ARE WE SO DIFFERENT? A STUDY OF TEACHER AND ADMINISTRATOR PERCEPTIONS OF SCIENCE EDUCATION

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Presented at the National Association of Research in Science Teaching 2016 Annual Conference,
April 17, 2016, Baltimore, MD

INTRODUCTION

Improving student knowledge and attitudes toward science requires supporting the entire school environment, including teachers and administrators. In this paper, we will present the results from a survey of schools in the Chicago area about their staff's perceptions of science education, a case study of piloting programming at schools, and also highlights of continued, ongoing work.

The research in this paper is part of the Science Leadership Initiative at the Museum of Science and Industry, Chicago (MSI), a larger project to advance school leadership in support of science education. This program creates a mechanism for the process of prioritizing science education carried out by **school staff** and directed by a **teacher** leader with support from a **school administrator**.

Science Leadership Initiative program developers created advisory committees to inform program development and take advantage of the varied perspectives and expertise of teachers and school administrators. In conversations among these committees, staff heard that teachers felt they had different ideas on how to support science education than their administrators, and vice versa. Those with science backgrounds also acknowledged that those without science backgrounds might not see the importance of science education. It seemed as if each collective felt that they had different thoughts and perspectives than the other. Teachers and school administrators need to work together to create a school culture that promotes student achievement (MacNeil, Prater, & Busch, 2009). Science teachers are trained to teach science, but this is not necessarily the case for school administrators. Differences may arise between these groups in their thoughts about teaching science. For this paper, our research question is, "What are the differences between science teacher and administrator attitudes, perceptions, and behaviors toward science education?"

Staff heard that teachers felt they had different ideas on how to support science education than their administrators, and vice versa. Those with science backgrounds also acknowledged that those without science backgrounds might not see the importance of science education. It seemed as if each collective felt that they had different thoughts and perspectives than the other.

What are the differences between science teacher and administrator attitudes, perceptions, and behaviors toward science education?

LITERATURE REVIEW

Teachers and administrators often have common backgrounds and interests. Most, but not all, school administrators (including principals and assistant principals) have experience with teaching in the classroom—but they do not necessarily share the same career path. While teaching may be the most common career precedent for principals, many teachers do not aspire to that position. In a study about why teachers often choose not to become principals, Howley, Andrianaivo, & Perry (2005) state that, "…if teachers do not see administration as the valued culmination of a career in education, but instead as an unpleasant task undertaken by individuals substantially different from themselves, they will tend…to discredit what school leaders contribute." The relationship between principal and teacher influence attitudes, and within a school, professional attitudes form under similar conditions. As leader, a principal's relationships strongly affect teacher attitudes, defining school climate (Price, 2012).

While the literature most often focuses on principals, we choose to use the term "administrators," to not exclude other administrators in the school building who are also important and influential in decision-making on school budgets, curriculum and instruction, and improvement. There are few studies in the literature that directly compare school administrators and teachers. One study on the beliefs and practices of teachers and administrators in an urban school district concluded that both groups have positive, strong beliefs about parent involvement and its importance in student achievement, but their minimal involvement or communication with parents did not match those beliefs (Barnyak & McNelly, 2009). Another study looked at the perceptions of change taking place in low-performing schools and found that teachers' perceptions of school improvement were lower than those of their respective principals. There was, however, some agreement on some survey items regarding the least improved areas of change (parental support of students' academic success, student discipline, school safety, and teacher supervision) during the school year and relative agreement between the groups on perceptions of progress made towards improvement in these areas (Tucker, Higgins, & Salmonowicz, 2004).

We found more literature regarding the perceptions of administrators and teachers in the field of special education and inclusion. Center and Ward (1987) surveyed teachers and administrators about their attitudes on integrating disabled children into regular schools. The study concluded that teacher attitudes reflected a lack of confidence in their own skills and that of support staff, whereas principal attitudes were consistently

more positive. A similar study by Praisner (2003) looked only at principal attitudes on inclusion of special needs students. Findings include positive attitudes toward integration, noting that principals have limited training and experience with special education. Another study suggested that teachers would be more reluctant than administrators and policy-makers to implement policies to meet the needs of students who have significant disabilities. Their survey revealed that teachers with more professional expertise in implementing inclusion programs had significantly more

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positive attitudes towards inclusion than those from randomly selected schools (Avramidis, Bayliss, & Burden, 2000). This study compared teachers with and without experience in special education, but it did not include the administrator population. Another large study of 680 general and special education teachers' and administrators' perceptions on full inclusion of all students found differences between those educators with and without experience educating students with disabilities, but this study only compared teachers and administrators with and without this experience (Villa, Thousand, Meyers, & Nevin, 1996). In general, the literature shows that principals tended to have more positive views than teachers.

Relating to the topic of science education, an important study looked at the basic understanding of administrators and STEM teachers about STEM education. Researchers asked participants to define STEM education and then analyzed the data by position (teacher and administrator) and discipline (math, science, technology, other) (Brown, Brown, Reardon, & Merrill, 2011). Both groups had similar responses, with about half able to define STEM as involving science, technology, engineering, and mathematics. However, when focusing on data related to beliefs about STEM education, all of the participants were collapsed into one group so the study was unable to get into deeper differences between the groups. Seventy-five percent of participants agreed that STEM education is important and cited STEM as a bridge between disciplines, an important skill builder, and providing context to school subjects, among other reasons. An important conclusion of this study was that a large proportion of teachers and administrators are unaware of the

literal definition of STEM. Overall, while Howley, Andrianaivo, & Perry (2005) suggest that there may be a difference in attitudes between teachers and school administrators in education, there is little research that actively juxtaposes the two groups to highlight possible differences, especially in the field of science education.
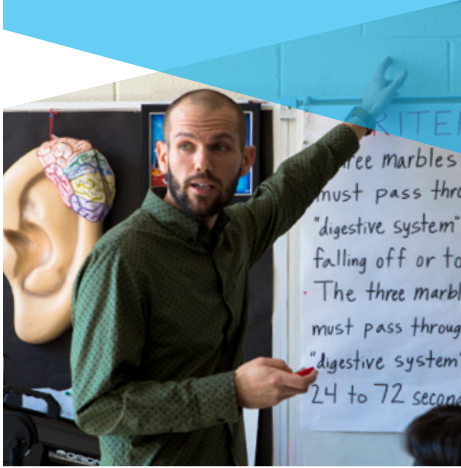
SCIENCE LEADERSHIP INITIATIVE

The Science Leadership Initiative is a program designed to support K-8 schools to enhance science education at the whole-school level (Chiu, Price, & Ovrahim, 2015a). It is focused on the School Partners Program, a program designed to prioritize science education at the whole-school level. The School Partners Program consists of a school team dedicated to the process of whole-school science reform. It consists of an administrator (school principal, assistant principal, or other level administrator within the school), a Teacher Leader, and a cross-disciplinary school team of six to 10 science and non-science teachers and staff across the school. The team, guided by the Teacher

Leader, uses a School Support Tool, a self assessment used by cross-disciplinary school teams to assess their current level of science education within a school. The tool is described on the Science Leadership Initiative website.[1] The Teacher Leader directs the team in the processes of evidence gathering, rating, action planning, and implementation. The Museum of Science and Industry, Chicago (MSI) supports schools in this process for up to three years.

The partnership between participating schools and MSI works in a number of ways. First, Teacher Leaders are trained on program components and the process of leading their schools in whole-school science reform before the start of the year. Administrators meet and network at the Museum with other School Partner administrators in the summer and at the mid-year point. Teacher Leaders also meet as a cohort at MSI in a series of four evening work sessions, once monthly from September-November, and again in spring. Schools are recognized for their year-long work at a recognition event held in May, where Teacher Leaders and administrators share successes as a result of their work with the Science Leadership School Partners Program. Finally, schools reflect on their successes and prepare for the next school year.

SURVEY OF TEACHERS AND ADMINIS- TRATORS

As previously described, existing literature does not have much to say about the differences between teachers and administrators in terms of STEM edu-

cation. As part of our program development process, focus groups were held with our advisory committee members to better understand the challenges and needs that schools were facing with science and STEM education, to initiate the program development process. In our focus groups, we routinely heard that teachers and principals both felt like the other group had different priorities regarding STEM education. One teacher remarked, "Principals tell us that, 'We've got the scientific method down,' as the definition of their STEM program. This is the relationship that administrators have with STEM." One administrator said, "I think there are a lot of administrators across the district that just didn't come from a science background and so they're just at a loss from the get go. They don't even know where to start to drive science or STEM programming at their school." Program developers decided to conduct an exploratory study of teacher and administrator perceptions of STEM education at the whole-school level to see what types of differences do exist, if any. The research questions for the survey were:

1. What are teacher and administrator perceptions and perceived value of STEM education in the greater Chicago area?

2. What supports can the local science center provide teachers and administrators to deliver quality science and STEM education?

The survey and its basic results are described in more detail in Chiu, Price, & Ovrahim (2015b). It included questions about awareness of STEM education, what schools do to support STEM and science education, and what is needed to deliver a quality science education to their students. The target audience for the survey consisted of administrators and teachers in the city of Chicago and

23 of its suburbs. We identified 839 kindergarten through eighth-grade schools, including public elementary and middle, charter, magnet, private, and parochial schools available through school databases in Cook County, Illinois, and randomly selected 175 schools. At these 175 schools, one administrator and one science teacher was selected. Each individual was given a survey consisting of 34-36 multiple choice and open-ended questions. The survey was administered between August and October 2014. In total, we contacted 350 administrators and teachers. A $15 Amazon gift card was offered as an incentive. We received 64 total responses, including 47 from teachers and 17 from administrators. These respondents represented 53 different schools in the greater Chicago area. All open-response questions were analyzed using frameworks drawing heavily upon the Framework for K-12 Education (NRC, 2012) and other literature.

One significant finding from the survey was the *lack* of strong differences between administrator and teacher responses. For example, school administrators and science teachers shared similar responses to the definition of STEM education. Eighty-five percent of administrators and 76 percent of teachers used the entire phrase of "science, technology, engineering, and math" in their definition of STEM education. This is a higher rate than found in Brown, et al. (2011), which could be attributed to the five years that has passed since the study was published and the recent push for and increased awareness of STEM education in the United States. Additionally, the survey showed that the groups agree on the importance of science and feel that there is strong support in their schools. However, one difference was that administrators feel more support from their non-science peers than do teachers (of their own non-science peers).

Administrator responses were more strategic, whole-school suggestions, wants, and needs in supporting STEM education, whereas teachers had more responses relating to working directly with students. The subtle differences found in the responses on how to support STEM education can be attributed to their different roles within a school. Overall, the survey revealed that neither administrators nor teachers have a defined and consistent method of incorporating STEM education into their schools. Both groups want to use more inquiry-based, hands-on learning and technology, but they share struggles like lack of resources and trouble understanding, and have needs like more professional development. Results illustrated that both groups feel that science and STEM are important subjects and lead to new skill development and opportunities for students.
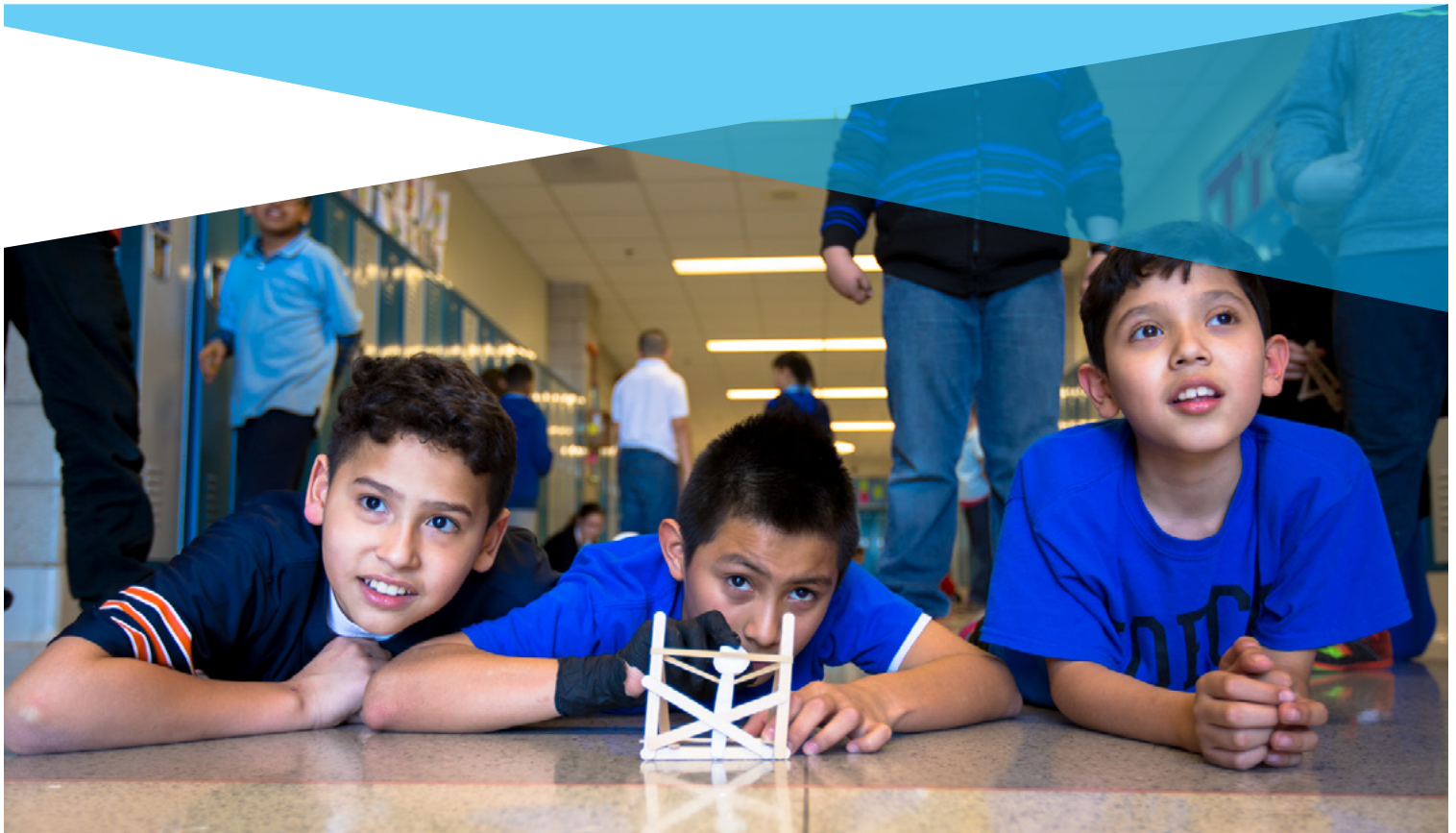
PILOT FOCUS GROUPS

Six schools were recruited to pilot key components of our newly designed school leadership program with a group of science and non-science teachers. All participants were invited to a focus group held after the pilot had ended. Nine teachers (out of 31) participated in a teacher focus group and two school administrators (out of eight) participated in an administrator focus group. The main reason some participants could not join a focus group was time (the focus group was held during summer vacation). The two groups were asked the same questions regarding their experience during the pilot of the program. Overall, the feedback from both groups was similar. The following are a few of the findings of the pilot process and quotes from the focus groups.

1. Incorporating science and non-science teachers across grade levels into the Cross-Disciplinary School Team increases awareness across the school.

Teacher: "[Working with a team] you get to learn so much from each other.…you do speak from your own [experience], but we were doing all the homework and everything that I did came from eighth grade… I forget that it's about the whole school."

Administrator: "When we shared examples I think is where we differed because what I see this teacher doing versus what two other teachers are doing, I also think that when we had conversations, I learned quite a bit about stuff that they were doing…"

Teacher: "As a non-science person, [this program] was really gratifying for me to see that some of the other things

that I was doing in my classes bled into the science work that the science teachers were doing."

Administrator: "Whether you're teaching history or science or English, there will be some levels of vocabulary that cross over from the math department…all teachers are going to have to come onboard with the new NGSS and they're going to have to have some level of awareness and how we can do cross curricular or interdisciplinary units between different content areas."

2. The presence of both teachers and administrators in each school's team increases awareness across the school.

Teacher: "I think it also helped us understand what goes on in our building. By having everyone's viewpoints to share what they do in their classrooms, what they're doing to support their kids for the year and realizing that we could actually use a lot of each other's strengths to make everything better…"

Administrator: "Sometimes you're talking to your own content area and that's the way you look at things, but maybe a history teacher brings up a question that no one thought about or the art teacher says maybe they can bring this component into our fine arts classes…"

Teacher: "I really liked that [the program] brought our school team together, we have a huge team of I think 10 people, it was the administrators, the STEM teachers, grade levels, so it was nice to be able to sit down together and collaborate to figure out where we are and where we want to go."

Administrator: "…As difficult as those conversations were to have, we enjoy and welcome those conversations because it's a building that has to come closer together and get our teachers on the same page, and it's a district that has to look at, 'Are our schools preparing our kids?' …It was eye-opening to hear what people thought about where we were, not only as individuals, but as departments and as a school."

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3. There is little collaboration within schools outside of departmental work.

Teacher: "[The program] helped to realize and highlight what deficiencies there are that we have in terms of supplies, in terms of curriculum, in terms of support. Not just for me as the middle school teacher, but hearing that and having the primary grade teachers be able to look at the administration and say, 'We need this.'"

Administrator: "[Teachers] may not be aware of what others are doing, and we found that even in the department, there might not be knowledge about what they're doing even though they talk and they try to have professional learning communities where they're trying to be more alike than different."

YEAR ONE PROGRAMMING

Following the work from piloting the program in winter/spring 2015, applications opened for year one of the Science Leadership School Partners program. From each school, a science teacher leader applied for the position of Teacher Leader, leading the process of school reform around science education at that school. The Teacher Leader was nominated by a school administrator who also supported the process of reform and programming at the school. The Teacher Leader and administrator recruited a small team of six to 10 cross-disciplinary teachers and staff. In total, 15 School Partners were accepted into year one programming, with a year one cohort of 15 Teacher Leaders and 15 administrators. Data collection from year one focuses on evaluation of the program. Based on the findings from the fall STEM perceptions survey and the discussions from the pilot focus group, we were able to incorporate questions on our program evaluations that enabled us to compare the attitudes and the perceptions of teachers and administrators that were involved with programming in the first year.

Programming officially began in August 2015. Following each meeting at the Museum, participants were given a short survey. School Partners were given a suggested schedule of meetings with their cross-disciplinary school teams for four times between September and December and again in April.

At the beginning of programming in summer 2015, administrators and Teacher Leaders were asked about their biggest obstacle to successful implementation of the School Partners

Programming. Administrators responded with maintaining motivation and momentum throughout the year-long process and having competing priorities throughout the year. Teacher Leaders responded with trust, colleague buy-in, a high rate of staff turnover, uncertainty with the programming, being honest with all participants including administrators, and the challenge of getting to meetings. Aside from those differences, three common obstacles were revealed. Time, funding/money, and communication with other staff members outside of the cross-disciplinary team. A list of responses from administrators and Teacher Leaders can be seen in Figure 1. Some of these challenges mentioned are more relevant to their roles as teacher or administrator, echoing results from our fall 2014 STEM perceptions survey. All of these challenges are present in a school environment and the obstacles are not unique to the School Partners Program but also are common to other school initiatives.

Administrators and teachers were also asked about things that they thought could improve science education at their school. Administrators said that time, coaching, new curriculum, increasing lab work, and more materials were things that could improve science education. Teacher leaders said being honest about the status of science education in their conversations could help improve science education at their schools. There were several overlapping responses. Both groups reported resources, partnerships with families and the community, communication with the staff and increasing teacher interest, professional development, incorporation of NGSS, buy-in, cross-curricular collaboration, and support given to non-science teachers and those not comfortable with science. A list of these responses can be found in Figure 2.

The large number of overlapping ideas suggests that both administrators and Teacher Leaders have similar ideas in how they can improve science education at their schools. Non-overlapping items seem like ideas that are related to the respective group's role at a school.

In January 2016, all 137 program participants, including 15 Teacher Leaders, 15 School Partner administrators, and 107 cross-disciplinary school team members, were sent an online survey about science education attitudes, program components, and their effect on themselves and the school. The survey was composed of 10 Likert questions, seven open response items, and a series of demographic questions (see Appendix for a list of questions). Eighty-nine surveys were fully completed. Results from the attitude items were overwhelmingly positive from all individuals, regardless of their role. Over 85 percent of responses on Likert questions fell into the Agree or Strongly Agree categories, indicating that participants feel that their understanding of science education and their team's understanding of science education has increased as a result of participating in this program and that there is more collaboration and discussion around science and STEM across disciplines and grade levels. A comparison of the teacher and administrator responses found that the attitudes of both administrators and teachers participating in the program working on whole-school science education reform at their schools were very similar.

The open-response items on the survey tell more about the similarities between our participants. The following are a few findings from the responses of the survey, broken down by participant's role in the program: Teacher Leader, administrator, or cross-disciplinary school team member.

> The program has allowed teachers, even those who don't specialize in science, to find meaningful ways of integrating science into their classroom instruction that is standards-based.

1. It is important to have conversation outside disciplines and grade levels around science at a school.

Teacher Leader: "[The program is] creating a dialogue between all disciplines about how we can support each other and students in science, and interweaving all the disciplines."

Cross-disciplinary school team member: "The ability to have open discussions with colleagues I typically don't interact with which has led to educating myself on the STEM that exists currently in our school."

Cross-disciplinary school team member: "Having the opportunity to talk to other teachers and learn about their perspective on science education as well as learning about the science taking place in their classrooms."

Administrator: "It has helped us find ways to incorporate science and STEM into other curriculum areas. It has also helped us to share the great things that are already happening across our school in those areas."

Teacher Leader: "The program has allowed teachers, even those who don't specialize in science, to find meaningful ways of integrating science into their classroom instruction that is standards-based."

Cross-disciplinary school team member: "The open dialogue between team members from across all different grade levels and disciplines in the school…"

2. Having these discussions with teachers of all subjects and grade levels and administrators helps to increase awareness around science education at the whole school level.

Administrator: "We are looking at ways to incorporate or share science and STEM activities throughout the school. It has brought more awareness."

> I think it has helped me understand what is happening in science outside my grade level. I was able to get a good picture of how science is taught throughout the school.

Administrator: "All staff are aware of ways we can integrate science in our school."

Cross-disciplinary school team member: "I think it has helped me understand what is happening in science outside my grade level. I was able to get a good picture of how science is taught throughout the school."

Cross-disciplinary school team member: "[This program] made me more aware of our goals and where were are going as a school and what other grade bands are doing in science education."

Cross-disciplinary school team member: "Awareness of STEM and how even the little ones can participate in these kinds of activities."

Cross-disciplinary school team member: "Our team is now more aware of what kinds of science activities are taking place across all the grade levels, whereas before this team, we had little idea of what other grades were doing in science."

3. Having these conversations and initiating the process of whole school reform around science education has positive effects on the school.

Administrator: "The on-going discussions held by the cross-disciplinary team during their meetings has led to a greater sense of ownership throughout the school."

Teacher Leader: "We have begun to look at science not as an isolated class, but how science is part of other subjects. This has caused the discussion to grow… What is also great is how much other teachers and departments want to be part of the discussion and are openly sharing what they do."

Teacher Leader: "Began searching for ways to integrate science across the content areas. Has helped us work together as a team more than separate entities."

Cross-disciplinary school team member: "We are really working to connect students (which comes from connecting teachers) with each other over STEM education. This program also let us know of the realities we need from administration to truly be successful in our goals."

Cross-disciplinary school team member: "This is just the start but I feel like it offered ways for science to overlap into our content with more meaning."

4. Teachers and administrators share similar challenges, including time and resources, when it comes to implementing programming and reform at their school.

Teacher Leader: "Being honest brought up some frustrations that members of the group were feeling. It was difficult navigating some of these situations, but well worth it in the end."

Teacher Leader: "[I] realized that it is difficult to find time to meet for these opportunities for discussion and planning."

Teacher Leader: "…getting the rest of the teachers on board who were not members of the cross-disciplinary team."

Administrator: "Time to meet, time to do the assessments, time to get the other teachers involved."

Cross-disciplinary school team member: "Most of our challenges are because of time, finances, and technology."

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IMPLICATIONS

School administrators – mostly principals – and teachers are heavily studied populations in education research, but the attitudes toward science of these two groups are seldom compared. Anecdotally, we found that administrators and teachers believe they are different from each other in their approaches to and opinions of science education. However, our research has surprised us in that teachers and administrators seem more alike than different. They share similar needs, wants, perceptions, and perceived importance of science education. This result implies that rather than dwelling on the assumption that teachers and administrators are different, they may be more similar than they believe and can work together toward improving science education through whole-school change. However, there are a few specific areas where they have differences.

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For example, they perceive different levels of support from their peers and their thoughts about how to improve STEM education reflects their different roles in the school (administrators tend to think more strategically while teachers think more operationally).

They also have slightly different challenges, which are related to their individual roles teaching in the classroom or overseeing operations of a school and managing teachers. One implication is that when putting together working groups of teachers and administrators, it may make sense to dispel this myth of difference at the beginning so that all members of the groups realize that they are more similar than they may think. This could help build cohesion and chemistry in groups that otherwise may have doubt and skepticism.

CONCLUSION

Whole-school science education reform cannot be implemented solely in the classroom. It requires the leadership of school administration and teacher leaders within a school. In the development of a program to advance school leadership in support of science education, we incorporated various stakeholder groups, including teachers and administrators. We found that by building on the strengths of the similarities of the two groups, as opposed to treating them as qualitatively different (or even antagonistic) groups, they were better able to collaborate across disciplines and grade levels. By giving School Partners a structure for initiating whole-school reform around science education, schools are better able to begin that process to improve their science education programs for their students.

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WHAT DO YOU THINK WILL BE YOUR BIGGEST OBSTACLE?

	Administrators	Teacher Leaders
SIMILAR	Time – finding time to implement, getting pulled to do other things	Time
	Funding	Money
	Communication to whole school staff beyond teams	Communication
DIFFERENT	Maintaining motivation and momentum to complete processes	
	Competing priorities	
		Trust
		Colleague/teacher buy-in
		Staff turnover
		Uncertainty
		Honesty
		Getting to meetings

Figure 1. "What do you think will be your biggest obstacle to successful implementation of the School Partners Program?" This figure shows a comparison of responses from Administrators and Teacher Leaders.

THINGS THAT CAN IMPROVE SCIENCE EDUCATION AT YOUR SCHOOL

	Administrators	Teacher Leaders
SIMILAR	Resources	Funding/Resources
	Bringing in families and community	Partnerships
	Increasing teacher interest	Communication with all staff and the community
	Professional development	Professional development with staff
	Correlation with NGSS	Educate staff on NGSS
	Training for buy-in	Listen to ideas from outside the team
	Cross-curricular connections	Cross-curricular collaboration
	Science support given to teachers	Support those not comfortable with science
DIFFERENT	Time	
	Coaching	
	Curriculum	
	Increasing Lab Work	
	Materials	
		Honesty

Figure 2. "Name things that can improve science education at your school?" This figure shows a comparison of responses from Administrators and Teacher Leaders.

APPENDIX

January 2016 Survey Questions

1. I teach at least one science class this year within self-contained or departmentalized subject class (Yes/No).

2. My role is best described as (Administrator, Teacher Leader Fellow, cross-disciplinary school team member).

Likert (5 pt. scale: Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree)

1. I have a shared understanding of science at the whole school level as a result of my participation in this program.

2. My team has a shared understanding of science at the whole school level as a result of my participation in this program.

3. I feel like I am a contributing member of my team.

4. I feel myself having more collaboration and discussion around science and STEM outside my discipline/grade level because of my participation in this program.

5. The discussions in meetings were applicable to my work at the school.

6. The rating system (Awaiting Initiation, Igniting It, Building It, and Living It) helped my cross-disciplinary school team have a more honest and open dialogue.

7. I feel that I am growing personally/professionally as a result of my participation in this program.

8. I understand the purpose of the Science Leadership School Partners Program.

9. I understand why we are doing this program.

10. My team is using technology in meetings in a productive matter.

Open Response

1. What has been the program's greatest benefit for you?

2. Give an example of how the program has affected your cross-disciplinary school team.

3. What are some challenges you had during this process?

4. Give an example of something unique that MSI, as an organization, brings to a program like the Science Leadership School Partners Program.

5. How has your cross-disciplinary school team's participation in this program impacted your whole school?

6. How do you feel the digital School Support Tool could be improved?

7. Do you have any other feedback, concerns, or improvement ideas to provide MSI staff? (OPTIONAL)

Demographics

1. Gender (open-ended)

2. Race (White, Black or African-American, American Indian or Alaska Native, Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, Native Hawaiian, Other Race-Please enter an 'other' value for this selection)

3. Ethnicity (No; Yes, Mexican, Mexican American, Chicano; Yes, Puerto Rican; Yes, Cuban; Yes, another Hispanic, Latino or Spanish origin: Please enter an 'other' value for this selection)

4. # of years in education (open-ended)