Teachers as learners
Freely revisiting fundamentals

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This month, I would like to share with you a research paper (actually, a monograph) that is almost like a story.

And a very gripping story, at that!

What do you think could happen if a group of serious, playful adults (who also happen to be teachers) is presented with a random set of objects and asked to play with them *just as they choose*? [Do I hear you say: "But this is what we would do with children!"?]

Well, here is precisely such an account: Eleanor Duckworth (one of Piaget's research students) gave the objects shown alongside to a group of teachers, and told them to do *whatever interested them*. Now that is quite a bizarre medley, isn't it?

So, my first awestruck moment was when I saw the totally unstructured start to this lesson … or *was there an intended lesson*? Her selection of objects provided a trigger for unfettered exploration by these adults. The main reason that this particular story turned out to be so gripping, in the author's own words, is: It was their willingness to be perplexed, and to struggle publicly with their own perplexities, that created the story.

It was this sentence that totally sucked me into the paper. Which of us (adults) is willing to get (and remain) perplexed? And what's more, to *display that publicly*? Duckworth showed me the supreme importance of this trait in learning, regardless of one's age, reputation or experience. As she points out, "It's not easy to create something respectable to do with such a nondescript collection of materials, and it is very easy to feel foolish".

Monograph: *Inventing Density*, Eleanor Duckworth (North Dakota Study Group on Evaluation)
Source: http://www.ndsg.org/monographs/NDSG_1986_Duckworth_Inventing_Density.pdf

Plastic dishpans and pails; water; glass, plastic and metal containers, with and without covers; escargot shells; nuts and bolts; odd pieces of wood, some hard, some soft; straight pins; corks; scrap metal; Styrofoam; rubber bands; plastic bags; toothpicks; aluminum foil; a balance, consisting of a pegboard with a plastic pan hung from each end.

Duckworth conducted this course (in educational psychology of science teaching) through eight weekly sessions of three hours each, in the University of Geneva. In this monograph, Duckworth shows how adults (who were all previously taught the concept of density) begin from scratch and end up coming close to its definition – or, as she puts it, *inventing* it! Their dogged persistence in moving from random exploration to more structured investigations slowly allows concepts like weight and volume to surface – which does not occur until the fifth week! (And we teach this to children in class V … or is it IV?)

I was struck by the spread of course participants: practising teachers (across levels, from kindergarten to high school), a married couple who were also teachers, students of Masters in Education programs, doctoral degree students and a French physicist who visited the course once. Since I would hate to spoil your fun in reading this exciting story, I am summarizing certain aspects under different heads below:

The role of the facilitator
Duckworth made several interventions during the course, but they were always measured and pointed. For instance, she would periodically summarize the guesses or questions that the participants had come up with until that point of time, and throw in a suggestion or two. She would also remain quiet when either her suggestion (or a question posed by one of the participants) was *not* taken up as the next experiment – *even if she deemed it to be a worthwhile experiment*. Midway through the course, when she brought in a new set of materials so as to

step up the challenge, *she did not stop them from doing aimless things with the objects* – as she felt that they were getting to know the materials through such acts.

Refraining from contradicting a die-hard theorist
All through the course, one participant, Pierre, repeatedly articulates his theory that things float because they have a lot of air in them. Duckworth did not confront him on this, but she also did not miss an opportunity to challenge him whenever possible. This fine balance between allowing a learner to voice his assumptions (however incorrect they may be), while at the same time, using every chance to draw his attention to evidence that counters the assumption, was what I found noteworthy. She also noticed with quiet sensitivity when Pierre struggled to articulate his thoughts: *He did not manage to say what he was thinking* … and resisted the temptation to speak for him.

Stepping up the challenge
It is only in the fourth week – when the facilitator changes the liquids that the objects are floated in – that the participants begin to talk of 'weight'. Until then, they have only talked in terms of volume, size, material and shape. Her patience in letting them reach this step was quite remarkable. Of course, she didn't have to prepare her students for a Board Examination in March! [Or answer her Principal/the students' parents about not covering the syllabus on time!]

What the presence of an 'expert' can do
This was the most amusing part of the entire monograph. Duckworth brought a physicist into the class in the sixth week, in response to a participant's wish. However, since she did not give him more than a brief idea of her expectations of him, he began to ask questions about their terminology which made her view him as a nuisance. I was struck by the way technical jargon never ceases to divide the so-called expert from the layperson, even if the layperson is engaged in a very thorough and scientific exploration. In fact, the most muddled thoughts of Pierre were received with respect by the physicist simply because they were couched in scientific-sounding language! Another striking difference was the manner in which the physicist dismissed certain ideas expressed by the participants as 'non-scientific', while *Duckworth listened to every idea with seriousness*. Duckworth observes that the physicist leaves her students more confused than before!

The way we view science
The physicist's view of science also clashed with the author's, as he declared that merely doing experiments was not enough – one had to have certain hypotheses before embarking on them! Duckworth observed, in fact, that Pierre's hypothesis was the *very thing that was preventing him from thinking outside of it*. And she could see that this is the way it is with most people: they can explain away anything if they just hold on to their hypothesis long enough. She describes this very succinctly in

Illustration: Prarthana Chudasma

Now bring it into the school!

1. Identify a topic or two that you can allow your students to freely explore. This exploration may be through experiments, drawing, writing, debating, mind-mapping or role-playing.
2. You can decide on a set of periods that you will use for this, just as Duckworth had set aside eight sessions for her course.
3. Allow unfettered exploration to happen, as your students wade through the ideas that come to their minds.
4. Nudge your students to think through the ideas that emerge, but try not to speakout their thoughts for them.
5. Accord full attention to what each student is trying to express: and don't get swayed by better English or finer line drawings.
6. Note their mind's journeys: as they go backwards and forwards, from one side to another, and give suggestions only occasionally for the next step.
7. Watch your tendency to rush in and 'tell them the answer' or 'solve' their dilemmas.
8. Record your mind's journey, too, through this exploration, just as Duckworth did.
9. See where this experiment ends ...if it ends!
10. Send in your findings to thinkingteacher22@gmail.com.

Please do share your responses to these suggestions at thinkingteacher22@gmail.com.

what I regard as the best part of the entire paper: I did not try to develop my view that before you have hypotheses you have to explore, developing the familiarity out of which hypotheses can grow; that the trouble with the science most of us have learned is that it is made far too neat – neat hypotheses, neat formulas, neat answers – before we have any sense of what the questions and perplexities are, so the science we learn never touches what we think of the world around us.

If only for this masterstroke above, please read the entire monograph!

Missed opportunities

The author is very honest about the chances that she missed, how she failed to connect certain dots, (realizing this only in hindsight) and that she was left with many questions. Her most revealing admission is: I was as much groping to make a connection with my students' thoughts as they were, and I moved as stumblingly toward the helpful questions as they moved stumblingly towards the helpful ideas.

What held them to their experiments

The following sentence riveted my attention: So far, my students were tantalized and intrigued; enough to keep pondering and to try to make sense of what they saw.

The question which immediately came to my mind was: *What can we, as teachers do, to tantalize and intrigue our students so that they keep pondering and trying to make sense of what they see?* Of course, there is always a great deal of heterogeneity in any class – but then, this element was equally present in Duckworth's group of adults. And yet, with a simple challenge of doing just about anything with a myriad of strange objects, look how she managed to garner this degree of involvement and attention!

Remembering what was taught

Somewhere in the seventh week of the course, one of the students recalls that they had been taught Archimedes' Principle: now, what was it? As they haltingly try and recall it, Duckworth despairs – "Well, there it is, they've done it by remembering!" But to her gratification, it leads nowhere, as the adults toss the concept out and continue their explorations. What can be greater proof of truly experiential learning?

The emergence of a concept like density

If you may recall the March 2018 **Research In Action** column, a bunch of sixth graders came to a point (in their class on Archimedes' Principle) where they could see that *there was some property that was similar* in a lump of gold and a gold crown, of identical weight. It was stated in that research paper that these students were now ready to learn the concept of density. (Visit https://thinkingteacher.in/letting-children-think-things-through-for-themselves/ for the entire article.) Now how did this group of adults arrive at the concept of density?

You can read the monograph to find out!

The author is Founder Director of Thinking Teacher (www.thinkingteacher.in), an organization that networks with teachers across the country. Thinking Teacher aims to awaken and nurture the reflective practitioner within each teacher. By taking (action) research out of the classroom, Thinking Teacher develops the (action) researcher in the teacher. And then, by bringing research into the classroom – as in this series – Thinking Teacher's goal is to help build deep inquiry and rich learning into the teaching process. The author can be reached at <neeraja@thinkingteacher.in>.