Intellectual Needs

For student to learn what we intend to teach them, they must have a need for it, where ‘need’ means intellectual need, not social or emotional need (Harel, 2008b).

Five categories of intellectual need:

* The need for certainty – need to prove and remove doubts
* The need for causality – need to explain or determine a cause
* The need for computation – need to quantify and calculate values
* The need for communication – need to persuade other and establish common conventions
* The need for connection and structure – need to organize and find logic with structure

The structure of an activity eliminates intellectual need.

Many students are engaged in problem-free activity and as a result do not have a clear image of the problem.

Pseudo-conceptual behavior looks like conceptual behavior but occurs when one applies surface level strategy that does not involve control, reflection, or analysis.

Pseudo-analytical behavior can look like analytical behavior but it involves procedural knowledge and superficial ideas of similarity without analysis or understanding why things work.

\*These processes can be difficult for an observer to detect.

Student are not usually choosing to apply a superficial strategy that eliminates the need to intellectually engage with a topic or problem.

Problem-free activity focuses on students’ understanding of a task and the needs it might stimulate.

The tasks that teachers present, what issues are discussed, and the way in which students question or alternative solutions are addressed all have a pronounced effect on where classroom activity.

Intellectual need stimulated in a student depends on that students interpretations of problems.

Four categories of problem free activity are:

1. The situation or immediate goal is not understood by students
2. The goal of the activity as a whole is unclear
3. There is not intellectual necessity for the method of solution
4. Students know in advance what to do, so the problem need never been considered carefully

Students only check their answers when required to do so. Checking becomes a part of the procedure.

Asking questions of students such as “how many answers might you expect?” or “how can we see whether this answer works?” can help clarify the meaning of a problem.

The lack of realistic connections in a problem may have caused it to be viewed as artificial: a way to test what students know rather than a meaningful application of their knowledge.

When students are required (even implicitly) to use only the most recent procedures in solving a problem, that problem loses intellectual legitimacy. Viewing tasks as simply an excuse to practice a method that the teacher says is important.

In an effort to make things easier for students, teachers will sometimes give problems in standard forms that invite students to use a known method rather than exploring the meaning of a problem and different way to solve it. Even when a particular method is not imposed on students, such actions can deprive students of learning opportunities because it is precisely the difficulties and confusion in solving the problems that destabilize students’ current knowledge and require them to extend their thinking.

When students know what they will do to complete a task before engaging with a problem, they are involved in problem-free activity.

Problem-free activities are conducted by teachers because of the way they view mathematics. They see what will be tested as ‘the mathematics’ that they are supposed to teach.

Teachers are not supposed to stimulate students to think deeply about problems; rather they are supposed to stimulate students to prepare students for testing and future courses by covering specific material. This view is shaped by external pressures.

The performance-driven attitude (where performance is measured by speed and accuracy rather than deep understanding) leads teachers to look for ways to speed up student learning, such as giving students a fixed procedure before assigning problems.

Learning arises from solving problems that require students to go beyond their current knowledge.

Teaching with intellectual need requires:

1. Formulate long term goals for instruction
2. Choose tasks carefully
3. Emphasize the meaning of problems and their solutions
4. Allow students to explore their own methods of solving problems.

When alternate solution methods arise, students should be encouraged to compare them based on intellectual criteria.

When students understand a problem thoroughly, the answers they offer are more likely to contain mathematical insight, even when those answers are not complete and correct. In addition, many student errors can be traced to the way students interpret problems, rather than simply their lever of knowledge.

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