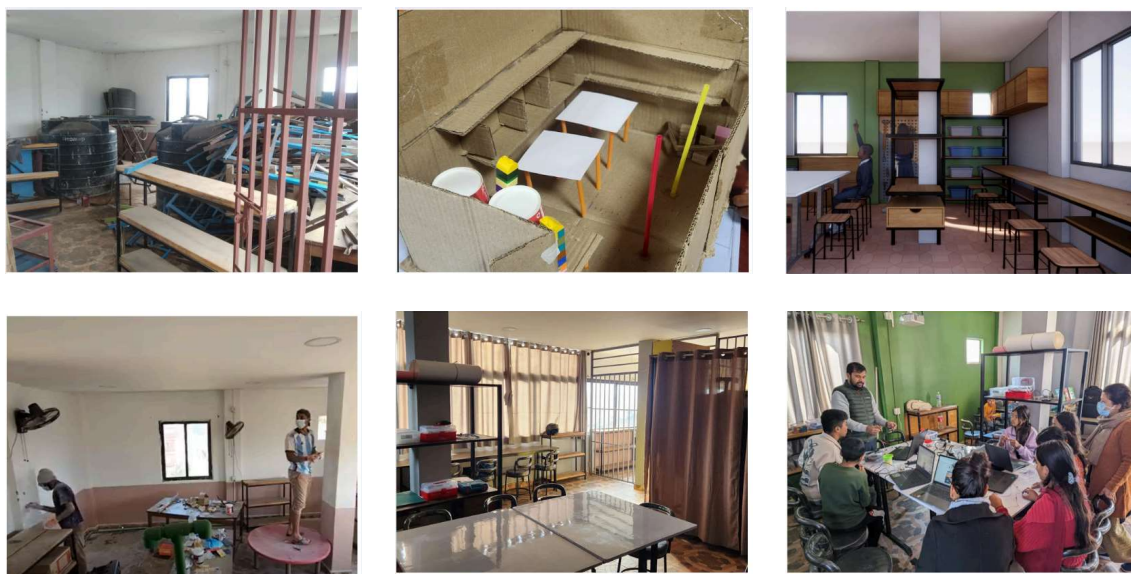


Figure 13: Transformation of Panchakanya School making space

### Implications

For a PLC, this approach acknowledges that meaningful professional learning happens when teachers can connect new ideas to their existing knowledge, practice, and pedagogy. Starting with familiar materials or activities lowers barriers to participation and builds safety and comfort, while introducing complexity over time encourages curiosity and deeper reflection. By engaging first as learners in simple, playful tasks and then transitioning to adopting, designing and facilitating more complex experiences, teachers develop both confidence and pedagogical insight.

### P1.3

### Connections to Culture

#### Explanation

Grounding learning experiences in the local context honoring participants' cultural knowledge, practices, and materials as valuable foundations for creative exploration.

#### Connections to Theory

In the educational context, Cultural Modeling (Lee, 2003) can support students in learning academic concepts by linking them to the funds of knowledge they develop through home and community experiences.

#### Examples

**PV** Teachers were introduced to a sample lesson based on Cultural Modeling. In this demo lesson, teachers explored the phases of the moon (the target academic concept) using cultural knowledge from the Nepali lunar calendar and relevant cultural datasets, such as the timing of festivals, eclipses, birthdays, and celebrations like Father's Day and Mother's Day. This approach illustrated how academic learning can be meaningfully connected to

students' everyday practices and cultural contexts.

**P II** For the Novel, we selected the folktale titled The Lattice Window (Figure 14), which tells the story of how the locals of Kipu, a town in Kathmandu, got rid of Kawa:, a skeleton ghost. The book was chosen for its cultural relevance, as lattice windows are prominent motifs in many temples and historic palaces in Kathmandu, making the story relatable to the teachers' own experiences. To further connect with local culture, we also provided copies in Nepal Bhasha, an indigenous language of the Newar people which is taught in many public schools in Kathmandu.

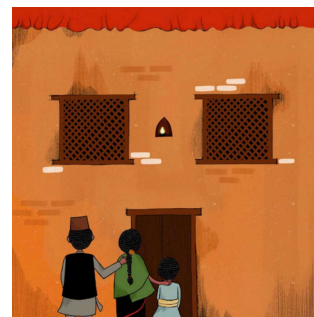


Figure 14: Illustration from The Lattice Window

**P IV** Rupa shared that a drawing activity sparked a childhood memory of drawing temples in her sketchbook, a practice taught by a teacher using simple steps to create complex images. Although she had long forgotten how to draw the temples, the workshop allowed her to revisit this memory. The temple (Figure 15) emerged as a recurring symbol in her visual expression, representing a strong foundation, both in design and in the values she wished to convey. For Rupa, temples became powerful metaphors for the qualities needed in herself and her community, linking personal, cultural, and pedagogical meaning.

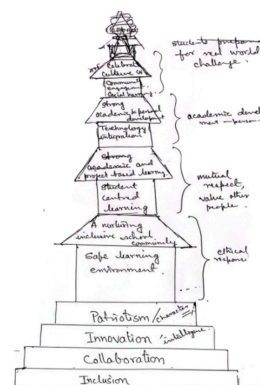


Figure 15: Rupa's temple drawing

## Implications

Professional learning should draw on local knowledge, contexts, and community practices to ensure relevance and ownership. For teachers, it means reimagining learning not as something that happens apart from their community, but as something deeply rooted in it. When teachers work with locally available materials, local stories, and shared experiences, they model for students how creativity and problem-solving can emerge from their own cultural worlds.

### P1.4

### Structures for Generativity

#### Explanation

Designing activities and learning experiences that open up new ideas, connections, and possibilities rather than converging on a single correct answer.

#### Connections to Theory

Generative learning structures encourage exploration, iteration, and solution diversity

(Willner-Giwerc et al., 2020). When educators experience generative practices themselves, they begin to see how simple, open-ended activities can stimulate deep thinking, collaboration, and reflection in their classrooms.

## Examples

**P III** In a session on feedback, teachers experienced the value of iteration by making multiple drafts of a scientifically accurate butterfly drawing. Based on Ron Berger’s feedback framework (Be kind, Be specific, Be helpful), they practiced giving and receiving constructive feedback with peers. The activity was particularly generative for community teachers in Gulmi, who found it highly engaging and appreciated that it required only simple, low-cost materials like paper and colors.

**P II** The teachers were introduced to simple yet generative drawing activities such as “How it works diagrams,” in which they illustrated the inner workings or mechanism of an object around them. Teachers were highly engaged and eager to share their diagrams. Sangden drew a claw hair clip, explaining that its mechanism functioned like a door hinge, with the spring held in thick grooves. Samaya and Rupak both chose hand sanitizers, likely influenced by COVID-19 safety practices. Samaya noted that a spring, similar to a ball pen, allows the top to move, while Rupak added that pressing the top creates a partial vacuum due to pressure differences (Figure 16). This seemingly simple activity was remarkably generative, prompting teachers to uncover the complex mechanisms in ordinary everyday objects that are often invisible to us.

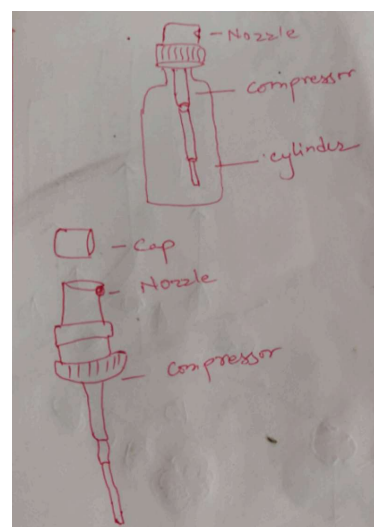


Figure 16: Rupak’s how it works diagram of a hand sanitizer

## Implications

Professional learning should incorporate generative learning structures that promote exploration, iteration, and multiple pathways to solutions. When teachers themselves engage in open-ended, design-oriented tasks, they experience firsthand how simple prompts can lead to deep thinking, collaboration, and creative problem-solving. This experiential understanding shifts perceptions of learning from completing prescribed tasks to engaging in inquiry-rich processes.

### P1.5

### Strategies for Playful Engagement

#### Explanation

Using curiosity, experimentation, joy, and hands-on exploration to foster meaningful learning.

#### Connections to Theory

Play has long been recognized as an essential component of how young people make sense of their worlds, providing opportunities for risk-taking, exploring new configurations, and taking on new roles (Parker et al., 2022; Zosh et al., 2018).

## Examples

**P III** Community teachers at Gulmi were invited to build an animal from a pile of LEGO blocks that were spread over a table-top. Although many were using LEGO for the first time and were initially hesitant, they slowly began creating lions, giraffes, dogs, and peacocks. The playful challenge sparked creativity and eased participants into an open, imaginative mindset for the session.

**P I** Teachers made a Thaumatrope, a simple 2-frame animation technique made using pencil and paper. Anu created two drawings: a fish and a bowl, that formed the illusion of a fish swimming inside the bowl when the stick was spun (Figure 17). The activity was inherently playful because it invited the participants to draw a fun two-frame animation to tell a story.

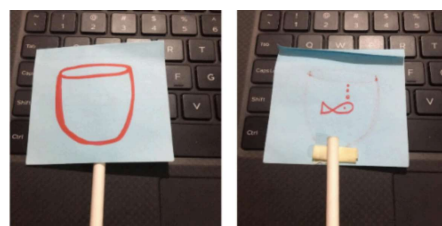


Figure 17: Anu's Thaumatrope

## Implications

For teachers, embracing playfulness means designing learning experiences that invite exploration, iteration, and creative problem-solving rather than compliance with fixed procedures. When educators experience playful learning themselves, they begin to recognize how curiosity, resilience, and collaboration can be cultivated through hands-on, open-ended activities. Embedding playfulness within professional learning not only makes sessions more engaging, but also models alternative pedagogical possibilities, encouraging teachers to reimagine their classrooms as spaces where meaningful and joyful learning can occur.

## *Principle 2: Multidimensional Reflection*

| P2   | Multidimensional Reflections                          |
|------|-------------------------------------------------------|
| P2.1 | Structures for Pedagogical Reflection                 |
| P2.2 | Prompts for Historical Reflection                     |
| P2.3 | Spaces for Collaborative Reflection and Peer Learning |
| P2.4 | Pathways for Expressing and Sharing Through Making    |

## P2.1

## Structures for Pedagogical Reflection

## Explanation

Opening up space to be critically reflective of pedagogical practice and intentionally creating opportunities for teachers to pause, examine, and make sense of their teaching and learning practices.

## Theory

By engaging in structured reflection, teachers develop greater awareness of how their decisions, facilitation, and classroom interactions influence student learning (Gerard et al., 2011; Sisk-Hilton, 2009). Inviting teachers to draw, share their drawings, or write reflections on their drawings, as these artifacts provide an excellent forum for critical reflection (Weber & Mitchell, 1996), which we know is essential to professional practice. This process can reveal the subtleties and uncertainties in individuals' perceptions of teaching, as well as the cultural, social, historical, and personal biases that shape their understanding of teacher education.

## Examples

**PI** During the values activity, Anita first selected five key values for her as a teacher: Problem Solving, Critical Thinking, Discipline, Positive Attitude, and Inclusivity. When asked to visually represent the relationships among these values, she placed Problem Solving at the center and connected the other four values with outward-pointing arrows. In a subsequent iteration, when teachers were asked to depict the values of their making space, Anita chose a flower as a metaphor (Figure 18). Each petal represented a value like Creativity, Cooperation, Equity, Community, and Multimodality, which were linked to learning. This iterative process illustrates how teachers can externalize and refine their understanding of values in relation to their evolving pedagogies.

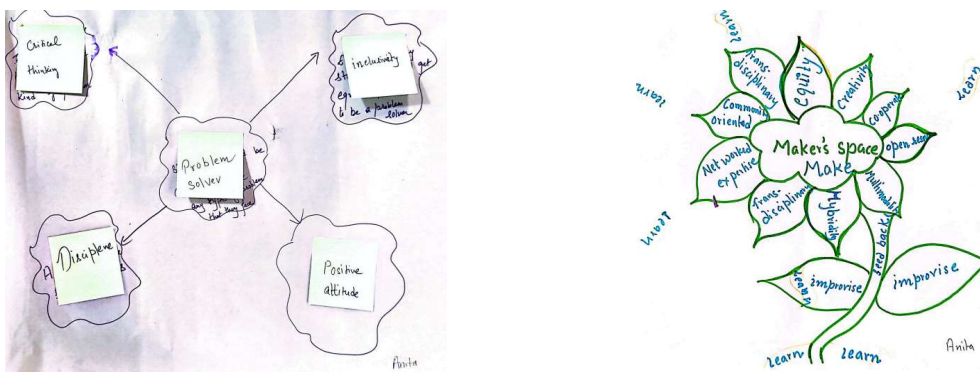


Figure 18: Anita's evolving drawings of key values

**PII** After each classroom observation, we provided feedback using the What Went Well (WWW)/Even Better If (EBI) structure, helping teachers identify strengths and areas for improvement. In addition to these peer-feedback structures, teachers also began reflecting more deeply on their own pedagogical shifts. Tilak shared that earlier, a “good class” was defined as one where the teacher was comfortable and students sat quietly, but now he recognized that silence often signals a lack of interaction and limited learning (lines 54-57). Similarly, participating as a “student” in our sessions prompted him to reconsider the

nature of homework: if assignments required effort but did not clearly contribute to knowledge, skills, or attitudes, then their value was questionable (lines 59-64). These realizations, supported by structured opportunities for feedback and reflection, highlight how teachers gradually reframed their assumptions about effective teaching and learning.

|    |                                                                                                        |
|----|--------------------------------------------------------------------------------------------------------|
|    | [Teacher Pair Interview, 00:04:44.10]                                                                  |
| 52 | T: ... When I reflect on how my pedagogy has changed, I now think that things that I                   |
| 53 | used to think were making my class ineffective before are actually essential. For                      |
| 54 | example, <b>if a teacher is teaching a class comfortably and all the students are</b>                  |
| 55 | <b>silent.</b> We often <b>used to say "Wow! It's a very good class."</b> But now, we say <b>"It's</b> |
| 56 | <b>a lecture method. The students have not even discussed with each other. There is</b>                |
| 57 | <b>no interaction. How can students learn without any interaction."</b> I think I have                 |
| 58 | come to that realization or insight. Another thing is that it has been a long time since               |
| 59 | I participated as a student in the PEBL sessions. <b>As a student, I was asked to do</b>               |
| 60 | <b>some homework.</b> I again came to the realization after a long period that it was really           |
| 61 | difficult to do homework effectively. <b>These days, I think about how fruitful the</b>                |
| 62 | <b>assignments that I give to my students are. If they are putting so much effort</b>                  |
| 63 | <b>into it, then is it result oriented or not? Did the students' knowledge improve, or</b>             |
| 64 | <b>did their skills improve, or was there a change in their attitude.</b> We should                    |
| 65 | consider those things as well.                                                                         |

## Implications

We need to intentionally design spaces for structured reflection within professional learning. Across the five phases, structured reflections using WWW/EBI framework and through iterative drawings, supported teachers in noticing and articulating their own pedagogical shifts.

### P2.2

### Prompts for Historical Reflections

## Explanation

This design element stretches the reflective plane back in time to encourage teachers constructing longer arcs of reflection that include the histories that shaped their present pedagogical perspectives.

## Theory

Teachers' existing beliefs, assumptions, and practices shape how they interpret and implement new pedagogical ideas (Gerard et al., 2011; Loucks-Horsley et al., 2010). By eliciting prior understandings, through drawings, written reflections, or discussions, teachers can critically examine the foundations of their practice (Sisk-Hilton, 2009). This process of surfacing and articulating existing knowledge not only supports individual reflection but also enables collective sense-making within professional learning communities. When teachers share and discuss their perspectives, they create opportunities to challenge assumptions, compare approaches, and build shared understanding, laying the groundwork for more intentional and informed pedagogical choices.

## Examples

**PII** During a “Picture and a Quote” activity inspired by Photovoice (Wang & Burris, 1997), teachers were asked to share one or two photos to introduce themselves, accompanied by a quote that explained their choice. Tilak shared a photo of his grandmother with the caption: “My grandma is the greatest teacher for me, but she is considered illiterate in the eyes of the so-called modern world.” When he presented this to the group, it sparked a rich discussion on what literacy means and what is valued in the current education system. This seemingly simple photo activity opened space for historical reflection, allowing participants to connect their personal histories and family legacies with broader questions about education, recognition, and cultural values across generations.

**PV** As Rabina and Anita finalized their school values, which included Respect, Integrity, and Patriotism. They recognized that values can evolve over time and became curious about how their school’s values had developed historically. While exploring the history of Saraswati Niketan, established in 1947, Rabina discovered long-standing traditions tied to these principles. Reviewing old documents and mementos, she found artifacts such as a student ID card, a school badge, and a silver token presented to the class of 1992 (Figure 19). Engraved on the token was a line in Nepali: “विद्या निष्फल भो, त्यसको जो छैन देश सेवक,” which translates to, “Education is in vain if it does not cultivate a server of the nation.” This discovery revealed that patriotism had always been a core part of the school’s identity, reinforcing its inclusion as a primary value and illustrating how historical reflection can deepen understanding of enduring school values.



Figure 19: A silver token of love presented to the class of 92 at Saraswati Niketan

## Implications

For educators, engaging in historical reflection cultivates a sense of continuity and purpose. It allows teachers to see themselves as part of an ongoing story of education that is shaped by collective experiences, systemic shifts, and community wisdom.

## P2.3

## Spaces for Collaborative Reflection and Peer Learning

### Explanation

This design element emphasizes the importance of designing environments where teachers can learn with and from each other. These spaces allow educators to exchange ideas, give and receive feedback, and collectively make sense of their experiences along with their evolving pedagogies.

### Theory

Collaboration transforms reflection from an individual process into a shared one, where learning deepens through dialogue, observation, and co-construction of meaning (Tam,

2015). By intentionally structuring these spaces, educators can move beyond hierarchical classroom norms, where teachers hold privileged positions, and foster reciprocal peer learning that values multiple voices and experiences (Ochs, 1997).

## Examples

**PII** Deepening teachers' understanding of the five characteristics of Learning through Play (LtP) required careful scaffolding and structured peer dialogue. Rather than simply asking teachers to "identify play," we first invited them to experience play themselves. In one workshop, teachers played a game together and reflected on the prompt: What makes play fun? Building on their responses, we introduced the five characteristics of LtP and watched a short video developed by LEGO Education to ground the framework in classroom examples. Teachers then practiced noticing the characteristics through a guided progression. Working in pairs, they analyzed three curated classroom videos and used a grid on Google Slides that aligned with the five characteristics (Figure 20). The prompt was specific: Add your ideas in the corresponding box when you notice an instance that fits the definition of a characteristic of play. The first video showed two students excitedly discovering how a periscope allows you to view objects from a higher or lower perspective without being in the line of sight; the second featured students building a scribbler bot and celebrating when the motor worked; the third showed students iterating designs to build the tallest book-supporting structure. Initially, teachers tended to make broad statements such as "students are engaged" or "they are iterating." Through facilitated dialogue and repeated viewing, however, they were pushed to ground their interpretations in observable evidence by responding to questions like Who is engaged? What exactly shows iteration? What language indicates social interaction?

One area of consistent struggle was identifying the "meaningful" characteristics of play. Many teachers could easily recognize joy, active engagement, iteration, and social interaction when a motor worked or a structure stood tall. Meaningfulness, however, required deeper interpretation. It was only after collective discussion of the first two videos, probing students' intentions, connections to prior knowledge, and ownership of ideas, that teachers began to articulate more nuanced examples. This iterative cycle of observing, documenting, discussing, and revising interpretations demonstrated that noticing play was not intuitive; it required structured prompts, multiple viewings, peer dialogue, and facilitation. Through this process, teachers gradually sharpened their analytic lens and developed a more evidence-based understanding of playful learning in practice.

| Joyful                  | Actively Engaging             | Iterative                                                        | Meaningful | Socially Interactive                 |
|-------------------------|-------------------------------|------------------------------------------------------------------|------------|--------------------------------------|
| When the project worked | Trying to accomplish the task | Trying to make it correctly. Repetition to get it done correctly |            | The discussion that they were having |

Figure 20: Anita's noticings of playful characteristics when viewing the second video

**PI** During a virtual session based on Isabel Wilkerson's book, *Caste*, the facilitator used a shared Google Document to engage participants collaboratively in exploring the book's eight pillars of caste. Combined with small breakout rooms in Zoom, these tools created

spaces for participants to discuss complex ideas and co-construct understanding. In one breakout room, Rupak shared a personal childhood experience of casteism, which resonated with others and sparked deeper reflection. These collaborative virtual spaces allowed teachers to learn from one another, clarify difficult concepts, and collectively deepen their understanding.

### Implications

Structured spaces for collaborative reflection and peer learning allow teachers to share ideas, make their thinking visible, and learn from one another. Through storytelling, discussion, and multimodal representations, teachers can examine classroom decisions, experiment with new approaches, and integrate theory with practice. Participation in PLCs disrupts isolated, textbook-driven habits, fostering trust and collaboration.

## P2.4

### Pathways for Expressing and Sharing Through Making

#### Explanation

Providing ample opportunities for teachers to communicate their ideas, experiences, and stories of making, tinkering, designing, and engineering through tangible artifacts.

#### Theory

In making, as participants produce “fabricated objects that are multidimensional and require multiple modes to convey all the elements of a project” (Lui et al., 2019), making can become a language for expression allowing participants to externalize thoughts, emotions, and imagination in visible, shareable forms.

#### Examples

**P11** In the session Capturing and Sharing Stories from Classrooms, teachers were introduced to video-making using CapCut. Tilak created short videos showcasing his students engaged in hands-on activities, integrating a storyline, background music, and video edits such as trimming, cutting, and joining clips. Through this process, he effectively documented and shared both teachers’ and students’ learning journeys, making their experiences visible and engaging for a wider audience (Figure 21).



Figure 21: Frames from Tilak’s short video

**PV** After finalizing the digital design of the school's core values, Rabina and Anita envisioned bringing it into physical form, creating a tangible, interactive installation. Rabina proposed using a real tree branch from her garden as the base, grounding the design both literally and symbolically. Once the branch was secured on the wall, she engaged her Grade 9 students in selecting colors and adding decorative elements, turning the installation into a collaborative creation (Figure 22). This multidimensional approach not only transformed the abstract values into a visible, shared artifact but also provided a meaningful way for students and teachers to express, engage and interact with the school's guiding principles.



Figure 22: Students coloring the value tree

### Implications

Providing educators with opportunities to represent ideas through tangible artifacts makes thinking visible and transferable, allowing both teachers and peers to engage with and learn from each other's work. These expressive pathways foster personal connection, ownership, and agency, enabling teachers to take pride in their learning while supporting deeper understanding and meaningful integration of new pedagogical ideas.

### *Principle 3: Sustained, collaborative communities*

| P3   | Sustained, Collaborative Communities            |
|------|-------------------------------------------------|
| P3.1 | Structures for Sustained Engagement             |
| P3.2 | Spaces for Appreciating Teacher Engagement      |
| P3.3 | Processes for Building Trust and Shared Purpose |
| P3.4 | Processes for Building Trust and Shared Purpose |

## P3.1

## Structures for Sustained Engagement

**Explanation**

Unlike traditional professional development, which is often lecture-based, short-term, and disconnected from classroom practice, our approach was playful, materials-based, and designed for multi-year engagement. These structures enable teachers to iteratively explore, apply, and refine new ideas over time, fostering deeper learning, stronger habits, and meaningful integration of practices into their everyday teaching.

**Theory**

Teaching practices are usually well established, and hence change gradually (Loucks-Horsley et al., 2010; Sisk-Hilton, 2009). This view is supported by researchers' finding that PD programs had a much stronger impact when they were sustained beyond 1 year (Gerard et al., 2011).

**Examples**

**PII** **PIII** **PIV** Three Phase I participants played pivotal roles in sustaining and expanding the work across subsequent phases: Sangden led the Phase II and Phase III efforts, Sameer focused on designing and refining lessons for Phases II and III, and Surya spearheaded the Phase IV initiatives. Their continued involvement exemplifies how long-term relationships and shared leadership were central to deepening impact and ensuring continuity. Similarly, five early adopters from Phase I helped test and refine the redesigned activities with their students. Their feedback was vital in finalizing the 12 lessons for Stage 2 of Phase II. They also supported our team by co-designing sessions. For instance, Rabina adapted the Capturing and Sharing Stories session using examples from her own classroom. Likewise, Phase I teachers actively supported professional development for new cohorts. Some facilitated virtual sessions while others traveled to remote sites. Their ongoing involvement strengthened the community.

**PIV** **PV** In phases IV and V, we continued to work with 8 maverick teachers, defined as educators who went beyond scheduled sessions, stayed actively engaged with the teaching community, and invested significant time and effort in bringing playful learning experiences to their students. Their sustained commitment played a crucial role in institutional adoption. Rabina and Rupa, both Head Teachers, played a crucial role in moving the project forward by leveraging their decision-making positions to prioritize making spaces in their schools. Similarly, senior teachers like Rupak, Saradha, and Madhav persuaded their school leadership to invest in these spaces.

**Implications**

Sustained engagement was key to deepening teacher practice and fostering community ownership. By continuously collaborating with the same teachers over multiple years and phases, we created continuity, trust, and a shared purpose allowing teachers to grow into leaders, co-designers, and mentors within the broader community of practice.

## P3.2

## Spaces for Appreciating Teacher Engagement

**Explanation**

Providing platforms for teachers to showcase ideas, document progress, and receive public acknowledgment reinforce teachers' identities as innovative educators and highlight the impact of their work within and beyond their schools.

**Theory**

Recognizing and celebrating teachers' efforts is essential for strengthening motivation, validating their hard work, and fostering a culture where sustained effort is seen, shared, and valued. PLC design should treat recognition and celebration of teachers' efforts as a central design feature rather than an add-on (Meesuk et al., 2021).

**Examples**

**PV** We recommended two teachers to present their work at a Teachers' Conference organized by Kathmandu University (Figure 23). Buddha showcased how he engages students in his making space, while Anita shared the process of developing their school values and involving students in creating a physical installation to showcase the values. Both presentations were well received, and many educators expressed interest in their approaches, with several planning visits to learn from their experiences firsthand.



Figure 23: Buddha and Anita presenting their work at a Teachers' Conference

**PII** Similarly, we made a conscious effort to highlight teacher impact at community events. During the Phase II closing event, we hosted a poster session where teachers showcased how they transformed their classrooms using playful learning (Figure 24). Shree highlighted students' newfound confidence as they applied playful learning beyond the classroom, winning municipal and district-level science competitions and motivating other teachers to adopt similar approaches. Buddha shared how he facilitated hands-on learning in low-resource schools, demonstrating that play and experimentation can thrive with minimal materials. Tilak reflected on his shift from teacher-centered instruction to fostering interaction, iteration, and curiosity, guiding students toward deeper learning. Sabina demonstrated how she turned her classroom into a "room of discoveries," to teach scientific concepts like chromatography and light through hands-on experiments, designing her own lesson plans, and providing students space for free play and prototyping, which encouraged creativity and collaboration. The presenters engaged in conversations with

fellow teachers and educators from other schools, fostering dialogue and inspiring positive change across diverse learning contexts.



Figure 24: Teachers sharing their posters at the PEBL closing event

**PII** **P III** **P IV** **PV** In each of the phases, we organized a graduation ceremony to recognize the efforts the teachers had put into implementing new ideas into their classrooms and to celebrate their dedication. In Phase III, two teachers delivered speeches sharing their experiences of integrating learning through play into their classrooms, reflecting on the challenges and successes they encountered. The ceremony concluded with a group photo of all participants proudly holding their completion certificates, creating a memorable and affirming moment that highlighted their commitment and growth (Figure 25).



Figure 25: Teachers being facilitated at the closing events

### Implications

Creating structures to celebrate teacher engagement strengthens motivation, validates professional effort, and encourages continued innovation. When teachers feel seen and valued, they are more likely to share practices, collaborate with peers, and contribute to a broader learning community, fostering a supportive and interconnected professional culture.

## P3.3

## Processes for Building Trust and Shared Purpose

## Explanation

Creating opportunities for teachers to learn from one another, experience each other's contexts, and engage in open, informal dialogues that foster mutual respect, strengthen relationships across schools, and cultivate a shared commitment to playful learning.

## Theory

Research from Thailand (Meesuk et al., 2021) and Ghana (Ayilimba et al., 2025) highlights that PLCs grounded in shared values, collective focus on student learning, and supportive leadership enhance teacher trust, confidence, and capacity for independent learning. By designing teacher engagement through the lens of PLCs, trust, mutual respect, and shared purpose become foundational, enabling teachers to engage deeply, experiment safely, and sustain transformative practices over time.

## Examples

**PI** In the first virtual meeting, teachers were invited to share drawings of four major events that inspired them to become educators. Many reflected on influential role models, such as family members, school teachers, or broader educational figures like J. Krishnamurti. Some teachers shared motivations shaped by challenges or dissatisfaction: Anu reflected on her frustration with previous teachers, Sujit initially did not want to teach but wanted to challenge the stereotype that teaching is a fallback profession. Teachers also shared insights on the evolving meaning of teaching: Sangden emphasized continuous learning, Samaya recognized that learning extends beyond grades, Padma highlighted teaching as a multidisciplinary profession, and Jessica spoke about supporting students who are struggling. Creative expressions included Arati's drawings (Figure 26, right) of a Sun (stability), Plant (lifespan of teaching), Water (clarity), and Children (joy in interactions). Rupak reflected on teaching as a "noble profession," noting respect for teachers and recognition during COVID-19 vaccination prioritization. This sharing activity fostered trust, revealed diverse motivations and experiences, and created a shared sense of purpose among the participants, forming the foundation for a collaborative community.

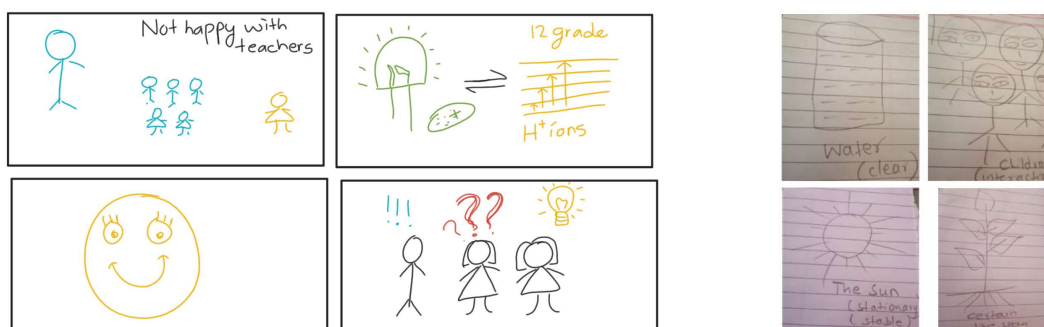


Figure 26: Teachers' drawings of 4 major events that inspired them to become a teacher

**PII** **P III** At the beginning of Phase II, teachers took turns sharing stories behind their names, covering the literal meaning, strange surnames, who named them, nicknames, or even common mispronunciations. For instance, Rupak shared that his name was originally Dipak, but his parents changed it to Rupak as Dipak was too common; Anita shared that

her name means “nothing negative, only positive things happen”; Srijana mentioned that her aunt had given her the name; and Rupesh explained that his name means “god of beauty.” Similarly, in the first session with the Gulmi community teachers, we began with a name game to help participants get to know each other during the three-day program. Sitting in a circle, each teacher introduced themselves by acting out their name with a fun gesture or wordplay. For example, Madhav linked his name to playing a percussion instrument called *madal*, and Hira formed a diamond shape with her fingers to represent her name, which translates to “diamond.” Initially shy, the teachers quickly warmed up, taking turns to creatively introduce themselves. These simple, playful activities fostered trust, eased initial awkwardness, and laid the foundation for collaboration within the new community.

**PV** We held each week’s sessions at different making spaces, and a highlight was the lunch shared at the end of each session. These meals sparked a friendly sense of competition among the schools, with each trying to outdo the others with delicious, culturally meaningful food. Saraswati Niketan School started the trend by serving a traditional Newari lunch for Yomari Purnima, including yomari - steamed rice flour dumplings filled with molasses and sesame seeds. Panchakanya School followed with a festive Sel roti set - a sweet, ring-shaped rice bread associated with festive celebrations. These lighthearted lunches not only offered a taste of cultural heritage but also created a relaxed environment for teachers to connect, exchange ideas, and build camaraderie across schools.

### Implications

Prioritizing trust and shared purpose enables teachers to engage more openly with innovative practices, take risks, and collaborate across schools. When educators feel connected, respected, and aligned around a shared goal, they are more likely to sustain experimentation, support peers, and contribute to a cohesive, collaborative professional learning community.

### Principle 4: Curricular Iterations

| P4   | Curricular Iterations                           |
|------|-------------------------------------------------|
| P4.1 | Structures for Iterative Pedagogical Refinement |
| P4.2 | Processes for Co-designing Teacher Resources    |
| P4.3 | Flexible Designs for Ready-to-Adapt Lessons     |

|      |                                                 |
|------|-------------------------------------------------|
| P4.1 | Structures for Iterative Pedagogical Refinement |
|------|-------------------------------------------------|

### Explanation

A core principle of our work was treating curriculum design as an iterative, collaborative process. Instead of finalizing lessons in isolation, we continuously refined activities based on teacher feedback, classroom observations, and student responses. Teachers became

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co-designers as they were involved in testing prototypes, adapting lessons to their local contexts, and sharing insights that shaped subsequent versions. This cycle of testing, reflecting, and improving ensured that the lessons and activities remained practical, culturally relevant, and meaningful to students.

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## Theory

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Inviting teachers to draw, share their drawings, or write reflections on their drawings, as these artifacts provide an excellent forum for critical reflection, which we know is essential to professional practice (Weber & Mitchell, 1996). When such reflective artifacts are embedded within iterative cycles of testing and refinement, they enable educators to make their pedagogical thinking visible, question underlying beliefs, and refine curriculum and instruction in context-responsive ways.

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## Examples

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**PII** We conducted classroom observations to see how teachers were using our resources with their students. After each observation, we provided feedback using the “What Went Well” (WWW) and “Even Better If” (EBI) structure, helping teachers recognize strengths and areas for improvement. For example, during one observation, we noted that Tilak asked insightful questions and structured student reflections effectively (e.g., “What did you learn? What did you struggle with? Anything interesting to share?”). We also suggested improvements, such as using a randomizer - popsicle sticks with student names, to engage all students and assigning students responsibilities for distributing and collecting materials to increase attentiveness and reduce preparation time. In a subsequent observation, Tilak implemented those suggestions, assigning a student to hand-out materials, which not only saved time but also fostered a sense of responsibility among the students.

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**PI** When teachers were asked to draw connections among play, making, storytelling, engineering, and learning, they used a variety of approaches (Figure 27). One teacher represented learning as a tree trunk with the other four elements as branches, while Anu compared the learning process to a Central Processing Unit, with play and making as inputs and narratives as output. Other teachers developed their own unique representations. The drawings also revealed shifts in teachers’ thinking over time. In his second representation, Rupesh added arrows to highlight relationships and possible connections among the components, indicating a more relational understanding of how play, making, storytelling, and engineering are interconnected. His use of arrows might have been influenced by observing colleagues’ representations during teacher community discussions, demonstrating the iterative nature of evolving pedagogies shaped by collaboration, observation, and exchange of ideas.

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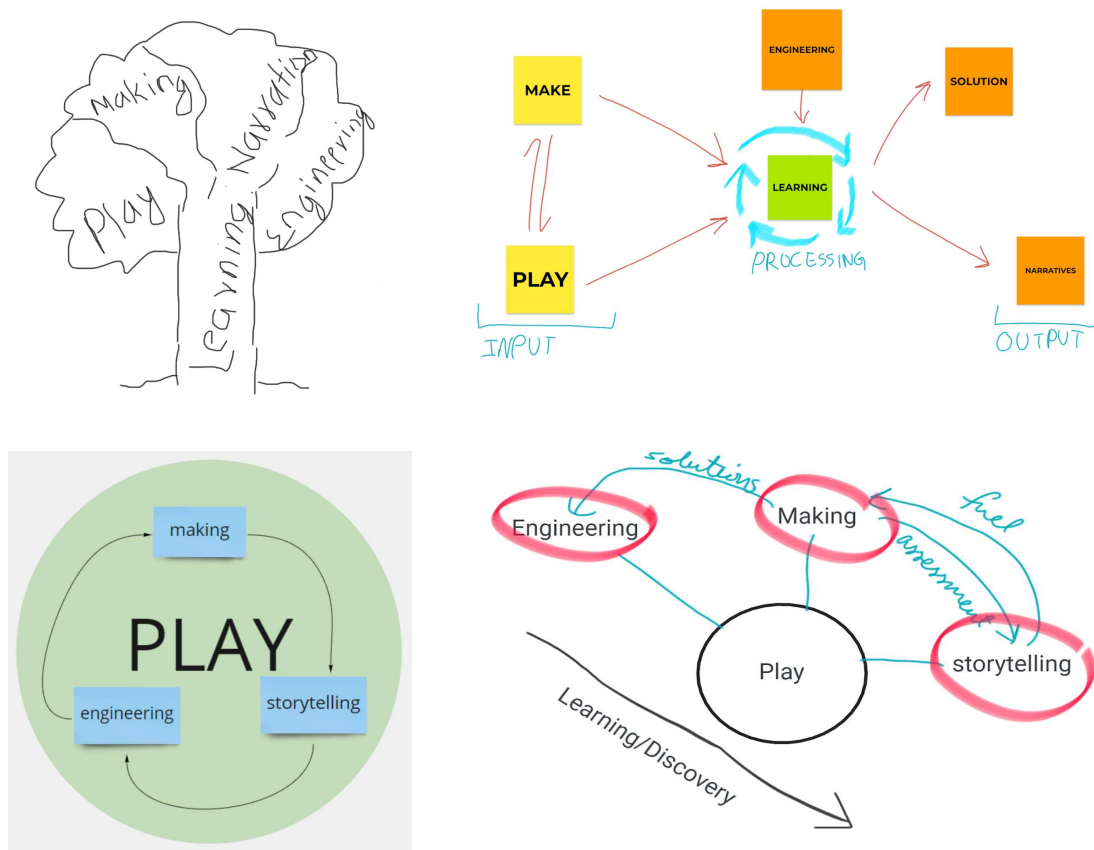


Figure 27: Teachers' representations

**PV** Teachers focused on revisiting and refining their representations to better reflect their evolving pedagogies and connections to school values (Figure 28). This iterative process helped teachers make their values and teaching practices more explicit and thoughtfully interconnected.

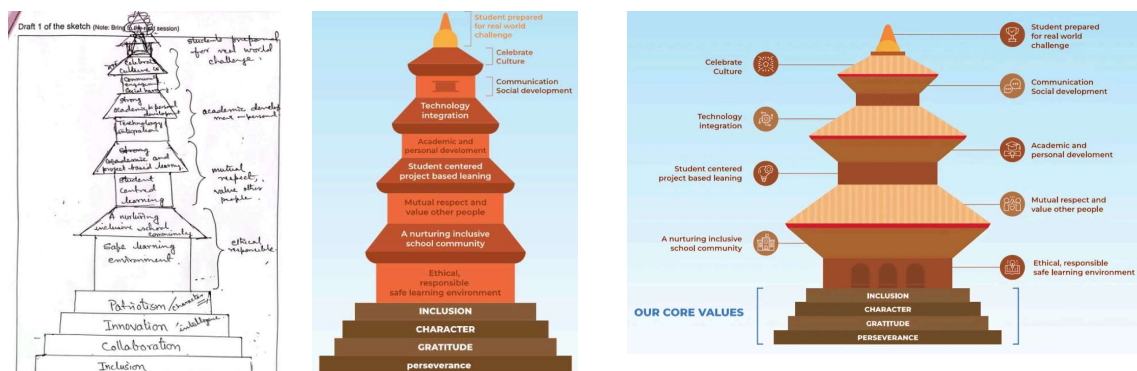


Figure 28: Rupa's iteration of her school's core values

## Implications

By engaging in continuous cycles of adaptation and reflection, educators are better equipped to respond to diverse student needs, integrate new pedagogical approaches, and sustain improvements in practice over time. Collaborative, iterative engagement can bridge the gap between professional design expertise and classroom realities.

**P4.2****Processes for Co-designing Teacher Resources****Explanation**

Co-designing teacher resources involved collaboratively developing, testing, and refining lessons to align with teachers' contexts and students' evolving needs. Through cycles of experimentation, reflection, and redesign, resources became more grounded in classroom realities.

**Theory**

Iterative pedagogical refinement draws on principles of design-based research which emphasize cycles of testing, feedback, and improvement (Brown, 1992; Collins et al., 2004; Edelson, 2002). By positioning teachers as co-designers within structured iterations, professional learning becomes a dynamic process where classroom insights, student responses, and peer feedback inform continuous adjustments.

**Examples**

**PII** **P III** In our work with early adopters, we received valuable feedback. Early adopters suggested that the educator guide be compiled into a single booklet rather than separately stapled sheets, so we consolidated all lesson plans and added sample lessons along with additional ideas teachers could implement in the classroom. Feedback also highlighted the need to refine some lessons. For instance, some students were confused by the word “wick.” Including a Nepali translation in brackets or labeling the “wick” in the student guide picture could have clarified this. In another example, when students were asked to think of real-world applications of chromatography, they struggled to come up with ideas, indicating a need for more scaffolding. They suggested adding a section in the student guide showing real-world uses, such as forensic applications popularized in TV shows like CID - a popular Hindi crime drama series, where chromatography can help test substances like blood or identify poisons. In response to such feedback, we focused on designing kits that supported free play while enabling meaningful learning, creating instruction sheets that allowed multiple outcomes and encouraged solution diversity, developing a teacher guide that offered opportunities to plan sessions with multiple variations, and producing videos that reduced preparation time for teachers.

In Phase III, we translated key resources, including the teacher and student guides, into Nepali. We also simplified complex language that students had struggled with in the previous phase. Providing the student guide in Nepali, the language most teachers and students in public schools in Gulmi and Hetauda are comfortable with, not only improved comprehension but also strengthened cultural connections, making the resources more accessible and relatable.

**PV** **P IV** In Phase V, teachers were introduced to a sample lesson based on Cultural Modeling (Lee, 1993), which links academic concepts to students' funds of knowledge from home and community experiences. To support this, they were provided with a lesson template that guided them in brainstorming ideas connecting target curriculum concepts with cultural datasets and familiar resources. This lesson template not only helped teachers

plan lessons effectively but also demonstrated how academic learning can be meaningfully integrated with students' everyday practices and cultural contexts.

Beyond providing lesson templates, we intentionally structured multiple layers of guidance, feedback, and revision to support meaningful iteration. In Phase IV, at Shramjit School, where the focus was on paper crafts, we introduced a pop-up card activity as an accessible entry point. However, the goal was not replication but progressive complexity. Kaushali began with this straightforward version, which students quickly replicated. She also documented student work through photographs and short reflections, which were shared in the PLC WhatsApp group and discussed in follow-up meetings. Inspired by online examples of more elaborate designs she shared with her students, gradually the students experimented with complex and creative projects, many of which are now displayed on the making space walls (Figure 29).



Figure 29: Photos of student work that the teachers shared on the PLC WhatsApp group

Similarly, at Saraswoti Niketan, the iterative process was even more structured. During the initial Novel Engineering sessions, Rupesh, an early adopter, facilitated sessions for grade 4 students while teachers observed. Afterward, the group met to debrief, identifying strengths and areas for refinement. Teachers then revised the lesson plans before leading sessions themselves with a new cohort. Feedback was gathered through classroom observations by Sameer and teacher reflections. For example, observation data suggested that the original four-week timeline was insufficient for students to deeply engage with the story and connect with characters, leading to an extension to eight weeks. Over time, responsibility gradually shifted: instead of relying on pre-made lesson plans designed by Karkhana, teachers co-designed and shared their own versions in advance of sessions, discussed them in virtual planning meetings, and revisited them after implementation.

### Implications

Collaborative resource development enhances relevance, usability, and teacher ownership. When teachers participate in refining materials, they are better equipped to adapt lessons thoughtfully, leading to more meaningful classroom experiences. Iterative co-design therefore strengthens both the quality of instructional resources and teachers' confidence in implementing them effectively.

## P4.3

## Flexible Designs for Ready-to-Adapt Lessons

**Explanation**

Providing a strong foundational structure while giving teachers the flexibility to adjust activities based on their classroom realities. Instead of rigid structures, the shared lessons and activities offered adaptable pathways that teachers could modify according to student needs, available materials, time constraints, and local contexts.

**Theory**

Asking teachers to design curriculum was unproductive because teachers often lacked necessary expertise to design materials and were not able to distinguish the most valuable uses for the technology. In addition to that, teachers also lacked preparation time. On the contrary, asking teachers to customize an existing curriculum designed by professional designers allowed teachers to focus their efforts on distinguishing effective pedagogical practices to address their students' particular learning needs (Gerard et al., 2011).

**Examples**

**P11** Teachers were introduced to drawing activities such as “How it Works” diagrams, where they illustrated the inner mechanisms of everyday objects. The activity proved highly engaging and generative, encouraging teachers to uncover the often-invisible complexity of familiar items. Several teachers later replicated the activity with their students, providing objects like staplers, punching machines, scissors, ballpoint pens, and water sprays for observation as they created the diagrams. Some also connected the exercise to science lessons on simple machines, integrating it directly into the curriculum.

Similarly, Tilak adapted the LED art lesson to test whether structured iteration would deepen student learning (Figure 30). Rather than conducting the activity as a one-time task, he redesigned it into four rounds, allowing students to revise and improve their work with each draft. He introduced small adjustments across rounds, such as advancing selected students and encouraging redesign to sustain motivation and increase challenge. Contrary to concerns that repetition might reduce interest, students' creativity and engagement grew with each iteration. Through this flexible adaptation of the lesson, Tilak recognized that designing space for revision and “safe failure” fostered deeper learning and ownership.



Figure 30: Photos of Tilak's students showcasing their work

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**P III** In line with adapting to local contexts, in Phase III, a Novel Engineering activity led to a rich discussion on the use of materials. The standard list we share includes popsicle sticks, rubber bands, toilet paper rolls, construction paper, wooden skewers, paper cups, and duct tape. These materials proved difficult to source in remote villages and raised concerns about replenishing supplies after projects were completed. When we introduced an art educator's idea of viewing materials through a different lens to include natural and locally available resources like leaves and branches, the teachers expanded the list with their own suggestions to include alternatives such as basket-weaving straw, bamboo, cane, clay, and sand.

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### **Implications**

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Providing teachers with a well-structured yet flexible curriculum empowers them to adapt lessons to their classroom realities, balancing guidance with autonomy. Rather than requiring teachers to design materials from scratch, which can be time-consuming, allowing them to customize professionally designed activities enables focused, context-responsive decision-making.

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Having articulated the design principles that emerged from this study, we now return to the 5 phases of implementation and the corresponding stages, to illustrate how these principles were enacted, refined, and sustained over time. While the principles offer a synthesized account of what guided the PLC's evolution, they were not predetermined; rather, they developed through iterative cycles of planning, experimentation, reflection, and revision across multiple phases.