Dripping Water Wears through Stones:
Small Changes to Bring Your Teaching to the Next Level

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Introduction

In the first article of this series, Tina Grotzer, Emily Gonzalez, and Tessa Forshaw set a vision for Next Level Learners—ones who are agentive and self-directed, who focus on developing flexible expertise and know how to use their minds effectively. Next Level Learners are also integrated emotional, cognitive, and cultural beings who reflect upon their own cultural and contextual assumptions.

What are some practical steps that educators can take to nurture the growth of Next Level Learners? Teaching is complex and it takes time and effort to master the art of teaching. There is a Chinese idiom: 水滴石穿 (shui di shi chuan), about how the continuous dripping of water can wear through a material as strong and hard as a stone. It speaks to the power of continual effort at making the most challenging changes: if we change a little bit of what we do, small as a drop of water, over time, we will see the transformation of ourselves and our learners.

Here are the four things you can do today to bring your teaching to the next level.

1) Put learners' agency at the center of teaching

Putting learners' agency at the center is one of the most powerful things that educators can do to encourage agentive learners. In an earlier piece in this series, Tina Grotzer described the characteristics of agentive learners who are self-driven, engage in progressive problem solving, and know how to use their minds effectively.

How can educators support learners' agency? There are many ways to afford agency to learners, such as giving them choices in how they learn, how they express their understanding, and how they shape their learning environment. For example, educators can make the classroom space malleable by allowing learners to adjust their physical working space and work in an environment that facilitates the entering of a "flow state". In some forms of pedagogy, learners play a central role in what they learn. For example, in the Living Curriculum, learners and educators together set the curriculum and map out the learning path. [1]

One form of agency in learning that is less talked about is the agency to engage in sense-making. Cognitive science research has shown us that human brains are not empty slates, but active builders of models. Therefore, knowledge cannot simply be transmitted—for learning to happen, learners have to do the heavy lifting of sense-making for themselves. What does it mean to engage in sense-making? From a very young age, we actively test things out and build models to make sense of the world around us. Research shows that babies and young children think, draw conclusions, make predictions, look for explanations, and even do experiments[2]. Such active processing has to take place for learning to happen. Educators, therefore, need to put learners' agency at the center and give them the time and space to do the intellectual heavy lifting and sense-making.

It is important to note that respecting learners' agency is not asking them to figure out everything by themselves. Teaching is what enables them to "stand on the shoulder of the giants" and inherit the extensive wealth of human wisdom accumulated over the past 50,000 years[3]. Learners will try to make sense of a phenomenon using their knowledge and lived experience, but when they reach a "ceiling" of sense-making, scaffolding their processing by providing information and experiences will help push their thinking further. Teaching is therefore necessary to challenge our default thinking patterns and to bring our current understanding to a new level by actively revising and sometimes rejecting and trading up for more powerful explanatory models.

What does a balance of "teacher guiding" and "learner sense-making" look like? For instance, when learning about conditions of combustion, children often relate to putting out the fire with blowing out their birthday candles. They might know that blowing air extinguishes the fire. However, it is unlikely that they will figure out non-obvious conditions, such as the importance of available oxygen by themselves. In this case, you can scaffold their sense-making by giving them new experiences, such as putting out a candle by placing a glass over it to deprive the fire of oxygen. Children will realize that, in this case, their previous understanding of 'blowing air' cannot explain why the fire went out. You can also challenge learners' perception with real-life examples of how wind can spread the wildfire further rather than putting it out; here, a more powerful explanation is required. In this case, teaching about oxygen is not telling children the answer, rather you are offering information as a piece of the puzzle for their sense-making.

2) Focus on the learners' sense-making and dialogic discussion to teach for deeper understanding

It is important to note that teaching for deep understanding is not merely shifting from "teaching-by-telling" to conducting hands-on activities. In an earlier piece of this series, Tina Grotzer identified seven characteristics of deep understanding and offered practical tips that teachers can adopt. She revealed the nature of deep understanding as that which "is flexible, nuanced, empowering and often applicable in multiple contexts, and leads to a sense of confidence, engagement, and often, a greater sense of humility about what is and is not understood."

A powerful way to teach for deep understanding is through dialogic discussion, which provides opportunities to reveal learners' initial understanding, unpack conceptual and structural knowledge of hands-on activities, and engage students in the authentic epistemic practice of the discipline, such as scientific argumentation. However, orchestrating a productive discussion is challenging—as it requires educators to contingently respond to the dynamic flow of student talk. In my research, I work with teachers to co-design a professional learning program using mixed-reality simulation (Mursion) to simulate the fast-paced and improvisational nature of classroom discourse, through which teachers practice leading discussions in a low-stakes environment, just as a pilot learns to fly a plane in a flight simulator.

What are some actionable tips to facilitate productive discussions for deep understanding? First, attend to learners' process of sense-making rather than focusing on whether an idea is right or wrong. For example, when reasoning about how dissolving takes place, a student said "I tried to crush salt really hard, but no matter how hard I try, I can always see them. I can't believe that water is stronger than me that it can make salt so small that it disappears!" At first glance, this idea seems wrong and does not align with the scientific explanation. However, when we pay closer attention to the sense-making process, we see that the student is trying to understand the

underlying mechanism of dissolving by relating it to their experience of crushing salt. It seems the student has some notion of a particle model but lacks an understanding of the polarity of molecules and the relational causality of dissolving. Rather than evaluating this idea as right or wrong, we should ask ourselves "how do I help students move their thinking forward?"

Secondly, you can intentionally use pedagogical tools, such as "talk moves" to foster a productive discussion. In their research, Sarah Michaels and Catherine O'Connor found a number of talk moves that are associated with productive academic talks. For example, the "say more" family of talk moves encourage students to expand and elaborate on their own or others' ideas such as "Can you say more about that?", "What do you mean by that?", Can you give an example?"[4] You can find nine talk moves in the Talk Science project.

Thirdly, leading a productive discussion requires both zooming-in and out, like a road trip—we need to pay attention to each turn and the overall direction of where we are going. In a productive discussion, educators attend to each turn of talk, and at the same time keep in mind the connections among student talk and the direction of the discussion, the goal of which is to push student thinking forward.

3) Embrace learners as a whole person and empower learners to do the same

Learning is not merely a cognitive process but is deeply intertwined with emotions. For learning to take place, learners must feel emotionally safe and open. Therefore, educators need to be intentional in fostering a safe and open space where different voices are heard and respected, so ideas can resonate, clash, and give birth to new ideas. Such open classroom norms can be set by having students decide on the "ground rules" in the classroom, just as they might do in the playground. One example of a ground rule is "we will pay attention to what others say and give good reasons for our contributions." Ground rules are seemingly simple, but it is a big step towards a culture change in the classroom. Classroom culture is important as it has implicit assumptions and expectations that shape explicit behaviors.[5] Many educators already practice some versions of ground rules in their teaching. It is important to note that setting ground rules is not a one-off event. Ground rules evolve over time and with different needs, and it takes time and reinforcement for culture to take root. It can take 6 -12 months to fully establish classroom culture.[6]

Educators can also leverage emotions to foster learning and motivation. For example, Megan Powell Cuzzolino showed in her research that epistemic emotions ('the finding-out emotions") foster conceptual change and motivate further learning towards something larger than oneself[7].

Furthermore, educators can empower learners to attend to their cognition and emotions. For example, we should not only be mindful of embedding a growth mindset in our feedback and interactions with learners, but also equip them with the tools to cultivate a growth mindset in themselves. For instance, we can teach learners to pay attention to their inner dialogue (e.g., I am not a math person) and the power of "yet" —recognizing that they have a choice (e.g., I might not know how to tackle this math problem yet, but I will figure out how by seeking support from my teacher and my friends).

In the Next Level Lab, we are developing materials and tools in the "Next Level Learner Moves Project: Acting like Fast Fish" for educators to empower learners to understand the cognitive architecture of their minds to bring their learning and work to the next level.

4) Recognize yourself as a learner

It is often overlooked that educators are learners as well. Educators are learners who learn to teach and learn with their students. Bryan Mascio said "Teaching is, after all, a complex intellectual skill. Those who are learning that skill, or learning to improve that skill, are at their core learners—even while they are simultaneously the teachers of others."[8]

It is often said that teachers teach the way that they were taught. The experience of being a learner embeds implicit and deeply held beliefs and assumptions about how learning works. There is often a significant discrepancy between the way most teachers were taught and effective pedagogy. Mascio shared a paradox in his research, in which a novice teacher attempting to use a constructivist approach in her teaching and argued for why it was so important, talked about how she preferred to be told when it came to her own learning. If we were taught throughout our life using an instructionist approach, it is likely that we assume that learning is accumulative, and teaching is to transmit knowledge. Rather than going through a slow process of sense-making, we might find that we prefer the shortcut of telling. Therefore, a large part of learning is in fact unlearning. According to Grisold, Kaiser, and Hafner, unlearning is not about eliminating previous knowledge, but rather a process where we reduce the influence of entrenched ways of thinking to create new knowledge and patterns of thinking[9]. Therefore, teachers need to be reflective of their own beliefs about teaching and be mindful of how it can influence their practice.

In the most recent piece of this series, Ashley Etemadi and Chris Dede illustrated the unprecedented advancement of technology in artificial intelligence and how it is transforming the landscape of education and the workplace. As Tina Grotzer has said, "today's knowledge might become tomorrow's misunderstanding." Teachers have to constantly update their repertoire of knowledge and learn with and from their students. There is evidence that when teachers position themselves as partners who share epistemic authority with learners such that everyone is learning and finding out together, rather than mentors who know it all, learners are more likely to take on a disciplinary identity (e.g., being a scientist, historian) and appropriate the disciplinary practice.[10] In this aspect, the teacher is acting like a good mentor who has deep conceptual and structural knowledge in their domain and who behaves similarly to how a good doctoral program supervisor would. Though they might not know the answer to your specific research question, they can help you to map out the terrain to find out the answer together.

Conclusion

In this article, we considered four ways that you can bring your teaching to the next level.

First, put learners' agency at the center. Next time, before you are about to make a decision in the classroom, ask yourself whether it can be made by the learners instead. Before you give an answer to students, ask yourself "who is doing the heavy lifting of sense-making?" Secondly, design learning experiences for deep understanding that engage students in the process of sense-making and use productive dialogue to support it. You can ask yourself — what are the learners trying to make sense of here? How do I help my learners to move their thinking forward? Thirdly, embrace learners as a whole person and teach them to do the same. Think about —do learners feel emotionally safe in my classroom? Does my teaching acknowledge both the cognition and emotions of learners? What can I teach students about how to learn? Finally, recognize yourself as

a learner and reflect on—what are my beliefs and assumptions about teaching and learning? How are they influencing the way I teach?

So, what would you like to do differently today to move your teaching to the next level?

Bio:
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