Elementary Principals' Role in Science Instruction

Patricia Casey
University of Texas

Karen Dunlap
Texas Woman's University

Kristen Brown
Coppell ISD

Michele Davison
Plano ISD

This study explores the role elementary school principals play in science education. Specifically, the study employed an online survey of 16 elementary school principals at high-performing campuses in North Texas to explore their perceptions of how they influenced science education on their campuses. The survey used a combination of Likert-type rating scale items and open-ended questions. Responses from elementary principals suggest that the important components of instructional leadership for science included a) collaboration with teachers, b) changing teaching assignments, and c) teacher motivation.

Key words: principal, instructional leadership, elementary, science

Demands of state and federal accountability focus attention on the achievement of elementary school students in science. Elementary schools are often rated based on students' performance, as are elementary school principals in some states. This study explores the role elementary school principals play in science education. Specifically, the study employed an online survey of elementary school principals at high-performing campuses in North Texas to explore their perceptions of how they influenced science education on their campuses.

The participants in the study were all principals at recognized or exemplary elementary school campuses in North Texas during the 2007–2008 academic year. For purposes of school accountability ratings in Texas, science was first tested in the fifth grade using the Texas Assessment of Knowledge and Skills (TAKS). To achieve a recognized rating, at least 80% of the students tested must have met the minimum expectations; for an exemplary rating, 90% must have met minimum expectations. The campuses were almost all exemplary, with an overall average of 96% of the fifth graders passing the science exam. Over 67% of the students tested on the selected campuses were individually commended for scoring at 90% or above.

METHOD

The purpose of the study was to explore the principals' perceptions of how they influenced science education on their campuses where achievement in science was high. Elementary school campuses in North Texas with science scores at or above 80% (i.e., 80% or more of the students tested met minimum expectations) in the school year 2007-2008 were identified and invited by email to participate in an online survey.

The first section of the survey requested basic information about the participant and the school, and the number of fifth grade students tested in science and test scores. The second section of the survey had rating scale items about (a) the organization of the science program at the school, (b) the importance of a variety of factors principals used to make decisions about science, (c) the influence of a variety of factors on science instruction, and (d) the factors the principals perceived to be most beneficial in improving science instruction on their campuses. The participants were

DOI: 10.5929/2012.2.2.5

asked to provide an overall assessment and to respond to one open-ended question about the fifth grade science instruction on their campuses.

The rating scale items were analyzed for descriptive statistics. The responses to the open-ended questions were hand coded and examined for patterns or themes. Thus, while the small number of participants (n=16) was a limitation, some salient points were found.

FINDINGS

Four main themes related to effective instructional leadership for elementary science emerged from the data. The findings suggest the importance of (a) encouraging collaboration, (b) aligning the curriculum, (c) implementing modes of teaching science that complement teacher strengths through staff organization, and (d) providing professional development.

Instructional Leaders and the Importance of Collaboration

Principals need to be strong instructional leaders who support and collaborate with teachers in science content and instruction (Griffith, 1999). Elementary principals in this study consistently valued their role as instructional leaders. They attributed the student performance on their campuses in science to two main factors. First, they encouraged collaboration with and among the teachers. Second, they were strategic about staffing and teaching assignments—decisions these principals made after collecting and using information about teachers' science skills and strengths.

While all the principals in the study believed that teachers were doing a "good" or "excellent" job of science instruction on their campuses, the participants acknowledged the importance of collaborating with teachers to build capacity. When principals described factors influencing science on their campus, four principals mentioned working alongside teachers when making decisions about science instruction. They described spending more time working with teachers on science instruction and less time focusing on other management duties in the building. This finding was consistent with that of McGhee and Lew (2007) in their study of principals' actions that affect writing instruction.

Fourteen of the 16 principals stated they considered teachers' strengths and relationships with students when making instructional decisions for the campus, with a special focus on teaching assignments (math, science, language arts). Responding principals suggested that teachers are more likely to have a positive impact on student achievement and feel more confident about their teaching methods when allowed to instruct in their areas of strength.

Participants also suggested that it is important for principals to be in classrooms making observations in order to assess teacher strengths and weaknesses related to characteristics of quality science instruction: content knowledge and teacher attitudes, pedagogical knowledge, knowledge of students, and a clear understanding of the science curriculum (Gess-Newsome, 1999). Following observation, principals can identify areas needing improvement and can target professional development, peer coaching, or other modes of support for teachers to improve instruction. If teachers improve their science teaching methods, then student achievement in science also should improve. In a recent study of principals' work to improve instruction, May and Supovitz (2011) found that principals' work with individual teachers that was very focused was more likely to result in improved instruction than broader, more general professional development.

Participating principals worked collaboratively with teachers to ameliorate weaknesses in science instruction, as suggested by other authors (Bakkenes, de Brabander, & Imants, 1999; Gess-Newsome, 1999; Griffith, 1999). One principal described giving every teacher in the building a science exam that was equivalent to the exam the students were required to take. The teachers struggled with the exam and had to complete it in groups because the process took much longer than expected. As a result, teachers realized how difficult the exam must be for fifth grade students and fifth grade teachers. They became motivated to look at the science objectives for each grade level and align their curricula. As a result, the principal was able to take advantage of a teachable moment and turn frustration with the science exam into motivation to improve science instruction across all grade levels. Accordingly, participants described how they, as instructional leaders, encouraged staff and provided them with the tools and resources to improve curricula and instruction.

DOI: 10.5929/2012.2.2.5

Communication and Collaboration

The principals in this study reported giving teachers time to write a curriculum for science to improve the quality of instruction. Additionally, principals reported that a district science coordinator spent many hours collaborating with and assisting teachers with science ideas for all ages of elementary students in order to enhance instruction. According to Blase and Blase (1999), teachers value time given for collaboration and team planning time. Printy (2010) further states that teachers are compelled to improve practice and to learn new skills and argues that teachers learn best and improve most when principals stay engaged with teachers as they collaborate to make decisions about instruction.

Additionally, the principals in this study suggested the importance of having regular, personal contact with all teachers to communicate with them about instruction as other research suggests (Bakkenes et al., 1999; Blase & Blase, 1999; Printy, 2010). These participants expressed concern that in the absence of open and honest conversations about science curriculum, teachers at lower grade levels might continue to focus their time and energy on other subjects that are routinely tested in state exams, like reading and mathematics. Therefore, taking time to have conversations about curriculum was seen as a means to direct teachers' attention to areas of weakness in the curriculum.

Alignment

Thus, even though science was not tested until students were in fifth grade, principals reported that all teachers on these high-performing campuses understood the importance of teaching each science objective to mastery and reviewing science concepts taught in previous grade levels. Every teacher in the building played an important support role in the school's fifth grade science scores—accountability for the results was shared rather than belonging to only the principal and the fifth grade teachers.

When one principal was assigned to the campus, "science was not being taught at every grade level or in every classroom. . . . We had to shift the philosophy of the campus." Several principals from this study indicated the importance of alignment of science instruction between the grade levels. This is important not only for the elementary campus but also for students entering middle school. Elementary science classroom practices (whether positive or negative) have a strong correlation with future outcomes in science in middle school and high school (Rice, 2005).

Further, curricular decisions should be made based on research. All of the participants ranked making teachers aware of scholarly research and best practices in science education as a very important role of the principal. Similarly, Seifert and Vornberg (2002) contended that the principal is responsible for researching instructional programs and providing teachers with information about their instructional options.

Participants more frequently referred to making decisions about science instruction in response to other data, such as student, teacher, or testing feedback, rather than to scholarly research. Whereas these participants said they valued research, they did not say that they selected or implemented programs, practices, or methods based on research or evidence of effectiveness. Moreover, Blase and Blase (1999) indicated that effective instructional leaders use data to make their decisions and are willing to change programs if there is evidence to show the program is ineffective.

Staffing and Organizing for Science Instruction

Another predominant theme emerging from this study targeted the process of deciding how teachers are assigned for science instruction. As one principal described, "We have been . . . departmentalized, partially departmentalized, and self-contained." This principal moved back and forth between models using student needs and teacher strengths to decide which method was best for a particular school year. When strong content teachers were available, the principal and the teachers would rather be departmentalized for instruction. This allowed teachers to focus on their areas of strength and specialize in a content area (Gess-Newsome, 1999).

From the 16 principals' responses about the mode of instruction on campus, seven indicated their fifth grade science instruction was departmentalized, with separate teachers for math, science, social studies, and language arts. Five principals stated that their teachers were partially departmentalized, with math and science teachers and social studies and language art teachers delivering instruction. When teachers were asked to move back and forth between instructional programs and "redesign" the programs themselves, principals were encouraging a sense of "flexibility"

DOI: 10.5929/2012.2.2.5

and openness to change (Blase & Blase, 1999, p. 365).

However, when a weak group of students enters fifth grade, the teachers would rather be self-contained. According to a principal, they "felt a much stronger connection with all of their students, particularly when it came to the TAKS test." This model requires teachers to teach all content areas and may lead to greater knowledge about or relationships with individual students (Gess-Newsome, 1999).

The principals' comments described tough decisions facing elementary administrators in terms of teaching assignments. Effective principals focus on student achievement and, at the same time, attend to effective instruction (Byrd, 2010). These responses suggested that there may not be a correct way to deliver science instruction, but the decisions should be made with teacher and student interests in mind. Teachers have invaluable knowledge about their students' interests and needs and should be consulted when decisions are made about the curriculum and instruction (Marks & Printy, 2003).

Professional Development

Ten principals selected "professional development in science" as a potential benefit for science instruction on their campus. Nine principals wanted more time with district science coordinators on campus, which could include professional learning and instruction in science teaching techniques. Ten principals thought having teachers with a strong content background teaching science on their campus was beneficial. Monk (2008) described how teacher preparation programs may now provide more science-specific coursework for elementary teachers, but teachers typically have varying degrees of expertise in science content knowledge and instructional methods.

Responses from principals who participated revealed a focus on instructional leadership and science curriculum, but professional development was perceived as less important, based on principals' comments. Additional research suggests that many elementary teachers are weak in science content knowledge and the skills needed to teach the science curriculum effectively (Gess-Newsome, 1999). Teachers weak in science content may need to be encouraged by their principal to attend professional development activities focused on science (Desimone, Smith, & Uneo, 2006). Principals can promote professional development activities and can open up dialogue about sound instructional practices for teachers (Blase & Blase, 1999).

Some authors have argued that many teachers in the field of science would like more support than they receive from campus administrators and district science-curriculum specialists (Desimone et al., 2006). Although quality professional development may improve science teaching ability, some studies have indicated that teachers are less likely to utilize their new knowledge in the classroom if the principal is not supportive or feels inadequate in the area of science (Prather, Hartshorn, & McCreight, 1988). Thus, teachers are more likely to implement skills and strategies learned from professional development if principals are strong and confident about their own skills in science content knowledge and pedagogy. Whereas principals' support of science instruction may be shaped by their previous experiences (Youngs, 2007), our findings suggest that principals benefited from participating in science professional development alongside their teachers.

CONCLUSIONS

Few studies have focused on the role principals play in elementary school science instruction. This study analyzed the perspectives of 16 elementary principals from high-performing schools in North Texas. Further insight could be provided by the district science coordinator or the science teachers' views on the role the principal plays in science instruction, as well as in support of science instruction.

In the area of science program organization, more data are needed to demonstrate whether departmentalized instruction for science is more favorable than self-contained instruction at the elementary level. Principals in this study indicated they would like to use research and best practices in science instruction to make decisions, but there is little research on departmentalization at the elementary level. Because elementary campuses vary in the organization of the elementary science programs, further research may reveal trends in program designs and student achievement.

Although science instruction in these schools has produced high levels in student achievement in the past, the principals perceived room for improvement. Other elementary principals may be able to use the experiences of the prin-

DOI: 10.5929/2012.2.2.5

cipals on these high-performing campuses to improve science instruction for all children.

REFERENCES

Bakkenes, I., de Brabander, C., & Imants, J. (1999). Teacher isolation and communication network analysis in primary schools. *Educational Administration Quarterly, 35*(2), 166–202.

Blase, J., & Blase, J. (1999). Principals' instructional leadership and teacher development: Teachers' perspectives. *Educational Administration Quarterly, 35*(3), 349–378.

Desimone, L. M., Smith, T. M., & Ueno, K. (2006). Are teachers who need sustained, content focused professional development getting it? An administrator's dilemma. *Educational Administration Quarterly, 42*(2), 179–215.

Gess-Newsome, J. (1999). Delivery models of science instruction: A call for research. *Electronic Journal of Science Education, 3*(3). Retrieved from http://wolfweb.unr.edu/homepage/crowther/ejse/newsome.html

Griffith, J. (1999). The school leadership/school climate relation: Identification of school configurations associated with change in principals. *Education Administration Quarterly, 35*(2), 267–291.

Mackey, B., Pitcher, S., & Decman, J. (2006). The influence of four elementary principals upon their schools' reading programs and students' reading scores. *Education, 127*(1), 39–55.

Marks, H. M., & Printy, S. M. (2003). Principal leadership and school performance: An integration of transformational and instructional leadership. *Educational Administration Quarterly, 39*(3), 370–397.

May, H. & Supovitz, J. A. (2011, April). The scope of principal efforts to improve instruction. *Educational Administration Quarterly, 47*(2), 332–352.

McGee, M. W., & Lew, C. (2007). Leadership and writing: How principals' knowledge, beliefs, and interventions affect writing instruction in elementary and secondary schools. *Educational Administration Quarterly, 43*(3), 358–380.

Monk, D. H. (2008). Reflections and commentary from the field: Connecting the reform of administrator preparation to the reform of teacher preparation. *Educational Administration Quarterly, 44*(2), 282–295.

Prather, J., Hartshorn, R., & McCreight, D. (1988). A team leadership development program: The Elementary Science Education Enstitute (ESEI). *Education, 108,* 454-463.

Printy, S. (2010, April). Principals' influence on instructional quality: Insights from US schools. *School Leadership and Management, 30*(2), 111-126.

Rice, D. C. (2005). I didn't know oxygen could boil! What preservice and inservice elementary teachers' answers to "simple" science questions reveals about their subject matter knowledge. *International Journal of Science Education, 27,* 1059-1082.

Seifert, E. H., & Vornberg, J. A. (2002). *The new school leader for the 21st century: The principal.* New York, NY: Rowman & Littlefield Education.

Youngs, P. (2007). How elementary principals' beliefs and actions influence new teachers' experiences. *Educational Administration Quarterly, 43*(1), 101–137.

Patricia Casey, Ph.D. (pjcasey@uta.edu), is an assistant professor at the University of Texas in Arlington. Her research focuses on educator professional development to improve teaching and learning.

Karen Dunlap, Ed.D. (kdunlap@twu.edu), is an assistant professor in the College of Professional Education at Texas Woman's University in Denton, Texas. Her research interests include teacher identity transformation, pedagogy in the online environment, and teacher preparation.

Kristen Brown, M.Ed. (kbrown@coppellisd.com), received her master's degree in educational administration from

DOI: 10.5929/2012.2.2.5

Texas Woman's University and is the Director of Advanced Academics & Career Technology Education in the Coppell ISD.

Michele Davidson (mdavids101@gmail.com) received her bachelor's degree in deaf education and her master's in educational administration. She currently teaches Pre-Kindergarten ESL in Plano ISD.

DOI: 10.5929/2012.2.2.5