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## Abstract

The purpose of this mixed methods study was to assess the perceptions of K

## Introduction

For the past decade, the United States (U.S.) federal government and all 50 states have invested substantial dollars in Science, Technology, Engineering and Mathematics (STEM) education (Tofel-Grehl & Callahan, 2014) in response to legislation such as America COMPETES (Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science) legislation (H.R. 2272, America COMPETES Act, 2007), reports such as the National Academy of Sciences study, Rising Above the Gathering Storm (2007), and enterprises such

Knowledge and awareness can help V K D S H D Q L Q G L Y L G X D O ¶ V S H U F H S W L R Q V Collaboration and communication between stakeholders provide the means necessary to

finance; comprehensive understanding of standards based reform; and, thorough familiarity with student performance demands associated with legislation such as No Child Left Behind (2001) (Farkas, Johnson, Duffett, & Foleno, 2001; Feuerstein & Dietrich, 2003; Lecker, 2002; Sherman & Grogan, 2003). In addition, public school superintendents are H [ S H F W H G W R H V W D E O L V K W K H L U G L V W U L F W ¶ V Y L V L R Q develop worthy dimensions of teaching and learning; introduce and execute policies; and, build quality relationships with integral groups (Carter & Cunningham, 1997; Sharp & Walter, 1997; Waters & Marzano, 2006).

Bjork, Browne, Ferrigno, and Kowalski (2014) conceptualized the work of superintendents into five distinct roles: (a) superintendent as teacher-scholar; (b) superintendent as manager; (c) superintendent as democratic-political leader; (d) superintendent as applied social scientist; and, (e) superintendent as communicator.

According to Bjork et al. (2014), superintendents are considered to be master teachers, and in fact, a 2000 report stated that 40% of superintendents perceived their primary role as that of educational leader (Glass, Bjork, & Brunner, 2000). Similarly, greater than one-third of the superintendents involved in the Glass, Bjork, and Brunner study (2000) stated that effective management was one of the roles their school boards expected them to fulfill. Management tasks of superintendents include budgeting, educational accountability, and compliance with state and federal directives (Glass et al, 2000).

The political savvy of superintendents has also been a critical attribute as superintendents must increasingly handle bond and local school tax issues that require a penchant for inciting support from school board members, parents, citizens and teachers regarding district endeavors (Howlett, 1993).

Moreover, 83% of superintendents indicated school board relations requiring micro-politics were particularly challenging (Glass et al., 2000). Kowalski et al. (2010) characterized superintendents as applied social scientists because they utilize their knowledge of research to inform the educational decisions they make.

Historically, superintendents have worked in an isolated environment, protected from potential interference by parents, citizens, and teachers (Blase & Anderson, 1995). Superintendents were likened to corporate executives, and their communication styles were unilateral and impersonal (Achilles & Lintz, 1983).

Conventional communication methodologies changed when the U.S. became a more information-based soci 0 G [(methodologi)-3(eb

simplifying language. Peer debriefing was accomplished by having two researchers independently code the open-ended responses and discuss findings.

## Findings

### STEM awareness/resources

Superintendents and principals indicated 77.0% disagreement with regard to their perceptions of STEM awareness/resources of the districts and schools they served, demonstrating agreement in only three of 13 areas.

Specifically, superintendents and principals differed in their perceptions that their districts understand the importance of STEM education as 78.2% of principals and 100.0% of superintendents agreed that their school district understands the importance of STEM education.

Similarly, superintendents and principals differed in their perceptions of the statement that the school districts understand the importance of STEM education, with 74.3% of principals and 100% of superintendents in agreement. In addition, differences existed between principals and superintendents regarding whether districts understand the importance of STEM education, with 36.3% of principals and 71.4% of superintendents agreeing.

Principals and superintendents also differed in perceptions regarding whether more work needs to be completed to spread awareness of STEM education, with 89.4% of principals and 78.6% of superintendents agreeing. Additionally, principals and superintendents differed in their perception that increasing the STEM talent pool is necessary for economic vitality, with 92.5% of principals and 85.7% of superintendents agreeing. Further differences were found regarding perceptions that students with postsecondary education are more likely to secure a career in a STEM field with 83.2% of principals and 71.4% of superintendents agreeing.

Regarding the statement that there are STEM education Web sites available for this region that include activities for teachers and students, 83.0% of principals and 78.6% of superintendents indicated agreement. Principals and superintendents also differed in their perception that information on regional STEM career opportunities is available online, with 51.2% of principals and 64.3% of superintendents agreeing.

Principal and superintendent differences were also reported regarding perceptions that information related to STEM opportunities in their regions is available online with 51.0% of principals and 71.4% of superintendents agreeing. Finally, perceptions of whether or not STEM online tools are available to their districts differed, with 49.7% of principals agreeing and 71.4% of principals agreeing.

On the contrary, principals and superintendents were in agreement in only three of ten areas of perceptions. First, principals and superintendents agreed that STEM skills are integral to student success today (Principals 92.5%, Superintendents 85.6%).

Administrators also agreed that there are colleges, universities, and community colleges that offer scholarships for students to pursue STEM degrees in their regions

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| 8. There are colleges and/or universities and/or community colleges that offer scholarships for students to pursue STEM degrees in my region. | Superintendent<br>Principal | 28.6<br>5.0 | 57.1<br>63.1 |
| 9. There are STEM education Web sites available for this region that include activities for teachers and students. | Superintendent<br>Principal | 7.1<br>6.2 | 57.1<br>63.0 |
| 10. Information on regional STEM career opportunities is available online. | Superintendent<br>Principal | 0.0<br>3.8 | 64.3<br>51.2 |
| 11. Local organizations recruit STEM talent online. | Superintendent<br>Principal | 14.3<br>16.7 | 28.6<br>30.4 |
| 12. Information related to STEM opportunities in my region isavailable online. | Superintendent<br>Principal | 7.1<br>12.4 | 71.4<br>30.4 |
| 13. There are other STEM online tools available to this district. | Superintendent<br>Principal | 7.1<br>12.4 | 71.4<br>49.7 |

(during elementary and middle school).

Specific suggestions included:
(a) hiring a STEM teacher to run a STEM lab;
(b) providing a STEM specialist at each elementary campus;
(c) providing more information regarding STEM and STEM careers to elementary schools; and,
(d) implementing specific STEM curricula at the elementary level.

**Superintendents.** Qualitative analysis of V X S H U L Q W H Q G H Q W V ¶ U H V S R Q V H V U H Y H D O H G W K H following overarching themes in order of frequency of occurrence:
(a) more access to technology;
(b) connect schools with STEM professionals;
(c) educate parents about STEM and STEM education; and,
(d) provide STEM instruction in elementary schools.

Specifically, 64.0% of superintendents offered suggestions related to the need for technology, including the following:
(a) more coding and robotics opportunities;
(b) one-to-one computer availability; and,
(c) the creation of dual credit courses in STEM technology.

factors that contribute to the lack of congruence between the administrators in this area?

There are probably several underlying reasons as to why there is a lack of agreement

Pressure to provide more qualified employees must come from lawmakers and private entities. As colleges and universities recognize the need in society for graduates in STEM areas, perhaps the emphasis placed on STEM professions will prompt more students to consider the possibilities of STEM careers. Until colleges and universities begin to address weak STEM education programs, K-12 schools will continue to suffer the consequences of underprepared STEM teachers.

This apparent lack of focus on STEM education results in the perpetuation of a cycle which lacks the emphasis necessary to change the current culture regarding STEM in schools. Once teacher candidates and future administrators have been appropriately trained in STEM education and assume teaching and administrative positions, the focus on STEM in K-12 schools should improve.

This particular study provides information colleges and universities could use to bolster their teacher preparation programs, resulting in a greater number of better qualified teacher candidates trained in the STEM areas. If administrators are able to hire better prepared teachers, the culture surrounding STEM implementation will be more conducive to STEM education.

## Professional development

This study expresses the need for systemic, continuous professional development activities in STEM for all educators. School districts must begin to place the proper emphasis on continuing education for teachers and administrators.

The research literature has emphasized the need for STEM related professional
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## Instructional leadership

This study affirms the need for leaders in

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