Designing Effective Projects: Teaching Thinking
Environments that Encourage Thinking

Creating a Thinking Classroom

Students learn to think in thoughtful classrooms, places where students enthusiastically grapple with important issues by considering multiple perspectives, developing informed opinions, and effectively communicating their opinions to others. Creating this kind of environment is the biggest challenge teachers face, but teaching in such an atmosphere is not only rewarding, but enjoyable for students and teachers alike.

In order for students to develop their thinking skills, they must feel comfortable taking risks and failing occasionally. Project-based learning, in which students can exercise their thinking muscles on authentic problems, provides an ideal structure for infusing the teaching of thinking into curriculum content.

Language of Thinking

A thoughtful classroom is infused with a "language of thinking" that is used by both teacher and students. This language highlights the process of thoughtful learning and differentiates between thinking that is shallow and superficial and thinking that is deep and meaningful. Vygotsky (1986), the father of constructivism and student-centered learning, reminds us, "Thought is not merely expressed in words; it comes into existence through them" (p. 218). Talking helps people think and it helps students learn to think.

Teacher Questions

One of the most basic kinds of language used in the classroom is teacher questioning. Teachers are often encouraged to ask higher-level questions to improve their students' abilities, asking more "why" and "how" questions and fewer "what" and "when" questions. There is no evidence, however, that answering these kinds of questions alone has a direct effect on students' ability to think.

Wegerif (2002) illustrates this conclusion with the example of a teacher asking "Why did Huck Finn's father abduct him?" This question could elicit deep thinking and may help some students improve their thinking abilities but, as he explains, if students "are in the habit of guessing or making hasty judgments about what causes things to happen," they will just continue to practice patterns of shallow thinking.

Some, so-called deeper questions, ask students for subjective judgments: "What did you think of the poem?" "Should we clone human beings?" Students can usually answer such questions easily, but without having to justify and support their opinions, they are not likely to grow as thinkers (Appelbaum, 2000). In a thinking classroom, the teacher's response to a "why" or "how" question is "How do you get that?" "What reasons do you have?" "Where do your reasons come from?" "What about this other point of view?" These kinds of questions from a teacher and from students become part of the culture of a thoughtful classroom and ensure that there is more to answering a good question than a flippant, easy response.

Building classroom learning around good questions is an important part of encouraging thinking in students, but it is not sufficient. The questions must be accompanied by appropriate feedback, assessment, and instruction in how to think about them.

Language of Thinking
Student Questions
A greatly neglected component of a thinking classroom is student questions. In the traditional classroom, students answer questions; they don't usually ask them. For years, students have sat in classrooms where the teachers ask the questions to which they already know the answer. Genuine perplexity, which is at the root of all learning, is rarely admitted.

The culture of a thinking classroom must be built around genuine questions, questions which honestly confuse teachers and students. The switch from answering to asking questions will not happen quickly or painlessly for most students. Risk is involved in caring about something enough to confess lack of knowledge about it. Nevertheless, creating an environment in which students freely question the subject matter, the teacher, and each other is critical for developing thinking.

J. T. Dillon (1988), education professor, provides some advice for teachers to encourage student questions:
- Provide a place for student questions in your instruction and wait for them by
  - Periodically during a unit asking students to write down questions they have about the topic being studied
  - Basing a lecture, discussion, or exam on students' questions
  - Inviting students to question you or other students during discussions
  - Teaching students to question texts and other instructional materials
- Welcome questions.
- Sustain the question by:
  - Reinforcing and rewarding perplexity and the spirit of inquiry
  - Helping students come up with a way to answer the question
  - Finding out what the question is from the student's point of view
  - Examining the grounds of the question
  - Appreciating the student's knowledge revealed by the question
  - Expressing genuine interest in the question

Good thinkers are good questioners, and with many students, this skill does not happen automatically or by accident. In a thoughtful classroom, the encouragement of student questions is very important.

Reasoning
Weil (2000) speaks about teaching students the "dance of reason." To perform this dance, students must use language as a tool to form, analyze, and defend arguments. She describes the various steps to the dance:
- Examining their own and others' assumptions
- Questioning deeply
- Understanding the difference between relevant and irrelevant information
- Verifying sources of information
- Withholding judgment until you have enough information
- Evaluating perspectives and interpretations
- Recognizing contradictions
- Exploring interpretations

In thinking classrooms, words like evidence, point of view, and credibility are sprinkled throughout every subject area and every activity. They are occasionally the focus of instruction, but they are always the focus of learning.

Metacognition
Metacognitive talk, as Marzano's (1998) research shows, is one of the most powerful tools for improving student learning. Teachers are often reluctant to use thinking as a subject of conversation. Their apprehension may stem from most teachers' unfamiliarity with their own thinking processes and the awkwardness that usually accompanies initial attempts in this area. A little practice will help teachers become comfortable doing this and when they see the benefits, it will become a regular part of their instruction.

Two ways to foster metacognition are through learning logs or discussions. Prompting students to answer questions about their thinking can be very effective in helping them grow as thinkers. At the beginning of a project, students can think about how they are going to set goals and plan their work. During the project, they can ask themselves how their thinking strategies are working and how they might modify or change them to be more effective or efficient. When the project is completed, they can think about what they learned from the way they approached this project that will help them do better on the next one.

Room Arrangement
Clearly, thinking can happen in almost any kind of physical environment. Abraham Lincoln did it with a candle by the fire, and political prisoners have done it in solitary confinement in a cell. Most people, however, do better with a little support from the physical world around them.

Most deep thinking requires, at least at some stage, talk. Thinking classrooms need to be full of it, so an environment that makes it easier for students and teachers to talk to each other is likely to encourage deep thinking. Tables or desks arranged in groups facilitate meaningful interaction among students although a clever teacher can find ways for students to get together even in rooms where the desks are nailed to the floor in straight rows.

The best possible room arrangement is flexible. A teacher needs to be able to separate students and group them as necessary. There should be a place for one-to-one conferences as well as places for students to work in groups and places for students to be by themselves. All of this can happen just as well in a traditional classroom as in a large open space as long as a teacher is committed to providing a physical environment that supports student thinking.

Students also need access to the resources for thinking in order to complete authentic projects. A classroom library, scientific equipment, math manipulatives, maps and globes, animals and plants, give students interesting and meaningful fodder for thinking. Along with information, students also need access to materials for publication and presentation such as, chart paper, markers, cast-off clothing and household items for plays and skits, clay, paints, string, and a variety of other materials which bring out the creative instinct in students and appeal to a variety of learning styles.

Technology
Computers, digital cameras, and other types of technology can play an important role in a classroom that fosters thinking. In project-based learning classrooms, these tools provide a way for students to think about content as well as a way for them to share and explain their thinking. Email, electronic discussions, even a project visible on a computer screen where a group of students can look at it and discuss it together can help to make processes explicit and open for discussion.

Internet access can be a valuable tool in developing thinking in students by providing a structure for dialogue about thinking processes. In electronic environments, students do not have to compete with others for the right to speak. They can also take their time to compose their thoughts, which is important for students with learning disabilities and for non-mainstream language speakers.

Software that supports statistical analysis, visual representation of information through graphic

organizers and multimedia presentations, along with traditional word processors, are essential in the 21st-century classroom. Like any teaching method, however, access to computers does not guarantee deep thinking any more than access to great literature guarantees sophisticated literary analysis. This is especially true of computer games where, doubtless, students can be exercising higher-order thinking. Without explicit instruction in how to transfer those skills to other contexts, there is not likely to be much learning from technology for most students.

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