Developing Workforce Skills in K-12 Classrooms: How Teacher Externships Increase Awareness of the Critical Role of Effective Communication

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Abstract

This study investigates how participating in a teacher externship program increases the awareness of how effective communication plays a critical role in an industry-based environment. It also studies the teacher participants' commitment to changing their classroom practices as a result of acquiring this awareness. The program of focus, the Educators in Industry: K-12 Externship Program, is a 4-week summer work experience for K-12 educators in an engineering, design, or process-driven work environment, coupled with collaborative reflective practice. Participants also take three credits of coursework split over the summer and fall which requires them to design and implement classroom activities based on their externship experience. In this qualitative study, various forms of data were transcribed and analyzed using a thematic analysis approach. The results provide empirical evidence that teachers who participated in the teacher externship program developed a deep awareness of the importance of using effective communication in the workplace as well as a commitment to redesigning their classroom practices in order to engage their K-12 students in communication-focused learning activities.

Keywords: Teacher Externship; Workforce Readiness; Communication; Professional Development; 21st Century Skills; STEM Education; Qualitative Methods

Introduction

"Increasing opportunities for young Americans to gain strong STEM skills is essential if the United States is to continue its remarkable record of success in science and innovation" (National Science and Technology Council, 2013, p. 1). Research is demonstrating an increased demand nationwide for highly qualified employees in Science, Technology, Engineering, and Mathematics (STEM) related fields (National Science and Technology Council, 2018; United States Department of Education, 2019). Having STEM-capable citizens has significant implications for America's economic competetiveness in today's increasingly globalized and technological world (President's Council of Advisors on Science and Technology, 2010). In response to this need, the Next Genera-

tion Science Standards (NGSS) (NGSS Lead States, 2013) and the Common Cores State Standards (CCSS) (National Governors Association Center for Best Practices [NGACBP], 2010) were developed by K-12 stakeholders to produce a more STEM-proficient workforce. Both the NGSS and CCSS were founded in a vision to graduate students that are workforce ready. Even though not all states have adopted these particular standards, every state has mathematics, science, and language arts standards that include similar elements contained in the NGSS and CCSS, and are committed to developing STEM-capable citizens that are workforce ready.

The national conversation about improving workforce readiness hinges on fostering the skills necessary to be a highly effective employee while students are still learning in K-12 settings. By focusing on learning outcomes beyond content knowledge through primary and secondary grades, students can develop skills as identified by the framework for 21st century learning such as critical thinking, collaboration, creativity, and communication (American Association of College Teacher Education [AACTE] & Partnership for 21st Century Learning [P21], 2010; P21, 2019a). However, due to the lack of knowledge and experience in designing authentic learning experiences embedded with 21st century skills, some teachers do not include opportunities for students to engage in authentic application of these skills during classroom activities. Targeted professional development has been shown to significantly increase the use of 21st century skills in the classroom as a tool to engage students in authentic 21st century learning (Darling-Hammond & Baratz-Snowden, 2005). By integrating 21st century skills with content knowledge standards, teachers can provide students with learning opportunities essential to developing future workforce skills. Teacher externships have served as one of these professional development experiences that increase teachers' awareness for the need to provide authentic classroom learning activities for students, as well as developing the knowledge and skills needed to do so (Bowen & Shume, 2018; Dubner et al., 2002; Barrett & Usselman, 2005, 2006; Farrell, 1992; Kantrov, 2014). The primary aim of this type of program is for the teacher to gain an understanding about the kinds of knowledge, skills, and dispositions essential for successful employment in en-

gineering, design, or process-driven work environments. Upon return to the classroom, the teacher can apply insights gained through the externship to make their course content and learning experiences more relevant and engaging for the students. It also provides an authentic context for teachers to engage students in career awareness activities. This research study reports the results of an externship program that engages teachers in a summer work experience coupled with reflective practice.

Research Question

Preliminary research literature shows that teacher externships are a valuable form of teacher professional development. Although limited studies exist, research demonstrates these types of teacher professional development experiences have led to an increase in student achievement in science (Dubner et al., 2002; Silverstein, Dubner, Miller, Glied, & Loike, 2009), an increased use of design-based classroom activities (Bowen, 2014; Kantrov, 2014) and redesign of K-12 learning environments to engage students in authentic learning applications (Bowen & Shume, 2018; Barrett & Usselman, 2005, 2006; Basalari, de Seriere, Hawkins, & Miller, 2017). Early research also demonstrates how teacher externship programs transforms a teacher's impression of why engaging students in authentic learning experiences is critical for preparing them for the future workforce (Bowen & Shume, 2018; Basalari et al., 2017; Kantrov, 2014). By observing firsthand the activities that are critical to the success within an industry environment, teachers gain a new outlook on the experiences they need to provide for their students. This, in turn, influences teachers to increase the frequency with which they incorporate 21st century learning and STEM-based practices into their general classroom practices (Barrett & Usselman, 2005, 2006; Basalari et al., 2017; Bowen, 2014; Kantrov, 2014). However, the overall breadth of empirical data for documenting the impact of teacher externship programs is limited (Kantrov, 2014). This research study builds on existing evidence of other programs (Barrett & Usselman, 2005, 2006; Dubner et al., 2002; Farrell, 1992; Silverstein et al., 2009) by focusing on the teacher-reported outcomes of an industry-based teacher externship program. The research question for

this study is: How do teachers describe impacts of their externship experience on their awareness of the role of communication in workplace environments and on corresponding classroom practices related to communication skills?

Workforce Readiness

Workforce readiness extends well beyond mastery of content knowledge in foundational academic disciplines. It involves a complex array of knowledge, skills, and dispositions necessary to be successful and positively contribute to post-secondary educational and employment environments (Achieve, 2019; Beers, 2011). Workforce readiness skills, which involve competencies associated with 21st century learning may include creativity, critical thinking, collaboration, communication, innovation, problem-solving, and flexibility (P21, 2019a). These skills, sometimes referred to as soft skills, are necessary for workforce readiness in the current and future global environment.

Fulfilling Workforce Needs

Industry employers have indicated that possession of content knowledge and command of technical skills are not sufficient to meet employment requirements. Employers struggle to consistently fill positions for highly qualified employees in STEM areas because current applicants do not possess the necessary skills essential to success in the workplace (Rothwell, 2014; Xue & Larson, 2015). An Employers Needs Survey published by the North Carolina Department of Commerce (NCWorks, 2018) reported that of the over 1,500 employers that responded statewide, nearly 60% of the STEM sector reported significant difficulties in hiring new employees. Importantly, this study revealed that employers valued workforce readiness skills on par with technical skills when evaluating an employee's qualifications (NCWorks, 2018). Other employer-based reports along with educational research have outlined specific workforce readiness skills that are highly valued from an employee; some of these skills include problem-solving, teamwork, adaptability, innovation, leadership, time management, and design-thinking (Rutkowski, 2013; Siekmann & Korbel, 2016; Stawiski, Germuth, Yarborough, Alford, & Parrish, 2017). Critical thinking, creativity, collaboration and communication, typically labeled the 4 C's, are among the most documented 21st century skills critical for highly effective employees (P21, 2019a). Due to their importance for developing a future highly skilled employee, these four skills have been deemed critical for incorporating into K-12 education (AACTE & P21, 2010). Students need opportunities to develop and demonstrate competencies of content standards by applying formal problem-solving methods and workforce development skills (Basalari et al., 2017; Ignite, 2019; NGACBP, 2010; NGSS Lead States, 2013; P21, 2019b). P21 created a framework to outline

critical skills students need to be competitive in the future workforce (P21, 2019a). There are four major themes identified in this framework: a) key subjects (content knowledge) and 21st century themes, b) life and career skills, c) information, media and technology skills, and d) learning and innovation skills. The framework is as follows (P21, 2019a):

1. Content Knowledge and 21st Century Themes
   a. Content Knowledge - English, Reading or Language Arts; World languages; Arts; Mathematics; Economics; Science; Geography; History; Government and Civics
   b. 21st Century Themes - Global Awareness; Financial, Economic, Business and Entrepreneurial Literacy; Civic Literacy; Health Literacy; Environmental Literacy
2. Learning and Innovation Skills - Creativity and Innovation; Critical Thinking and Problem-Solving; Communication; Collaboration
3. Information, Media and Technology Skills - Information Literacy; Media Literacy; Information, Communications, and Technology (ICT) Literacy
4. Life and Career Skills - Flexibility & Adaptability; Initiative & Self Direction; Social & Cross-Cultural Skills; Productivity & Accountability; Leadership & Responsibility

K-12 Classroom Relevance

According to Saavedra and Opfer (2012), the number one strategy for teaching 21st century skills is to make the learning experience relevant, which also turns out to be one of the greatest challenges for classroom teachers (Ignite, 2019; Newman, Marks, & Gamoran, 1996; Stepien & Gallagher, 1993; Taylor et al., 2016). Increasing student engagement in activities that help prepare them for the future workforce is a continuous challenge (Ignite, 2019; Lou, Liu, Shih, & Tseng, 2011; P21, 2019b). Many teachers that have earned their teaching license through traditional pathways typically do not have industry work experience, making it difficult to create authentic and relevant connections for students (Bowen, 2013; National Academy of Engineering and National Research Council, 2009). Therefore, most teachers may not be familiar with the knowledge, skills, processes, and dispositions that industry employees use to solve technological problems. Due to the lack of opportunity to experience industry practices, many teachers, although desiring to incorporate more classroom activities that develop workforce skills, seem hesitant to incorporate these learning experiences due to a low comfort level (Blumenfeld et al., 1991; Bryson & Hand, 2007). Through immersion in STEM-related corporate work environments, teacher externships provide valuable professional learning experiences that show teachers first-hand the skills needed to solve current technological challenges, and impact teachers' perceptions of the need to integrate workforce readiness skills into classroom ac-

tivities (Barrett & Usselman, 2005, 2006; Basalari et al., 2017; Bowen & Shume, 2018; Dubner et al., 2002; Education Digest, 2009; Farrell, 1992; Silverstein et al., 2009).

Communication Skills

Although there are many important workforce readiness skills, industry has indicated that employees need highly refined communication skills to be successful in a STEM-based work environment (NCWorks, 2018; Rutkowski, 2013; Wagner, 2008). As the globalization of industry and technology advances, there are several different forms of communication that are necessary to maintain an effective workforce, including written communication, oral communication, and digital communication. Developing communication skills in K-12 students requires intentionally and authentically designed lessons in which students engage in problem-solving activities that require the use of effective communication. P21 describes communication within their framework as the ability for students to communicate clearly in a variety of context and environments. According to the elements of communication included in the framework for 21st century learning (P21, 2019a), students should be able to:

- Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts
- Listen effectively to decipher meaning, including knowledge, values, attitudes and intentions
- Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)
- Utilize multiple media and technologies, and know how to judge their effectiveness a priori as well as assess their impact
- Communicate effectively in diverse environments (including multi-lingual)

Engaging students in communication-focused learning activities through their K-12 experience will help better prepare them to be successful in the future workforce.

Teacher Externships

Teacher externships are defined as "a summer work experience in an environment that engages the teacher in engineering or design-based activities in order to gain a practical understanding of how industry uses current tools, processes, and resources to solve technological challenges" (Bowen & Shume, 2018, p. 6). Working in a corporate setting as part of an externship program, teachers gain valuable knowledge about the skills necessary to be an effective employee in a STEM-based industry environment (Bowen & Shume, 2018; Barrett & Usselman, 2005, 2006; Farrell, 1992; Ignite, 2019; Silverstein et al., 2009). Such knowledge may include new or deeper understanding about the engineering design process, problem-solving, team collaboration, local and global communication,

critical-thinking, management strategies, or many other types of skills needed to be successful in the workplace. After completing an externship experience and reflecting on insights gained, teachers return to the classroom better equipped to engage their students in authentic learning experiences that resonate with how the current workforce operates (WestEd, 2009).

Existing Models

The idea of teacher externships is not new and nationwide there are a number existing programs for teachers to gain industry and research experience as a professional development opportunity. Although each of these programs may have a different focus and offer teachers many different styles of opportunities, the overall goal for these programs are relatively similar: to increase the teacher's understanding of how content knowledge and workforce readiness skills are being applied in an authentic setting in order to deliver authentic classroom learning experiences that increase students' engagement and achievement in the classroom (Bowen & Shume, 2018; Center for Education Integrating Science, Mathematics, and Computing [CEISMC], 2019; Ignite, 2019). There are several teacher externship programs across the country: Ignite in California (Ignite, 2019); Georgia Intern Fellowships for Teachers (GIFT) program out of Georgia Tech's CEISMC (2019); Kenan Fellows Program for Teacher Leadership (2019) out of North Carolina State University; Iowa STEM Teacher Externships Program (Governor's STEM Advisory Council, 2019), and Teachers in Industry out of the University of Arizona (University of Arizona, 2019).

Of these, the Ignite, GIFT, and Kenan Fellows programs are three of the longest running programs. Since 1985, the Ignite program has been placing California teachers in STEM-related research positions for 8-week summer work experiences. To ensure they are making use of the knowledge and skills gained through the work experience, teachers are required to produce an Education Transfer Plan, an intentionally developed strategy for integrating the knowledge gained into classroom learning activities (Barrett & Usselman, 2005; Ignite, 2019). Since 1991, the GIFT program places on average more than 75 teachers per year in university and industry settings across the state of Georgia (Barrett & Usselman, 2005, 2006; CEISMC, 2019). Since 2000, the Kenan Fellows Program has placed over 400 teachers in North Carolina, engaging them in an industry work experience, a professional development program and a capstone project (Kenan Fellows Program for Teacher Leadership, 2019). All three of these programs have produced evaluations reporting that after participating, classroom teachers are more likely to use "real-life" examples, incorporate hands-on activities, integrate other fields of knowledge within their course curriculum, and use scientific inquiry as a method of problem, investigation and solution development (Barrett & Usselman, 2005, 2006; Ignite, 2019; Kenan Fellows

Program for Teacher Leadership, 2019). Participating teachers also have a higher retention rate than teachers who do not participate (Barrett & Usselman, 2005, 2006; Ignite, 2019). These are three examples of programs that aim to empower teachers with additional skills to increase authenticity of course material in the classroom and have proven these types of externship experiences have worthwhile impact on classroom teachers.

Educators in Industry: K-12 Externship Program

The teacher externship program of focus in this research study is the Educators in Industry: K-12 Externship Program. This program is located in the upper Midwest region and began in 2011. As a collaborative effort of university faculty, local economic development associations, education cooperatives, businesses, and K-12 educational communities, the Educators in Industry program provides in-service teachers an authentic work experience to see first-hand how corporations are currently using engineering, design, and process-driven activities, along with 21st century skills to solve technological challenges. Teachers for the program are selected through an application and interview process. To be eligible, participants must either be actively teaching in a K-12 classroom, or be in a position that has regular and direct interaction with students such as an administrator, media specialist, or career counselor. Businesses are selected based on the amount of resources available and their commitment to providing a worthwhile experience for the teachers. Once teachers and businesses are selected and paired, the work experience lasts for four weeks during the summer: full time Monday through Thursday, with a half day on Friday dedicated to faculty-led collaborative reflective practice with all the participants. Teachers also receive continuing education credits by enrolling in summer and fall courses. These courses involve lesson plan development and required implementation in the fall. Further details of the teacher and business selection process, summer work experience, and coursework can be found in Bowen and Shume (2018).

Methodology

A prior exploratory study into the impacts of the Educators in Industry externship program previously reported (Bowen & Shume, 2018) produced five themes, one of which was the importance of communication skills. The current qualitative study drills down into that theme and uses thematic analysis to determine how teachers describe the impacts of their externship experience on their classroom practices related to communication skills. Thematic analysis, an interpretive research method suitable for identifying patterns of meaning in qualitative data, is a highly iterative process through which data are coded and codes are collated into themes (Flick, 2014). According to Braun and Clark, a theme "captures something important about the data in relation to the research question, and represents some level of patterned response or meaning within the data set" (2006, p. 82). This study sought to analyze the data for patterns of meaning related to communication skills to provide an understanding of the teachers' perspectives on impacts of their externship experiences on classroom practice.

Study Participants

Participants for this study consisted of 26 educators, 11 male and 15 female, who completed the Educators in Industry program in 2016, 2017, or 2018. All participants were classroom teachers except for one, a library media specialist who also worked with gifted and talented students. Participating teachers worked with a range of grade levels from 3rd through 12th as well as a variety of subject areas. Participant demographics are summarized in Tables 1 and 2.

Data Collection

This qualitative study involved collection of data from several sources, including small group discussions, individual written reflections, teacher-designed lesson plans, and individual telephone interviews. Data used in this study were collected over a span of three years, with some variability in the types of data collected each year. Data were collected directly by the researchers: assistant pro-

Grade Level	2016	2017	2018	Total
Elementary (3-5)	3	2	1	6
Elementary/Middle School Blend	-	1	-	1
Middle School (6-8)	3	3	6	12
Middle School / High School Blend	2	3	-	5
High School (9-12)	1	1	-	2

Table 1. Grade Levels Taught

Subject Area	2016	2017	2018	Total
Business / Computers	1	1	-	2
Engineering / STEM	-	2	-	2
English Language Arts	1	2	2	5
Family and Consumer Sciences	-	1	1	2
Mathematics	3	-	1	4
Science	-	-	2	2
Social Sciences	-	1	-	1
No Subject Specialty	4	3	1	8

Table 2. Subject Areas Taught

fessors who hold doctorates, one in STEM education and the other in teacher education. One worked in industry as a civil engineer prior to teaching engineering courses at both the secondary and university levels; the other taught science coursework at both the secondary and university levels, and brings over 25 years of experience as a science educator.

During the summer externships, half-day debrief sessions were conducted every Friday morning by the researchers who served as instructors for the continuing education course that teacher participants took in conjunction with their externship experience. Weekly debrief discussions during summer externships were audio-recorded and transcribed for data analysis. Participants wrote individual reflections during their summer externship and produced lesson plan portfolios in fall. Lesson plan portfolios consisted of lesson plans and related instructional materials that teachers designed or redesigned based on their summer externship experience and implemented in the classroom in fall; portfolios also included a written reflection and evidence that the unit plan was implemented such as anonymized student work samples or an observation letter from a school administrator. Further, one of the researchers conducted semi-structured follow-up interviews by telephone with each participant at the end of the semester that he or she completed the program; interviews, typically about 40 minutes in length, were audio-recorded and transcribed.

Data Analysis

In this study, we followed Braun and Clark's approach to thematic analysis, "a method for identifying, analyzing, and reporting patterns (themes) within data" (Braun & Clark, 2006, p.79) that involves "searching across a data set - be that a number of interviews or focus groups, or a range of texts to find repeated patterns of meaning (Braun & Clark, 2006, p.86). Braun and Clark (2006, p. 87) de-

scribe thematic analysis as a recursive process that moves back and forth among six phases: "1) familiarizing yourself with your data, 2) generating initial codes, 3) searching for themes, 4) reviewing themes, 5) defining and naming themes, 6) producing the report." Inductive analysis, a "bottom-up" (Braun & Clark, 2006, p. 83) approach where themes are grounded in the data themselves, can be distinguished from theoretical analysis, a "top-down" (Braun & Clark, 2006, p. 83) approach where themes are linked to the researcher's pre-existing theoretical or analytic interest. Because we sought to identify themes related to the importance of communication, we used both approaches in the analysis for this study. During iterative cycles of analysis, data were triangulated among debrief discussion transcripts, interview transcripts, individual written reflections, as well as lesson plans and lesson plan reflections. Data were organized and coded using NVivo 11 software.

Findings

Thematic analysis of the data resulted in a principal theme and three sub-themes reported below. Pseudonyms are used to protect participant identity.

Principal Theme - Central Importance of Communication

A consistently strong theme that appeared in debrief discussion transcripts, interview transcripts, individual written reflections, as well as lesson plans and lesson plan reflections was that every teacher highlighted the central importance of communication in the day-to-day work they observed during their externship experience. For example, Owen stated in his final written reflection of the summer:

> The biggest takeaway I learned from my experience is how important all forms of effective communication are. In all areas that I shadowed, everyone needed

to communicate what they did, how they did it, and how at times, they had to resolve conflicts.

In transcribed oral discussions, written reflection, and individual interviews, several teachers reported that communication was identified as the single most important skill set valued by employees and employers alike. The following quote from Emma during a weekly debrief session is representative of that perspective:

> Every one of them [employees] said, "Communication is huge." They didn't know that they would have to do that as much when they were going to school for engineering, but it's communication. That's the big one they need to work on.

Similarly, Will said in an interview:

> So just the importance of clear and concise communication and being able to work efficiently to get things done, I think that's the biggest takeaway that I kept coming back to...Every time I would try to leave [from a job shadowing assignment] asking a question: "What do you think I can tell my students?" And that always was one of the number one things - being an effective communicator.

One teacher, Liam, had the opportunity to join the company's CEO on a flight to the corporate headquarters on a private 6-seater plane. During an interview, he said:

> I reached out and asked him [CEO] to share with me what he thinks kids coming into industry would need. He just really talked about communication and being able to know who your audience is and how to proofread a letter and how to present yourself to different audiences, like you talk different to an engineer than you do to a city council than you do to those pouring concrete.

Teachers observed that employees spent a lot of time engaged in various types of communication for a wide assortment of purposes. Some teachers expressed surprise at the extent that communication tasks filled the workdays of the employees at their placements. Some teachers recognized relationships between effective communication skills and promotion to upper management positions as well as, conversely, poor team communication and project failure or even job dismissal. Teachers also frequently pointed out that the forms of communication they encountered, whether oral or written, needed to be efficient, accurate, and calibrated to the intended audience.

Teachers frequently reported that the repeated focus on communication they experienced at their externship placement compelled them to increase their commitment to teaching communication skills to their K-12 students. Ethan provided a representative quote in his last written reflection of the summer:

> A major take-away that I gained from this experience is the importance of communication skills. Regardless of an individual's position in the company,

everyone I observed had to frequently communicate, and most of them stressed to me the importance of communicating effectively for a given audience and purpose. As a teacher, I know that we value communication, but I feel that it also ends up closer to the bottom of my priorities due to the [subject area] standards' closer relationship to state testing. Given the importance of communication in the workplace, I feel that I have done students a disservice by treating it as a more minor skill. This take-away will definitely affect my teaching.

In the fall after his summer externship, Ethan submitted a project-based learning (PBL) unit of lesson plans that intentionally targeted and assessed students' verbal and non-verbal communication skills (e.g. voice, eye contact, and gestures during oral presentations; answering audience questions at the end of an oral presentation) as well as written communication skills (e.g. writing for a specific audience; use of media and other technology tools to communicate ideas). His portfolio included an accompanying written reflection, where Ethan explained:

> My Project-Based Learning unit has been an excellent vehicle to implement changes in my classroom based on eye-opening observations I had during my summer placement at [name of company]. The first connection between my summer placement and my PBL is my desire after the placement to help students communicate better. This PBL has been a more comprehensive experience with communication skills than any previous lessons in past years. As I stated in my final reflection in June, I felt that I did not often feature in my class due to a perception that it was too time-intensive. With this PBL, communication took a place at the forefront of my teaching. I feel that I emphasized the components of good verbal and non-verbal communication much more effectively, and I also feel that students internalized those skills much better as a result. In the past, good verbal and non-verbal communication was something that I noticed some students developed and others did not; this PBL makes it an explicit skill that I teach and students practice repeatedly, so it is not a matter of coincidence or luck that students pick up that skill.

Across debrief discussion transcripts, interview transcripts, individual written reflections, as well as lesson plans and lesson plan reflections, teachers discussed roles of communication at their externship and described related changes to classroom practice primarily with regards to collaboration, problem-solving, and oral presentation of ideas, which are the three sub-themes explained below.

First Sub-theme - Communication Related to Collaboration

When describing instances of communication observed at their externship placements, teachers frequently tied communication to collaboration, often noting how these two skill sets are connected together. In a written reflection at the end of her summer externship, Charlotte explained:

> During my experience at [Name of Company], one of the biggest takeaways was how crucial strong communication and collaboration skills are in today's industry. Every person I was with was a part of a team, and that team had to work together and communicate appropriately with one another and with their managers.

Similarly, during his second week in the program, Josh said:

> The biggest takeaway from this week was the importance of my students being able to communicate in a variety of ways. Throughout this week I saw a variety of presentations, emails, and discussions occur... In a world where it is impossible to be an expert in every area, individuals being able to communicate and combine the knowledge they have is critical for success both interpersonally and on a business level. In this world, going at it alone and succeeding is not a viable option.

A notable finding was that teachers reported an increased commitment to teaching communication skills in relationship to collaboration in the classroom due to their externship experience. The following representative quote is from an interview with Hannah, who said:

> The [externship] experience really cemented the idea that yes, you do want to push for those group projects, you do want them [students] to be able to really have those collaboration and communication skills, even though it can be very tough to get organized and seems chaotic in the classroom. That's the type of skills that they [employers] are really looking for. Can they [students] communicate and work with others?

Many teachers regarded communication and collaboration as skills that were deeply intertwined together. Units of lesson plans submitted in the fall typically included elements within learning activities and assessments that attended to students' communication and collaboration skills, such as strategies to check on the distribution of responsibilities within student teams, opportunities for peer teaching, and rubric categories or entire rubrics designed to assess communication and collaboration.

Interestingly, many teachers came to realize that their placement companies conducted business in multiple countries across multiple time zones. Some of these teachers highlighted cross-cultural considerations as salient aspects of tasks involving collaboration and communication, such as Sophia who commented in a reflection at the end of the summer:

> It was also eye-opening to see how many teams are spread out across the world. Team members from [Company Division Name 1] and [Company Division Name 2] both stressed how aware they are of time zones and how they must be aware and sensitive to cultural differences...Communicating and collaborating, especially cross-culturally, is imperative to success in industry.

Some of the teachers who realized there was an emphasis on long distance, technology-based communications at their externship placement indicated they planned to create similar opportunities for their students to collaborate synchronously or asynchronously with students from other schools, and consult with scientists, engineers, or other experts.

Second Sub-theme - Communication Related to Problem-Solving

When teachers described episodes from their placements where employees encountered problems, they consistently highlighted the important role of communication in seeking solutions. Brandon gave a representative quote in a written reflection when he said:

> During my first week at [Name of Company], the amount of communicating that each job position had was amazing. The skills needed in order to reach a solution through communication are more than just talking round and round. I witnessed workers using productive communication in order to come to a solution.

Teachers often highlighted the vital role of effective communication in the successful problem-solving they saw deployed at their externship placements. Conversely, in a few instances, teachers offered examples where poor or missing communication hindered problem-solving efforts.

Ultimately, teachers' awareness of the frequency and effectiveness of communication used to solve problems at their externship translated into increased commitment to provide their own students with authentic opportunities to develop communication skills within problem-solving contexts. Nearly all teachers who reflected on the role of communication in problem solving during the summer submitted lesson plans in the fall that provided students with scaffolded communication supports while engaged in problem solving related to engineering design challenges or local community issues such as hazardous weather, newcomer migration, and attraction of local tourism. For example, after describing an episode from the second week of her placement where an engineer she observed "was an incredible communicator and problem solver," Mia stated in a written reflection, "For the classroom, the implication is to stand back and let the student teams negotiate it out. This experience has reinforced that." During the next week of her externship, Mia further reflected, "Somehow with my [classroom] projects, I need to create a simulation where they [students] need to

work with each other to come to a compromise, so they can learn the value of problem-solving together using open communication skills." Later in the fall following her summer externship experience, she submitted a set of lesson plans showing she had redesigned multiple lab experiences to create authentic contexts for negotiation and problem-solving by having student team members take on various roles and work together through a variety of problem-solving tasks.

Third Sub-theme – Oral Presentation of Ideas

A third pattern that became evident in the data was the teachers' increased awareness of the importance to develop skills needed for presenting one's ideas to an audience. During weekly debrief discussions and in individual written reflections, several teachers highlighted various purposes for the delivery of oral presentations at their externship placements; some examples included presenting ideas at internal company meetings, making formal presentations externally to city boards or customers, and employees seeking approval from executives for the next phase of a project.

Teachers pointed to their externship experiences as a source of motivation to provide their own students with meaningful opportunities to develop oral presentation skills. For example, Jake said in an interview in the fall following his summer externship:

> When I think about getting students ready for the real world, I want them to be able to communicate effectively...Being able to get up in front of a group of people and share information effectively. That was huge. I went to a lot of meetings [at my externship] and I saw different ways of communication at [Name of Company]. As a teacher I realize that I need to spend more time in my classroom doing that with kids...So that's one of the biggest takeaways - I needed students to communicate more, so in my classroom I've been having them share more. I'm having them get up in front of the class, that type of thing. Because I think it's a really important skill a lot of the people at [Name of Company] said they wished they would have done more in school.

The unit plan that Jake designed and implemented that fall included learning objectives and learning activities that targeted various forms of in-person and online communication, as evidenced in his lesson plans, discussed in his portfolio reflection, and highlighted in a letter in Jake's portfolio from an assistant principal who observed one of his lessons. Another teacher, Sean, submitted lesson plans in the fall that had students work in teams to make group presentations to the class based on their individual research papers. Because he noticed that some students became distracted by creating visuals for the presentations the first time the class undertook this assignment,

his portfolio reflection noted that he later switched the format to podcasting in order to focus more squarely on oral presentation of ideas. When asked to describe changes to his classroom practice related to his externship in an interview in the fall after his summer externship, Sean said, "I guess the big piece that I probably concentrate on more than anything is the communication piece."

Some teachers highlighted the importance of adjusting oral presentations to different audience types and the value of engaging students with authentic audiences. For example, after discussing audience engagement at oral presentations at her externship, Becky said during a weekly debrief discussion:

> We need to keep it [audience engagement] in mind when we have our students communicate, and we need to have them communicate for various audiences for different purposes. The element of an authentic audience would help with our students improving their communication skills because it will be more meaningful for them.

In weekly debrief discussions, individual reflections, and interviews, other teachers also pointed out the value of creating authentic and meaningful contexts for students' oral presentations, for example bringing in community members to serve as panel judges at the end of a project-based learning unit.

Discussion

Bowen and Shume (2018) reported major themes that emerged from teachers' perspectives after participating in a teacher externship program. One of those themes was the importance of communication in the workplace. Therefore, this study researched the specific elements of communication that teachers thought were essential by answering the following research question: How do teachers describe impacts of their externship experience on their awareness of the role of communication in workplace environments and on corresponding classroom practices related to communication skills? The results from this study demonstrate that participation in the Educators in Industry: K-12 Externship Program creates a deep awareness in teachers about the importance of communication in the workplace. Based on the experience of being fully immersed in the daily activities at the workplace, teachers personally experienced the necessity of being a good communicator. Teacher consistently emphasized communication as a set of skills highly-valued in the workplace and essential to achieve short-term and long-term company objectives. They especially focused on the crucial role of communication in collaboration, problem-solving, and oral presentations. Based on these insights, teachers increased their commitment to designing classroom lessons that required students to engage in more communication-focused learning activities. These findings further support previous research that reports

teachers are committed to revising their teaching practices after participating in an industry work experience in order to provide a more authentic learning environment for their students (Bowen, 2014; Barrett & Usselman, 2005, 2006; Kantrov, 2014). Teachers in this study shifted their perception on communication in the classroom from an occasional addition to a primary focus of equal importance to existing content standards and worthy of its own assessments. Lesson plans implemented in fall after summer externship experiences together with other portfolio materials showed that teachers' shifts in perception about communication resulted in changes to classroom teaching. These findings should encourage administrators, teachers, teacher preparation faculty, and professional development providers to use the powerful insights gained by these teachers to leverage the development of communication-focused activities in the K-12 classroom to help better prepare students for the future workforce.

Future Research

This study reports empirical evidence demonstrating that after participating in a teacher externship program, teachers developed a personal understanding of the vital importance of effective communication skills in the workplace. These same participants also expressed and acted on an increased commitment to engaging their K-12 students in classroom learning activities designed to advance student development of communication skills relevant to the workforce. Our research will continue analyzing experiences in teacher externship programs and reporting other critical workforce readiness skills that teachers deem important to implement in the K-12 classroom. Additional research is also needed to determine if the teachers' commitment to changing classroom practices resulted in sustained change. Overall, the researchers will continue expanding this line of investigation in order for a broad range of K-12 classroom teachers to benefit from the knowledge and insights gained by teacher externship participants.

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