Intentional questioning to promote thinking and learning

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A B S T R A C T

Questioning is an important cognitive activity that enhances teaching and learning. The quality of the questions that teachers ask plays an important role in promoting or hindering students' curiosity, thinking, and, consequently, their learning. Asking good questions is an art that requires the teacher's creative intervention to facilitate learning. Questions create zones of proximal development when teachers are able to grasp their students' prior knowledge, thinking, and inquiries to scaffold them to the next level. Moreover, effective questioning in teaching marks the difference between being a facilitator of learning opportunities or a consumer of someone else's ideas. This study reports on a participatory action research project of a learning community of practice in a Reggio Emilia-inspired preschool where the teacher and research team found a way to implement an intentional teaching through questioning. By using documentation to reflect on the questions that the teacher formulated, the teacher became more thoughtful about her questions and learned how to formulate better questions. Furthermore, Harvard Project Zero's Teaching for Understanding and Visible Thinking frameworks helped the teacher develop a better understanding of fostering an emergent curriculum within the Reggio Emilia philosophy. The experience helped the school build a strong identity and empower teachers to master their teaching with high-quality questions.

1. Introduction

In a conversation between a mother and her 5-year-old child, the mother tells her that God loves her because she has a family, food and shelter. The child responded with a question: When poor kids do not have a family, food, and shelter, is it because God does not love them? Education should be rooted in the understanding that children are the people of today, so their questions should be taken seriously. As Korczak (1967) said, children are not the people of tomorrow, but rather they are the people of today. They have a right to be taken seriously and to be treated with tenderness and respect.

Children's questions reveal what matters to them; therefore, curriculum decisions should respond to their interests and curiosity. Children's questions uncover their curiosity and help them become active meaning makers. According to Rinaldi (2006), the adult's role is to help children find meaning in what they do, encounter and experience.

Questions are the primary way teachers interact with students in the classroom.

Formulating good questions uncovers children's theories and inquiries. However, Pelo (2014) claims that it is common for teachers to silence children and lead them to meet the teachers' agenda. Teachers who overlook the potential of their children's questions might lose opportunities to learn about their theories, and scaffold their thinking to new directions. Berger's (In Schwartz, 2016) research

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revealed that children's questioning declines at approximately age 5 or 6. Children stop asking questions when their questions are not valued or promoted in schools, especially when the teacher's emphasis is on the answers more than on the questions (Pelo, 2014).

Learning to formulate good questions is critical to improving teachers' discourse in the classroom and leveraging their students' deeper thinking. According to Pelo (2006), growing a culture of inquiry requires professional development rooted in the inquiry process, one that aims to foster and grow the values, dispositions and skills of researchers. These values, dispositions, and skills include curiosity; willingness to linger with questions; commitment to constructing knowledge with others through dialogue, disagreement, and challenge; and attentive observation.

Teachers naturally serve as models for their students; thus, modeling and reflecting on their questions leverage the students' thinking. Students who are able to ask their own questions can follow their curiosity and tap into their own interests. Ritchhart (2012) claimed that questions are culture builders; thus, a productive way to approach this matter is for teachers to examine their own motives and goals for questioning in the first place. Teachers who visibly model and reflect on their questions motivate their students to think.

This study reports on a Participatory Action Research (PAR) experience from a learning community of practice in a Reggio Emilia-inspired preschool in South Florida. According to Stevens (2016), the participatory nature of PAR embodies a democratic approach to research in which participants work collaboratively in the cogeneration of new knowledge to address a specific issue or problem. The teachers were interested in improving their adult-child interactions (questioning) and exploring the relationship between Project Zero's Teaching for Understanding (TfU) and Visible Thinking (VT) frameworks and the Reggio Emilia (RE) approach. Some common principles of the VT, TfU and RE approaches are as follows:

- Children are capable of constructing their own learning
- Children are collaborators and learn through interacting with others
- Children are natural communicators
- Children can communicate using a variety of symbol systems
- The classroom environment works as a third teacher
- Use of documentation to learn about children and provide learning opportunities

2. Theoretical frameworks

2.1. The art of listening and questioning

The current thinking in the nature vs. nurture debate is that they are interconnected in the development of human thinking and learning. Nurturing children's thinking is both an art and a science. Teachers who want to nurture intellectual dispositions and habits of mind have the challenge of provoking curiosity to uncover children's theories and imagination, thereby giving them ownership of their learning (Costa & Kallick, 2015).

Children are naturally curious; thus, the teacher's role is to create provocative learning environments that nurture curiosity through high-quality, adult-child interactions characterized by formulating good questions from both sides. Curiosity occurs in the gap between learning something and being exposed to something new (Schwartz, 2016). In young children, an action can be a question for a young child.

The ability to ask questions is an important habit of mind. Students who learn to ask questions take control of their own learning. Teachers' questions also reveal their expectations about their students' potential as thinkers. Reflection on the type of questions that teachers ask is a metacognitive activity that helps teachers be more intentional. Because imitation is a powerful form of learning, much of what students learn about questioning and problem-posing is a result of the teacher's modeling (Costa & Kallick, 2015).

Teachers' interactions with children are highly influenced by both their teaching philosophy and their expectations about children's potential to think. These expectations are what Malaguzzi (1994) referred to as *the image of a child.* He viewed the child as rich in potential, strong, powerful, competent, and connected to adults and other children. The image of the child is, for him, where teaching should begin. Questions play an important role in defining the image of the child. Rinaldi (2006) proposed a *pedagogy of listening;* for her, teachers teach better when they observe their children's learning processes by documenting their work and making their experiences visible.

The ability to ask questions also leads to the creation of new ideas, new inventions and better solutions (Ritchhart, 2012; Rothstein & Santana, 2017). Additionally, questions challenge students to reflect on their theories and take different perspectives. Formulating good questions benefits teachers and children in the co-construction of knowledge and the development of a *theory of mind* (ToM). ToM is a social-cognitive skill that involves the ability to explain and predict other people's behavior almost as if we had read their minds (Gallager & Frith, 2003).

We used Costa's levels of questioning (Costa & Kallick, 2015) and Ritchhart's (2012) typology of questions in the classroom to better understand the power of questions and analyze their quality.

2.1.1. Costa's levels of questioning

According to Costa and Kallick (2015), questions are the gateway into students' thinking; to them, masterful teachers not only ask many questions, but they also purposefully design and pose questions that are appropriate for each learning goal. Thus, teachers promote critical thinking by using intentional questions so that the children will better understand concepts and act intelligently. Skilled questioning is related to intention (more about this given in the questioning and intentional teaching section).

Questions can occur on a variety of different levels, some easy and close-ended and others more multifaceted and open-ended.

Having an inclination to ask questions and knowing when to ask the "right" questions can greatly aid teachers when leading group discussions and study groups.

Costa developed three levels of questions to identify the type of thinking that questions provoke in children. This classification is aligned with Bloom's taxonomy to help teachers recognize the type of thinking that a question can engage children. Ritchhart (2015) claims that although Bloom's categories capture types of mental activity, they are a useful starting point for thinking about thinking. The idea that thinking is sequential or hierarchical is problematic. Furthermore, Ritchhart, Church and Morrison (2011) and Berger (2018) challenged the idea that thinking is sequential or hierarchical is problematic because learning occurs randomly in real life. For example, we can construct a paper airplane without knowing about aerodynamics; understanding occurs when we construct, not necessarily when we recite information. Learners usually build understanding *by applying knowledge* and creating *things* Berger (2018).

Costa's Questioning Levels:

- Level 1 (the lowest level) requires one to gather information. The goal of this type of question is to collect facts. Students are asked to define, describe, list, observe and so forth.
- Level 2 (the middle level) requires one to process the information. The goal of this type of question is for students to compare, contrast, classify, sort, distinguish, explain, infer, analyze and so forth. Students are asked to process the information generated from the Level 1 information-gathering questions.
- Level 3 (the highest level) requires one to apply the information. The goal of this type of question is for students to evaluate, generalize, imagine, judge, predict, speculate, hypothesize, forecast and so forth. Students are asked to use the processed information generated from Level 2 to take action.

According to Costa and Kallick (2015), the strategic use of questions can deepen learning, build a growth mindset, and help students become more aware of their own thinking processes.

2.1.2. Ritchhart's typology of questions

Inviting children to ask good questions sparks their curiosity. According to Ritchhart (2015), questioning is the chief way that teachers and students interact around content. Open-ended rather than closed questions are generally advocated as a means of going beyond knowledge and skills to open up discussion. Ritchhart's (2015) research identified the following question categories for teachers' classroom discourse:

- Review: Recalling and reviewing of knowledge and information. This involves questions that produce terminology, procedures, content, events, and context.
- Procedural: Directing the work of the class. This involves going over directions and assignments, clarifying and checking for attention and agreement, task completion, and organization- and management-related questions.
- Generative: Exploring the topic. These are authentic questions or musings that the teacher does not know the answer to or essential questions that initiate exploring a topic.
- Constructive: Building new understanding. These questions extend, interpret, connect, link, orient and focus on big ideas, central concepts, or purposes.

Table 1
Levels of Thinking and Questioning with Typology of Classroom Questions.

Typology of Classroom Questions *Ron Ritchhart*	Combined with	Levels of Thinking and Questioning *Arthur Costa*

Review
  Recalling and reviewing of knowledge and information
  Many teachers begin their classes with revision questions to activate previous learning.
Procedural
  Directing the work of the class
  They direct activity and behavior to focus on the content.
	Level 1 Gathering	Gathering information
		Book questions/memorization – information is either known or can be found in a book.

Generative
  Exploring the topic
  Essential questions that initiate the exploration of a topic.
 	
Constructive
  Building new understanding
  These are questions that ask to connect and linking ideas, make interpretations, focus on big ideas and central concepts.
	Level 2 Processing	Thinking about the information
		Questions enable you to process information. They expect you to make sense of the information you have gathered and retrieved form long-and short-term memory.

Facilitative
  Promotes the learner's own thinking and understanding.
  They ask students to explain or elaborate their thinking to make it visible. These are follow-up questions to students' responses that lead them to deepen their understanding.
	Level 3: Applying	Applying the information to new situations and making judgments
		Questions require you to go beyond the concepts or principles you have learned and to use these in critical thinking situations.

• Facilitative: Promoting the learner's own thinking and understanding. These questions request elaboration, reasons, evidence, and justifications. They generate discussions among the classes to hear different perspectives while clarifying and uncovering new ideas.

We combined Costa's levels of questioning with Ritchhart's typology of classroom questions (Table 1) to categorize the type and quality of the teacher's questions and then used them as a reference to objectively analyze the teacher's questions. The combination of these frameworks facilitates the analysis by focusing on the following: gathering, processing, and applying.

2.2. Questioning and intentional teaching

Questioning and intentional teaching are directly connected. Teachers should be thoughtful, purposeful and deliberate in their decisions, actions and questions. Intentional teachers align their curriculum, thinking goals, learning opportunities and discourse so that they cognitively engage children in problem finding and solving by creating meaningful and authentic conversations. This ensures that the children are better positioned to learn with a sense of belonging and well-being.

Intentional teaching occurs when adults reshape their intention from *teaching thinking* to engaging children in authentic conversations. Adults who ask questions to understand a child's thinking are promoting a child's search to make meaning — a search to *know*, rather than to *learn* (Pelo, 2014).

3. Pedagogical approaches

3.1. Teaching for understanding framework

Teaching for Understanding (TfU) is a framework for thinking and learning developed by Project Zero researchers in Harvard's Project Zero (Blythe & Associates, 1998).

This framework is not a methodology but rather is a vision of education that emphasizes understanding. What is understanding? It is the ability to use knowledge and skills in a flexible and creative way in different and new contexts to solve real life problems, create products and interact with the world around us.

The TfU framework (Table 2) has four elements that respond to three essential questions:

1 What do I truly want my students to understand? Why? (Throughlines and Understanding Goals (UGs))
2 What am I going to ask my students to do so they can reach those understandings? (Understanding Performances (UPs))
3 How are my students and I going to know that they are understanding? (Ongoing Assessment (OA)

3.2. Visible thinking and cultural forces

Visible Thinking (VT) is another Project Zero research-based initiative that aims to integrate the development of students' thinking with the content they are learning across subject matters. According to Ritchhart (2015), thinking happens when the group's collective

Table 2
The TfU framework.

Central questions about teaching	Teaching for Understanding framework
What shall we teach?	**Generative Topics (GT)** are the most important concepts and ideas you want your students to understand. The generative topics should offer opportunities for multiple connections, should be interesting to the students and accessible to them.
What is worth understanding?	**Throughlines and understanding goals** (UGs) represent one element and they differ in size. The throughlines are the overarching questions that help us look at the "big picture" before launching into the specific work of planning individual curriculum units. The understanding goals focus on the central aspects of a generative topic that students must reach. They represent the places where we want the students to go and not the actions that they undertake in order to reach those destinations. These elements respond to the first essential question.
How shall we teach for understanding?	**Performances of understanding (PU)** are action accompanied by thinking skills where the students go beyond the information given to create something new by reshaping, expanding, extrapolating from, applying, and building on what they already know. The best performances of understanding help students both develop and demonstrate their understanding. This element responds to the second essential question.
How can students and teachers know what students understand and how can students develop a deeper understanding?	**Ongoing assessment (OA)** represent the cycles of feedback that the students receive in order to improve their learning and foster understanding. Its purpose is to inform both students and teachers about what students currently understand and how to proceed with subsequent teaching and learning. This element responds to the third essential question.

thinking and each individual's thinking are valued, visible, and actively promoted as part of the regular day-to-day experience of all group members. VT fosters deep learning, cultivates engaged students, and develops thinking dispositions. (Ritchhart, 2015) proposed eight cultural forces that could shape a classroom's culture:

- **Expectations.** Adults' expectations of their students' potential are critical. High expectations demand more from the students while low expectations hinder students' learning.
- **Opportunities**. Teachers who have high expectations will provide students with opportunities to think and learn. High-quality performances involve good thinking.
- **Thinking routines and structures**. Adults who value thinking use strategies that promote thinking. For example, what do you see? What do you think? What do you wonder? (See-Think-Wonder) What makes you say that? There are many other thinking routines that scaffold students' thinking to the next level.
- **Language and conversations**. It is important for children to use the language of thinking in conversations, which helps them develop metacognition or thinking about thinking. Language is also important for listening, community building, initiative and more.
- **Modeling.** Children learn from what they see. Teachers' actions give children messages; we want them to also see the teachers as thinkers and learners. Upon modeling, the teacher gradually releases responsibility, giving the student independence.
- **Interactions and relationships**. All children can think; thus, teachers should create an environment of trust, respect, active listening and perspective taking.
- **Physical environment**. Displaying children's work (documentation) on classroom walls makes their thinking visible. This concept was inspired by the Reggio Emilia philosophy, where the environment is considered a third teacher. It acts as a place of shared relationships among the children, the teachers, and the families.
- **Time**. Children need time to think about and reflect on their learning. Deep learning takes time, and teachers should give students time to focus on conceptual understandings by finding evidence and applying these conceptual understandings.

Within these cultural forces, the VT approach is characterized by the use of thinking routines, documentation and study groups, very similar to the Reggio Emilia approach.

3.3. Reggio Emilia approach

The Reggio Emilia (RE) approach originated in the town of Reggio Emilia in Italy after World War II. Loris Malaguzzi initiated the movement towards progressive and cooperative early childhood education in response to the parents' and the community's desire to have high-quality education for young children who would spend their time in preschools while their parents worked to reconstruct the country.

The RE approach is driven by the idea that children are capable of constructing their own learning. Children can build an understanding of themselves and their place in the world through their interactions with others. Children are communicators, the environment is the third teacher, the adult is a mentor and guide, and documentation is critical for individual and group learning. Both the curriculum and the pedagogy are shaped by the children's curiosity. Four important elements in RE-inspired schools are the emergent curriculum, in-depth projects, documentation and study groups.

3.3.1. Emergent curriculum

A classroom's curriculum emerges from the interests and questions of the children and is captured in the documentation. The RE approach uses the term *progettazione*, meaning to project to the next steps, to describe the curriculum. Teaching and learning become an art that RE educators express through the use of *progettazione*, a project curriculum constructed with pedagogical documentation (Rinaldi, in Edwards, Gandini, & Forman, 1998). Just as pedagogical documentation is constructed, *progettazione* is constructed in the process of each experience or project. The curriculum is adjusted accordingly through continuous dialogue among teachers and children throughout the process of creating pedagogical documentation (Gandini & Goldhaber, 2001). It emerges from the reflection/interpretation of pedagogical documentation and shapes the intentional teaching that determines the next steps (Edwards et al., 1998).

3.3.2. In-depth projects

An important aspect of the RE approach is the children and teachers' engagement in in-depth projects geared to solve problems. The projects are often introduced to children as provocations and can last anywhere from a week or two to the entire school year. Teachers are partners in the learning process; they carefully explore their children's curiosity and facilitate projects to emerge based on the children's interests.

3.3.3. Documentation

Documentation is a critical principle in the RE philosophy. It provides teachers with an opportunity to reflect on their teaching and explore the children's questions and interests. Documentation is an invitation to revisit experiences, share interpretations and make pedagogical decisions; it goes beyond just recording experiences. Documentation is also useful for involving the families and the community in the conversation. According to Kashin (2019), pedagogical documentation enables teachers to imagine or theorize understanding, present evidence of what they think they see, and collect data to inform their decisions about what to offer the children,

thus influencing the curriculum design. Displaying their documentation gives children the message that their work is valued.

3.3.4. Study group

Teachers reflect on the work, or documentation, the students generate in their groups. The study groups build communities of practice that are powerful for understanding and implementing innovative ideas such as those discussed in this paper.

4. Methodology

This was a participatory action research (PAR) project. PAR combines theory and practice, action and reflection; it involves researchers and participants working together to understand a problematic situation and change it for the better, as stated by Jacobs (2016). It encourages practitioners to be in control of their own lives and contexts. The authors, in our role as participant observers, observed the teacher and her students once a week for six months during circle time. This was followed by a study group session between the authors and the school staff.

4.1. Research questions

- How are the TfU and VT frameworks and the RE philosophy aligned to determine curriculum decisions?
- What are the effects of questioning in children's thinking and learning?
- How do teachers benefit from learning communities of practice?

4.2. Setting

The study took place in an urban private preschool inspired by the Reggio Emilia approach. The school also implements the Teaching for Understanding (TfU) and Visible Thinking (VT) frameworks. The school's teachers have high expectations for their children as thinkers; thus, they are constantly exploring opportunities for promoting children's thinking and making children's thinking visible through documentation and study group sessions for individual and group learning.

4.3. Participants

The study focused on one teacher who assumed the role of the participant researcher and her 15 four-year-old students. According to McNiff (2016), conducting research in the workplace means involving research participants.

The research team consists of the authors (two college professors) and a doctoral student with the role of participant observers. Under this capacity, they were able to have a closer look at and greater involvement and natural connections with the participants while simultaneously collecting data (McNiff, 2016). Four other teachers from the school who also joined during the study group sessions acted as critical friends. In action research, critical friends are colleagues willing to discuss each other's work, receive and offer feedback and help their colleagues see things in a new light (McNiff, 2016).

4.4. Data collection and analysis procedures

The teacher and research team documented the adult-child interactions during circle time on a weekly basis throughout the study. They led a study group session, including critical friends, in the afternoon of the same day. The documentation comprised videos, field notes and pictures and the teacher's reflections. To triangulate the data, the research team conducted a survey using the research questions at the study's completion and invited the teachers and children to share their concepts about thinking in the first and last study group sessions. They teachers did the same thing as the children but used the drawing-telling technique (Salmon & Lucas, 2011) to uncover children's concepts about thinking. Triangulation is a way to obtain data from more than one source and to show how the data from these different sources support the explanations to assure the validity of the research (McNiff, 2016).

The research team also used the Looking at Student Thinking protocol (LAST) (Ritchhart, 2015) to analyze adult-child interactions. The roles of the study group members are the following: the presenting teacher, the facilitator, the documenter and the critical friends. In the study group sessions, the research team shared a video and documentation that caught the teacher and team's attention. The presenting teacher listened to the discussion and questions about the documentation and ultimately responded. The facilitator, usually one of the authors, kept track of the time, asked the lead questions for each phase and redirected them as needed. The documenter recorded the group's discussion. The critical friends contributed to the discussion. The discussions served to clarify the teacher's intentionality and ideas in her efforts to help children deepen their conceptual understanding and set improvement goals.

5. Findings and discussion

The teacher's self-reflection and the research team's feedback opened doors to analyzing the quality of the teacher's questioning and implications in students' thinking and learning. The categories that surfaced from data coding were philosophical concepts about the RE approach and the TfU, conceptions about the roles of the child and the teacher, and questioning.

5.1. Reggio Emilia and the TfU framework alignment

The research team and school staff were interested in understanding how the TfU and VT fit with the RE philosophy. First, when we asked the teacher to share her understanding goals (UGs), she responded as follows: *Reggio-inspired schools do not set up UGs because they work with an emergent curriculum.* This was a misconception because in the Reggio Emilia approach, educators use *progettazione* to align with children's interests, which evolves into emergent curriculum. The author recommended the Reggio Emilia video documentary entitled "An Amusement Park for Birds" (Forman, 2020). The video recorded the educator's curriculum projections and goals that are similar to the TfU understanding goals. *Progettazione* emerges from the reflection/interpretation of pedagogical documentation and shapes the intentional teaching that determines the next steps (Edwards et al., 1998).

Like *progettazione*, with the TfU framework, teachers aim to engage students in higher-order thinking experiences to solve problems through deep understanding. The UGs define the possible destinations in an emerging curriculum. The Performances of Understanding (PUs) are aligned with the Ongoing Assessments (OAs), and it is possible to determine the direction of the project and future PUs with the help of the documentation.

5.2. Documentation

The use of documentation offered multiple opportunities to analyze the roles of the teacher and the children and the quality of their interactions. Malaguzzi's idea of pedagogical documentation makes children's thinking visible and accessible for children, teachers and parents. The research team brought to the teacher's attention that the documentation was visually inaccessible to the children. The teacher consequently rearranged the room to display the documentation at the children's eye level, letting them use it to support their ideas. The next day, the children spontaneously focused their attention on their drawings to re-visit their ideas. This was a provocation to continue the conversation about the parts and purposes of the plants. Consequently, the teacher considered suitable to modify some hands-on experiences to help children test their hypothesis.

5.3. The image of the child and adult-child interactions

The image of the child responds to adults' expectations. One of the cultural forces is having high expectations for children as thinkers. Vygotsky (1978) said that children grow into the intellectual life of those around them.

Children's cognitive involvement occurs when conversations revolve around their theories and questions. The teacher was strong in giving children a protagonist role; however, the quality of her questions hindered the children's generative and constructive thinking. The teacher was serious about respecting the children's theories, but her questions limited them to continue building on misconceptions. The lack of an understanding goal and the type of thinking needed to understand the topic impeded the teacher from offering opportunities (understanding performances) to propel learning. An example was the children's theory that plants grow from rocks, and the teacher's questions were not helping to change their misconceptions. The transcript below illustrates the adult-child interactions that persisted for several weeks. The children were determining where plants come from as they observed some plants.

> Teacher: Let's think a little bit about what Mario said. Mario said that the beans became rocks and a plant was born from the rock. Can plants be born from a rock? Chloe?
> Luis: No
> Teacher: Let's give Chloe some time. Chloe? If I plant a rock, can a plant grow from the rock?
> Chloe: (moves her head, affirming)
> Teacher: Chloe says yes, let's see here (the teacher writes Yes and No on the board); the teacher continues, Chloe says that a plant can be born from the rock. Chloe says yes.
> Mario: Me too.
> Teacher: Mario, Luis.
> Other children: Me too.
> Teacher: So, do you think that if I put a rock in soil and water it, give it sun, a plant can grow?
> Several children: Yes
> Teacher: Yes? OK, so all of you agree with that?

The example illustrates that the teacher neither scaffolded the children's thinking nor mediated their construction of knowledge. The emergent curriculum depends on the quality of the questions and conversations. Thus, the PAC directed the role of formulating good questions to scaffold children's thinking.

5.4. The power of questions

High-quality questions give children opportunities to uncover and externalize their thinking; children develop confidence when they see that others value their contributions. The quality of the questions determines the teacher's intentionality and curriculum decisions. Questions either promote or hinder children's curiosity and thinking. Good questioning not only helps students succeed in the specific, assigned cognitive task, but it also helps them learn how to cultivate the dispositions they will need to persist and thrive in all subject areas (Costa & Kallick, 2015).

A question can either engage children in good thinking or limit them to yes/no answers or fact retrieval, which disengages them.

The teacher's initial questions were close-ended (yes/no), as the previous example shows. After observing herself in videos, she became aware of the type of questions that she was using let her move from level 1 close-ended and gathering questions (or yes/no questions) to asking level 2 processing questions and then asking to level 3 questions that involve higher order thinking (see chart 1).

Thinking about thinking is critical to supporting children's learning how to learn ability. The quality of the teacher's questions determines the type of thinking that children can use to pose or solve a problem.

This PAR helped the teacher develop the ability to formulate questions with intention. The previous example showed that her predominant level 1 questions (closed and review questions that consisted of short answers or information retrieval) put her students in a passive position and at basic thinking levels.

> Teacher: …If I plant a rock, can a plant grow from the rock?
> Chloe: (moves her head, affirming)
> Teacher: Chloe says yes, let's see here (the teacher writes Yes and No on the board). The teacher continues: Chloe says that a plant can be born from the rock. Chloe says yes.

These types of questions only give children the option of a "yes" or "no" response.

Upon analyzing the adult-child interactions and recognizing her level of questioning, the teacher became more conscious of their limitations and switched to a more intentional discourse. The transcript below shows how the teacher's questions narrowed the children's responses to gather data. Questioning became a valuable habit of mind.

> Teacher: Elisa, what are the leaves for?
> Elisa: The leaves are to swim to.
> Teacher: Can plants swim?
> Elisa: But … they do like this (moves her arms).
> Teacher: Do you agree with that, Luca?
> Luca: Yes.
> Teacher: Do plants swim?
> Luca: Yes, when they drink water.
> Luca: No, they don't swim.

Upon studying how to formulate better questions, the children's responses were more generative. This was motivating for the teacher and helped her shift from information-gathering questions to questions that required the children to process and apply that information. Good questions helped the children build on their prior knowledge and made their learning more meaningful, and they used more critical thinking to build concepts to solve problems. See the teacher's questioning progress below.

> Teacher: And what happens when the sun shines on the leaves? Why do the leaves need the sun, Chloe?
> Chloe: Because they will die unless they have sun. So that the water goes up the plant.
> Teacher: That is to bring water up the plant?
> Chloe: And to hold the leaves. So that they don't fall, and in that way, stay up.
> Teacher (records these ideas while Chloe talks and says): To grab the leaves and to bring the water to the leaves. What happens if we don't have the stem?
> Chloe: They fall.

The teacher was constantly asked throughout the study, "What is your Understanding Goal? What do you want the children to understand?"

Gradually, the teacher's questions evolved into more cognitive questions, giving the children the flexibility to apply what they knew in different contexts or, in other words, to demonstrate their understanding. See this in the conversation below.

> Chloe: When plants grow, they die. When they grow very large, they die.
> Teacher: What makes you say that?
> Chloe: This one is almost big and she is about to die.
> Teacher: So, you think that when plants grow, they die, and what makes you think that?
> Chloe: Sad, because I love plants.
> Teacher: But those trees that we see on the street are very, very large, do you think they are going to die soon?
> Chloe: They are not going to die because nobody plants them, somebody made them. When someone plants something they die, but when someone makes something, they don't die…
> Teacher: So those trees outside somebody made them? And how do you know that?
> Chloe: They sent them a lot of wood, a lot of big wood because it is very large and they also picked up some leaves from other plants that died on the floor and then made the tree, they didn't plant it, they made it.

The child's theory was a misconception; for her, small plants are living creatures that grow and die while large trees are made (built) from parts of plants that are dead. The child's misconceptions informed the teacher of the child's theory, allowing her to scaffold her thinking to the next level.

The teacher began to replace her closed and review questions with constructive and facilitative questions.

5.5. Cultural forces at work

The analysis of cultural forces in the classroom occupied a space in the study group conversations. The teacher claimed to have high

expectations for her students' thinking, but her questions did not reflect this. Revisiting the documentation enabled her to recognize that a gap existed between her expectations and the opportunities to engage her students in cognitive activities. Later, when she began to use VT thinking routines such as "What do you See-Think-Wonder?" or "What makes you say that?", she noticed that those tools cognitively engaged her students.

6. Conclusions

Participatory action research (PAR) is powerful for supporting teachers' growth. The TfU, VT and RE approach philosophical principles line up to engage teachers in teacher-researchers roles to improve their practice. Malaguzzi (in Edwards et al., 1998) said that education without research or innovation is education without interest. The use of documentation is critical in the process. Documentation makes students' thinking and teachers' teaching visible and open to continuous improvement, which is an important habit of mind.

The PAR contributed to the teacher's attention to thinking about thinking (metacognition) and questioning. Her initial concept of thinking expanded as she became aware of the type of thinking she was modeling and fostering in her students when asking questions. This shift helped her become more intentional in her teaching as she began to put thinking up front when asking questions and planning a learning experience.

The literature suggests that children learn best when teachers build on their prior knowledge to make learning meaningful, functional and cognitively engaging (Vygotsky, 1978). Good questions are vital in understanding children's thinking to mediate their construction of knowledge. Teaching children to formulate their own questions also empowers them, and they will learn how to learn and take control of their learning. When the teacher improved the quality of her questions, she was able to dig into the students' thinking; consequently, she was able to scaffold their thinking that resulted in learning.

By connecting the TfU, Vt and RE philosophical principles, the school fortified its philosophy and identity. The PAR gave the teacher the opportunity to refine her question formulation skills to improve adult-child interactions. She became intentional in shaping the culture of the classroom around thinking.

Howard Gardner, a strong RE supporter and one of the developers of the TfU framework, said:

> The 'RE Approach' in other parts of the world, outside Reggio Emilia, only makes sense if we are capable of re-inventing it, if we are capable of understanding the context we work in, the values in which each culture believes, and then compare these with what RE has been capable of creating in its own specific context, and with its own resources. (Quoted in Rinaldi, 2013: p11)

The focal teacher understood the role of *progettazione* and an emergent curriculum, the connection with the TfU and VT frameworks, and the role of teachers as mediators of knowledge and as provocateurs. Malaguzzi (in Edwards et al., 1998) said that teachers must seek to capture the right moments and then find the right approaches for bringing together their own meanings and interpretations with those of the children into a fruitful dialogue. Good questions and thinking routines play important roles in uncovering children's thinking. Asking a good question relates to a student's thinking and the creation of learning opportunities. Questioning is an intellectual tool for students and teachers; it empowers students and gives them ownership of their learning. Similar to other research (Rothstein & Santana, 2017; Salmon, Campo, & Barrera, 2019), this study provides evidence on student cognitive engagement and deep learning as a result of teachers' reflection on the quality of their questions.

CRediT authorship contribution statement

Angela K. Salmon: Conceptualization, methodology, validation, formal analysis, supervision, resources, data curation. Draft original writing, review & editing, and visualization. Preparation, creation, and presentation. Oversight and leadership responsibility. Funding acquisition.

Collaboration between Angela K. Salmon and Maria X. Barrera: Investigation: Conducting the research and investigation process, classroom observations and study group discussions. Co-edited the revised publication.

Maria X. Barrera: Software, digital data collection, management and coordination responsibility for the research activity. Designed table 1. Management activities to video tape the sessions and code the data for interpreting the data for initial and later reuse.

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