

Attending to patterns of student thinking

What does the pedagogical practice of attending to patterns of student thinking consist of?

Beyond individual and cultural differences, it is possible to find common patterns in the way students reason and comprehend certain subjects. The advantage of knowing how to identify those common patterns is that the teacher can plan the class more effectively, correcting and anticipating the development of patterns that contain errors, and reinforcing those patterns which favor comprehension.

In order to identify patterns, it is essential for the teacher to be capable of making visible and eliciting the students' thinking (HLP N°3). The expert teacher recognizes similarities among the reasoning of his or her students and uses that information to potentiate their learning. For instance, a teacher who has identified that many of his students have erroneous ideas over a concept will focus on formulating questions and examples that point directly towards eliciting and correcting that error.

Many of these patterns tend to be specific to a discipline. Thus, the common patterns that arise in math class will be different to the ones that arise in history class. In particular, there is ample investigation about the implicit theories that students conceive in order to explain natural phenomena. Implicit theories are the result of a broader logical system that people confirm daily in their everyday experiences, outside the area of science (for instance, that summer is warmer because the sun is closer to the Earth). These theories are so deeply ingrained in the student's reasoning that are difficult to change, even after having studied theories which directly oppose them. Because of it, the expert teacher takes care of eliciting the students' implicit theories when she or he has recognized that the concepts to be studied tend to be counterintuitive.

What is not Attending to patterns of student thinking

- To try to make all students reason identically. The goal is to understand the way students are reasoning in order to correct in time any error in understanding and to reinforce the reasoning that will lead them towards deeper understanding.
- To only elicit previous knowledge. More than looking for what the students know or don't know, the goal is to identify how it is that they have come to know what they know and the internal logic they have followed to reach the conclusions they have reached.
- Expect students to reveal their implicit theories when the environment presents another theory as being more socially desirable. Implicit theories are better revealed in secure and free environments, where the teacher probes the students' deepest reasoning regarding a given subject.

Teaching Strategies for Diagnosing Common Patterns in Students' Thinking in a Subject

- Use strategies collected in the document of practice N°3 to elicit students' thinking.

Allow students to think out loud and then ask clarifying questions such as “What do you mean by this”?, and of deeper inquiry, such as “Why do you think this”?, “What makes you think this”?, “Why do you think this is so and not the contrary”?

To monitor the development of the class in order to identify common mistakes, prejudices, generalizations, biases, and implicit theories.

To develop and strategically propose tasks to reveal common patterns of reasoning. For example, to propose mathematical problems that point towards common problems of procedure, ask questions in history that point towards prejudices and common biases, or to pose scientific questions that point towards logic jumps.

To elicit implicit theories, ask students to:

- Draw a scientific model (for example, the shape of the Earth).
- Create categories to associate different elements that bind themselves to the concept to be studied (for example, organic and inorganic elements).
- Explain the logic behind a concept within steps (for example, to explain the formulae for obtaining the volume of a cylinder).
- Compare the logic of two explanations regarding the same phenomenon (for example, two models that explain the form of DNA).
- Teach students metacognitive language so that they are capable of expressing their own modes of reasoning. To provide a structure and protocols to guide them in the way they speak about their own reasoning. For example, “I think that _____ because _____”, or “I first thought _____, then I thought about _____, and that's why now I think that _____”.
- To provide a space for students to mutually probe their reasoning. Identify students that tend to reason the same way as to explore which factors explain those similarities.

References

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