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Robert L. Clark
Mayville Middle School

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The Helping Hand

An Administrator's Role in Encouraging and Supporting Effective Science Teaching

by **Robert L. Clark**
Principal, **Mayville Middle School**

ABSTRACT: Science teaching that mentally engages students and promotes all the goals we have for students, including a deep understanding of science content and the nature of science, is extremely difficult. That sort of teaching deviates significantly from the time-honored approaches that have permeated our schools for as long as any of us can remember. Because of that, many institutional constraints exist that make implementing effective science teaching even more difficult. This article addresses the principal's crucial role as an educational leader, the principal's responsibility to encourage and support effective science teaching practices, and efforts made in one building toward these two ends. *This article promotes Iowa Teaching Standards 1, 3, 4, 5, and 8.*

Effective Science Teaching is Complex and Requires Supportive Administrators

In the context of formal schooling, classroom teachers have the most influence on developing students' attitudes, skills and knowledge. The teachers' understanding of what learning means, how learning occurs, and effective approaches and strategies for promoting learning go far in predicting the success their students will encounter. However, teachers need support and encouragement in their efforts to implement practices consistent with desired goals and how children learn. A principal's actions to support teachers who are working to implement effective science teaching practices, and to encourage those teachers who are not to reconsider what they currently do, are crucial.

Effective teaching is a complex activity. Understanding the connection between teaching and learning means that students are active participants in the teaching and learning process. Having a clear set of student goals and understanding how students learn is fundamental for making effective pedagogical decisions. Ultimately, asking students thought-provoking questions that draw out what they know and their reasoning clearly shows their thinking and understanding related to the content

taught. Effective teachers are always assessing their students' understanding and using that information in making pedagogical decisions. Decisions regarding the developmental appropriateness of science content, engaging activities that force students to make meaningful decisions, choice of materials that promote learning, and crucial teacher behaviors and strategies to make the learning environment come alive demand from teachers a deep understanding of pedagogy and science content (Tobin & Garrett, 1988). As instructional leaders for a school building, principals should always be identifying and supporting research-based teaching practices to create an environment that encourages their use and sustained implementation.

However, too often principals are mired in bureaucratic responsibilities and neglect their role as educational leader. Horror stories abound of bright, energetic and capable teachers who are either not encouraged in their efforts to implement what are known to be effective teaching practices congruent with how people learn, or worse, told to teach in ways counter to effective teaching practices. Often this is done to maintain "harmony" in a building, but what results are embedded institutional constraints that maintain the status quo and chase some of the best and brightest out of teaching.

Effective educational leadership is also very complex, and meaningful change does take time. Administrators often seek ways to improve teaching and learning in their building through larger scale programmatic adoptions or through the hiring process as opportunities arise. Improved teaching and learning in a school should also be realized by enhancing leadership among teachers. Good educational leaders look through multiple lenses and enter into partnerships with teachers (Lester & Grant, 2001). Developing knowledgeable and effective teacher leaders provides ongoing benefits to a school by promoting a professional climate where research-based practices are understood, respected and supported by peers.

Meeting the requirements of *No Child Left Behind* has forced schools to first target students' performance in reading and mathematics. Unfortunately, schools' attention to science education has suffered during that time. However, by 2007, demonstrating a proficient level of understanding in science will be part of determining whether schools are making adequate yearly progress. Long before *No Child Left Behind* educators were working to increase the effectiveness of school structure and programming, and the professional development and support they provide to their teaching staff. *No Child Left Behind* simply instituted benchmarks and penalties for not reaching those targets. The support needed for changes to meet those targets has been left to schools to implement, and administrators and teachers must see themselves as colleagues working together to improve student learning.

Helping Teachers Identify Meaningful Student Goals

School administrators promote effective classroom teaching through the culture they establish and support. Part of this culture is recognizing the importance of defining and articulating broad but clear student outcomes or goals. The overwhelming daily demands placed on both teachers and administrators can easily result in their losing site of the kind of adults they want students to become. Developing a set of well thought out student goals that teachers wholeheartedly endorse reminds teachers and administrators what they should be promoting in all classroom and school-wide decisions.

The student goals developed for the teaching of science have much in common with goals in other areas, but differ in the content and in some particulars. Figure 1 provides a set of goals for students that reflect what most all science teachers say they want students to achieve. While administrators should play a key role in helping teachers develop meaningful goals for students, teachers must feel ownership of the goals that are developed. Both administrators and teachers must understand that helping students develop a deep understanding of subject matter content is dependent upon promoting the other goals. None of the goals in figure 1 stand alone. As administrators work to encourage and support effective teaching practices, they must keep in mind these student goals, the unique nature of particular content areas such as science, and what transcends all content areas.

The Importance of Understanding How People Learn

Effective teachers understand that how people learn is very complex. Overwhelming evidence illustrates that learners do not develop a deep understanding of content by simply being told what to think. That time-honored approach certainly doesn't promote the other goals listed in Figure 1. Learners take in information and use what they already know in trying to make sense of that new information. In doing so, learners shape and often distort a teacher's, textbook's, or activity's intended meaning.

Moreover, learners often hold strong beliefs that resist change. Learners' prior ideas and efforts to make sense of what they are experiencing apply to all learning, and they are particularly informative when understanding how students struggle to learn science. Because children of all ages come to school science learning experiences having explored their natural world and made, in their mind, sense of it, science teachers are faced with having to help these students understand why their prior ideas differ from that of the scientific communities.

Effective administrators consistently encourage teachers to understand the complexities in learning. Moreover, administrators must understand, and encourage teachers to understand, that the complexities of learning apply to themselves as well. Coming to understand what learning and effective teaching entails often requires letting go of views that we unquestionably accept and that guide practice. This means that learning is both cognitively and emotionally challenging. Administrators must recognize that teacher change takes time and provide both cognitive and emotional support through the process.

The Teacher's Complex Role in Education

Understanding how people learn, effective teachers place a priority on student ideas and the discussions that take place around those ideas. Thoughtfully designed lessons will include developmentally appropriate content (that which students can connect to their prior ideas and experiences), engaging activities that have students making and defending decisions, concrete experiences and

FIGURE 1

Science Specific Goals for Students

- Demonstrate a robust understanding of fundamental science concepts (not simply articulating facts and using mathematical algorithms to solve problems)
- Convey an understanding of the nature of science.
 - Identify problems for investigation, suggest strategies for conducting investigations, and successfully carry out those investigations
- Exhibit critical thinking when wrestling with science content
- Convey a positive attitude about science
- Apply scientific understanding to local, national and global problems
- Exhibit creativity and curiosity in science
- Effectively communicate and collaborate in science inquiry
- Set goals, make decisions, and accurately self-evaluate while inquiring and investigating
- Convey the importance of science in many careers

developmentally appropriate materials, and strategies that promote student actions that are consistent with our student goals. The use of effective teacher behaviors and interaction patterns supports classroom activities designed to test student ideas in the science classroom. In the end, teachers do not take on the role of purveyor of all knowledge but provide experiences necessary to mentally engage students in wrestling with ideas and the meaning of those ideas. Teaching is not simply telling, and effective teachers make deliberate and well-defended choices when to present information to students. These presentations are always interactive so that the teacher receives information from students along the way indicating whether or not they are making the intended meaning of what is being presented.

To accomplish all this, effective teachers of science structure the social climate of their classrooms so that students are encouraged to discuss, reflect, make predictions and describe or explain as they make sense of important science concepts. These teachers initiate and promote conversations in their classrooms by the questions they ask. Questions are designed to reveal prior knowledge and support positions with evidence or factual information as identified through classroom experience or media sources. The understanding that teachers gain about their students through appropriate questioning has

tremendous value as it can be used to determine experiences and lessons that respond to and build on the ideas students currently maintain. A teacher's use of questions will also generate additional student questions and eventually be used to consolidate ideas that then form a consensus for understanding. Children generate understanding by thinking or reflecting, discussing and applying what they think they know to new situations. Quality interactions value student conceptions and effective teachers use these exchanges to help students construct meaning on a personal level over time.

Such classroom instruction looks markedly different from time-honored practices. These teachers ask thought-provoking questions, convey a very positive non-verbal attitude, wait patiently and expectantly for students to respond, acknowledge students ideas and use wait-time II to generate additional student responses, and use both correct and incorrect student ideas in ways that promote student thinking and reasoning that moves understanding in the intended direction. These sorts of interactions occur before, during, and after meaningful classroom experiences. Children learn by thinking, discussing and reflecting on what they have done.

Promoting and Supporting Quality Instruction

The professional climate and level of professionalism within a school is related to how administrators and teachers work together. The climate in which decisions are made establishing the expectations for learning and teaching is productive when professional communities agree on how to respond to children in light of what we know about how they learn. Developing that relationship necessarily precedes any meaningful professional development. After developing relationships with teachers that promote school-wide climates that are responsive to student needs, administrators must look for professional development activities that teachers will see as worthwhile in improving teaching and learning.

The format and kinds of interaction between teachers and their administrator vary with the intent of each professional development activity. District and building-wide inservice activities are typically provided in one or more sittings with a "one size fits all" approach. If well done, these experiences can be valuable for improving teaching and learning in all areas including science. For instance, in my building we spent considerable time working together to establish a clear and comprehensive list of goals we want to promote. That list appears in figure 2 and each goal was purposely written to convey what students ought to be doing in all subjects. This list of student goals provides the basis for future professional development activities as these should clearly be directed at helping teachers promote the goals we together established.

FIGURE 2

School-wide Goals for Students

- Confidently share ideas and apply information and skills to new situations
- Demonstrate positive attitudes in their approach to class work
- Communicate effectively through both written and oral language and in the use of media technology
- Read efficiently conveying information and ideas embedded in textual materials
- Develop questions that deepen their understanding and strengthen skills
- Problem-solve through creative and independent thought
- Exhibit positive self-esteem and self-discipline by showing respect and tolerance of others and their Opinions, themselves and property
- Convey knowledge of subject matter

In my building we then spent considerable time working toward developing higher quality interaction patterns between teachers and their students. This was first targeted because mentally engaging students, drawing out their thinking and using that thinking in further instruction is at the heart of effective teaching and learning. One-shot inservice experiences do little, if anything, to promote effective teaching, so I set up a series of three interactive inservice presentations over a period of two years. I first brought in a faculty member from the University of Wisconsin-Milwaukee

and twice brought in faculty members from Iowa State University. These presenters engaged my teachers in discussions regarding how people learn, and teacher behaviors and strategies for engaging students in meaningful discussions that promote learning. For instance, one inservice was devoted entirely to audio/videotaping oneself teaching and learning to analyze that tape for the questions asked, wait-time I and II, non-verbal behaviors exhibited, and how students' ideas were acknowledged and used.

After these sessions, to encourage and support my teachers' efforts to understand and improve their interaction with students, we purchased audiocassette recorders and tapes that teachers can use whenever they wish to record and analyze their teaching practices. Because teachers' individual needs vary, I encouraged personal and self-directed professional development activities. Teachers were strongly encouraged to audio or videotape their teaching and analyze it using the approaches learned in the large group inservice activities. Thus, each came to understand what they do and to see how their interactions affect classroom dynamics through how they and the students interact with each other.

Importantly, teachers' efforts to improve their practice in this way counted toward the required hours of professional development they must complete each year. For the first tape that teachers completed, the presenters from Iowa State University agreed to provide feedback. Many teachers were interested in this feedback so I had a teacher leader in my building collect the tapes and mail them to the presenters. After listening to the tapes and providing feedback, the tapes and written feedback were mailed back to the teacher leader for distribution to each teacher. This procedure was important so that each teacher felt secure knowing their efforts toward professional development would not be used for district evaluation purposes.

Establishing professional reading groups around school issues has also provided an important basis for staff members to develop understanding of effective teaching and common language. Purchasing multiple copies of a title so that each teacher has the reading and is prepared for discussion in

groups encourages dialogue among teachers. This promotes understanding and strategies that support them in their common and unique classroom situations. Time used here to study and discuss with colleagues can also be used to meet the requirements of the professional development plan for individual teachers. The use of book clubs is valuable as it builds common understanding of effective practices among staff members but also establishes a professional relationship throughout a building as staff members come to know themselves and others as educators. Providing opportunities for teachers to talk with each other further supports building initiatives and helps to define the faculty's actions in terms related to student learning as well as promoting leadership capability among them.

Faculty meetings have also been used to discuss student learning. Teachers are willing to share lesson plans, activities, or specific classroom events as examples or for professional feedback from their colleagues. Teachers can be grouped by content area and grade level to facilitate a range of conversations that helps identify common issues and solutions that promote the student goals. The ideas and situations that are shared among teachers are more meaningful as common student behaviors are identified across classrooms and grade levels.

Coming back as a whole faculty to share ideas and generate consensus can answer important questions related to improving student learning like "How will this promote the goals we have for students?", "Where should we go from here?" or "How might these behaviors lead to more meaningful interactions with our student?" This format worked effectively in defining desired ends of instruction by determining student goals within our building and in identifying appropriate interaction patterns for classroom instruction. The manner in which we proceeded to acquire new meaning was consistent with how people learn by providing staff members the opportunity to examine their own teaching.

The supervision process must also be consistent with and support quality teaching. Teaching practices that support student learning should be incorporated into conversations between administrators and teachers during the pre and post conferences that take place in the supervision process. Having teachers articulate what their administrator will see in a lesson and the rationale for what will be occurring prior to a visit provides a clear picture of what a teacher

understands about student learning and effective teaching. The post-conference provides a powerful opportunity for the teacher to draw connections between what they did and its impact on students. Teaching is complex so lessons, even when they go very well, are rarely perfect. Examples of important questions to discuss in a post-conference are:

- What went well? How do you account for that?
- What was your role in making that portion of the lesson work well?
- What did not go so well? How do you account for that?
- What might you do differently next time to improve that part of the lesson?
- What student goals do you feel were promoted in this lesson? What were students doing that reflected that?
- How did you determine students' thinking throughout the lesson?
- How did you use that information in making decisions throughout the lesson?
- How might you modify this lesson so that it is more effective?

These questions are asked to help teachers understand the complexities in effective teaching, their significant influence on learning, and that improving teaching takes time, reflection and practice.

Conclusion

Effective teaching is very complex, and teachers are often overwhelmed with the daily demands of working with students. School administrators, as educational leaders, must encourage and support effective teaching and learning. At a minimum, administrators should ensure that institutional constraints do not impede teachers who are working to implement effective practices. This is particularly true when beginning or experienced teachers are working to implement effective practices that deviate from what is going on in colleagues' classrooms. These situations demand that administrators step into their role as educational leader and support these teachers.

For teachers caught in time-honored practices that deviate from what we know promotes meaningful learning, change takes an average three to five years of work for new approaches to be implemented and grounded as accepted practice. Attaining meaningful change takes time in complex systems that we find in schools (Fullan, 2001). Desired ends are realized when teachers and their administrator team to establish approaches that improve student learning. Providing and supporting quality instruction encourages a close partnership between school administrators and their teachers. It values the leadership capacity within a school and honors best practices as supported by the available body of research. Sustained implementation of effective teaching practices requires administrators to work with teachers in identifying desired goals for students and how to promote them. Without concerted effort and support by school administrators, effective instructional methods have little chance of surviving.

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Robert L. Clark is the principal of Mayville Middle School serving students in grades 3 through 8 in Mayville, Wisconsin. Prior to becoming a school administrator, he taught science for six years at Brown Deer High School and New Berlin Middle and High Schools in Wisconsin. Robert has published three articles on effective science teaching, has presented at both state and national level conferences in science, and has presented at a state level conference in reading.