

Building Communities of Science Learners in the Classroom Teacher's Guide

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Introduction

The main components of a science education system include the content of the school science curriculum, the characteristics of the science program, the nature of science teaching, and the assessment practices. In developing a community of learners, it is important to provide students with an opportunity to share in the decisions that will affect their social and learning environment. The *National Science Education Standards* includes Teaching Standard E, which states, “Teachers of science develop communities of science learners that reflect the intellectual rigor of scientific inquiry and the attitudes and social values conducive to science learning.” The performance indicators for this standard include:

- Display and demand respect for the diverse ideas, skills, and experiences of all students.
- Enable students to have a significant voice in decisions about the content and context of their work and require students to take responsibility for the learning of all members of the community.
- Nurture collaboration among students.
- Structure and facilitate ongoing formal and informal discussion based on a shared understanding of rules of scientific discourse.
- Model and emphasize the skills, attitudes, and values of scientific inquiry.

Elements of other standards are included in this standard to emphasize the importance in developing a community approach to learning and how teachers promote its development.

The goal of this guide is to provide teachers with possible strategies and resources for providing successful learning environments for all students both within a class and across classrooms.

Philosophy

The primary function of the science education system is to supply society with scientifically literate citizens and to train scientists to contribute responsibly to social issues. In attaining this goal, teachers must assume that all students are capable of learning and being successful in science class. A social as well as academic environment must be in place if all students are to succeed in learning science and have the opportunity to develop the skills and attitudes for life-long learning. To this end, the nature of the community in which students learn science is critical to making this assumption a reality.

Building Community within a Classroom

Strategies and Resources

The development of a community environment begins on the first day of class. The students, as well as the teacher, immediately begin to assess their surroundings. Do I have any friends in this class? Who is this teacher? Why am I here? Who are these students? Everyone has questions. Everyone is observing. Based on their personal histories that include their likes or dislikes for school and particularly science, students make inferences. Based on prior knowledge about their students, teachers make inferences. The skillful teacher needs to provide meaningful experiences that will include the students in developing a vision of the class environment that they wish to form. These initial activities should model the social and academic attitudes, values, and expectations that are to be the foundation of the classroom community throughout the entire year. Within these experiences the teacher should emphasize the following issues:

- Learning styles and multiple intelligence (we are different)
- Team building (we need to work together)
- Class behavioral expectations (we need to function as part of a society)
- Teaching for Understanding (we need to learn)
- Effective communication (we need to explain)
- Assessment practice (we need to self-assess and peer assess)

A strategy for addressing these issues is to start the beginning of the year with a “Community Building Unit,” a unit that involves students and teacher gathering and sharing information about each other in order to overcome initial perceptions.

As an example, a teacher may utilize a classification project where students have to perform observations and classify them. Either alone or in a group, students record their results. Under this platform, the teacher can explore the components that may affect or influence the similarities and differences in student responses.

Component 1: Learning styles and multiple intelligence

Students and teacher can explore their learning styles and different intelligences. By using on-line sources, each student can determine their individual learning styles and dominant intelligences. In addition, they can gain an insight into how they and others learn. This is very

important in understanding why different instructional methods should be employed so that all students can have the greatest opportunity for success. The teacher can then construct an activity to have students discuss how observation and classification results may be affected.

On-line tests:

- The Keirsey Temperament Sorter II and the Keirsey Character Sort - <http://www.keirsey.com/cgi-bin/keirsey/newkts.cgi>

Teacher Resources:

- Multiple Intelligences and Learning Styles - <http://www.bham.wednet.edu/mod9.htm>
- Multiple Intelligences Links Page - <http://ss.uno.edu/ss/theory/multiintellks.html>

Component 2: Team building

As students and teacher become more aware about learning styles and the way people learn best, the concept of teaming can be introduced or advanced. The teacher can create teams of students and have them repeat the observation and classification exercise. This time the goal is to identify positive of students working together. In addition, the teacher can facilitate a discussion about the behaviors that students like and dislike when working together.

Teacher Resources:

- Team Building: Major Issues Facing Teams - http://www.poynter.org/research/lm/lm_team.htm
- Team Building: Developing a Productive Team. Details characteristics of an effective team and provides an assessment rubric.- <http://ianrwww.unl.edu/pubs/Misc/cc352.htm#cogtb>
- Teachers engage students in complex problem solving and exploring ideas and issues, and classroom activities draw on students' culture, experiences, and knowledge. At-risk students, in particular, need environments that engage them in authentic tasks and offer them significant opportunities to develop knowledge. - <http://www.ncrel.org/sdrs/areas/issues/educatrs/leadrshp/le400.htm>

Component 3: Class behavioral expectations

The positive and negative behaviors identified about teaming can lead to a general development of behavioral expectations for the class. Together, the students and the teacher can develop a list of expectations that all members of the classroom community can agree to. The list should include expectations of the teacher as well as the students. Ownership of the rules is very important.

Teacher Resources:

- Create a warm and nurturing classroom climate - <http://www.geom.umn.edu/~dwiggins/plan.html#1b>

Component 4: Teaching for Understanding

The timeless question posed by students, “Why do I need to know this stuff?,” needs to be addressed in order to build a positive classroom environment. Students need to be convinced or “sold” that the class will be meaningful to them. In the observation and classification exercise the teacher can stress that there is not an absolute answer and the true goal is the development of inquiry

skills that can be used throughout life. Having the teams present not only their classification scheme, but also the reasoning behind it can emphasize this view. Teaching for understanding is much more powerful than teaching for a test.

Classroom presentations can be in many forms, including posters, talks and multimedia. The specific audience can be a teacher, another student, another team, or entire. Start at level that is most comfortable or non-threatening to the student.

Component 5: Effective communication

Common to all components of community building in a classroom is the ability to effectively communicate. Teachers should be aware of the attributes of effective communication and constantly find ways to include them in their activities. Aspects of effective communication will be discussed in most of the previous components.

Teacher Resources:

- Attributes of Effective Communication - <http://www.usoe.k12.ut.us/curr/lifeskills/effect.html>

Component 6: Assessment practice

Develop an assessment practice that becomes a positive message toward learning and not a punishment; a practice that includes the students in the process. Use assessment tools that emphasize the understandings, reasoning, and skills that the students do have with directions to work towards those that they don't. In the observation and classification example, students could be assessed by a holistic rubric that emphasizes the inquiry skills needed to perform the task. Teacher assessment is important but total assessment should also include peer and self-assessment. Assessment should have input from community members and not be a secret of the teacher.

The *National Science Education Standards* envision assessment changes that encompass the following changes in emphasis:

<u>Less emphasis on</u>	<u>More emphasis on</u>
Assessing what is easily measured	Assessing what is most highly valued
Assessing discrete knowledge	Assessing rich, well-structured knowledge
Assessing scientific knowledge	Assessing scientific understanding and reasoning
Assessing to learn what students do not know	Assessing to learn what students do understand
Assessing only achievement	Assessing achievement and opportunity to learn
End of term assessments by teachers	Students engaged in ongoing assessment of their work and that of others
Development of external assessments by measurement experts alone	Teachers involved in the development of external assessments

Building Community Across Classrooms

Strategies and Resources

Building communities across classrooms requires that the teachers and students share many of the same attitudes and goals of learning and the learning process. Many teachers have developed interdisciplinary projects across grade levels and/or disciplines based on common themes, content,

or skills. The key to the success of these projects is providing time and resources to developing a positive interaction between the students and teachers involved. The components that build successful communities within a class are also the ones needed to build communities across classes and across schools.

Advances in information technology allow students to communicate with other students, both within a school and between schools. Virtual communities can be created to conduct projects or solve problems. The following strategies are suggested as possible methods that could be utilized to initiate process of community building.

Strategy 1: Data sharing within a school

A database can be set up on a school's local server to include the results of an experiment or research project performed by students of a particular science class. Students of another science class can access the data and perform the necessary analysis. The students, through a computer message board, can compare and contrast their findings.

Strategy 2: Data sharing between schools

Many schools have teams of students as well as entire classes collecting data that is being recorded on Internet databases. Using the entries recorded by a particular school, the students of a class could perform an analysis of the data. Using email, available message boards, or letters, they can communicate their findings to the students from the other school. Their message can be designed to begin a dialogue that could include the possibilities of future explorations between the two schools.

Strategy 3: Peer review within a school

Teachers of different disciplines can create a project that introduces students to the concept of peer review as well as self-assessment. Students in one class, using a scoring rubric developed by all students and teachers involved in the project, can review the PowerPoint presentations development by students in another class about a specific task.

Strategy 4: Peer review between schools

Students can participate in online projects that include peer review.

Teacher Resources:

- Bioassay Peer Review (Environmental Inquiry) - <http://ei.cornell.edu/toxicology/peerreview/>