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ORIGINAL ARTICLE

Teacher and Parent Perspectives on Next Generation Science Standards Alignment Following Teacher Professional Development

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ABSTRACT

This study examined United States (U.S.) K-12 science teacher interactions with parents during Next Generation Science Standards (NGSS) reform following teachers' professional development (PD) participation, as well as parent accounts of understanding and support for NGSS. Fourteen teachers and 15 parents completed an online surveys and phone interviews. Themes, based on coded data, were constructed to represent relationships between teachers and parents during NGSS classroom implementation post-PD. We found that parents were generally unaware of NGSS and not well-informed about the changes the new standards brought to their child's science classrooms. Despite parents' lack of NGSS understanding, parents generally gave positive feedback about teachers' science instruction. However, parents expressed concern about their child's ability to transition between grade levels and subjects, the lack of an aligned textbook and homework assignments, and confusion with how to help their children at home in preparation for assessments. The results of this study suggest that it is important for school districts to inform parents adequately about the new NGSS curriculum and its implementation. While this study took place in the U.S. and pertains to NGSS, the findings are broadly applicable to teacher development and communications with parents during standards reform, regardless of country.

KEY WORDS: Next generation science standards; professional development; parents

INTRODUCTION

The 2013 release of the Next Generation Science Standards (NGSS) in the United States (U.S.) prompted need for teacher professional development (PD) and subsequent changes in teacher practices and materials. Whenever new standards are released in any country, PD is a common practice to prepare teachers and gain their buy-in. The literature documents that following PD, teachers often encounter barriers including a lack of time to prepare lessons, budget constraints, and testing policy (Banilower et al., 2013; Johnson, 2006). Parental interference as a potential barrier during standards reform is not well-documented in scholarly literature but was very prevalent in media coverage during the recent implementation of the Common Core State Standards (CCSS). Articles by Monk (2013) and Neuman and Roskos (2013) quoted parents as being concerned with not being involved or informed about CCSS. Anderson (2014) and Bidwell (2014) both reported that many parents pulled their students from traditional schools to be home schooled following the CCSS release. In a proactive effort to avoid potential parent backlash during the transition to NGSS, this study specifically investigated the role parents play in NGSS implementation with the intention of informing district administrators, teachers, and PD practitioners how to increase parent understanding and support of the new standards.

BACKGROUND

Parents are an often overlooked stakeholder when it comes to educational policy and standards reform (Remillard and Jackson, 2006), and there is only a limited number of articles that shed light on parent understanding and support of NGSS. Loewus (2014) found that shortly after the release of NGSS, parents and politicians had little understanding about the new standards. Three years later, Loewus (2017) reported that while politicians had become increasingly aware of NGSS because of the inclusion of climate change content, parents were still largely uninformed. However, Silander et al. (2018) found that the majority of parents wanted to help their children with science at home, despite being unaware as to how to do so. It may be wise for school districts to inform parents proactively about NGSS in an effort to help parents understand how they can help their children learn science outside of the classroom. In addition, informing parents about NGSS could avoid potential parent backlash, similar to what

Science Education International
32(1), 72-79
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occurred with the implementation of the CCSS mathematics in years past (Reckhow, 2016). Scholarly literature is also lacking in regard to CCSS, but media coverage of parent backlash has been extensive. While parents do not hold the same level of importance in standards reform as school staff members (Remillard and Jackson, 2006), parental involvement regarding the CCSS rollout demonstrated, at minimum, the importance of informing parents of what to expect when curriculum undergoes significant changes. Understanding parents' perceptions, feedback, and concerns regarding their children's science education would be valuable information for school staff moving toward informing parents about NGSS. While this study was conducted in the U.S., the findings also pertain to teacher development and interactions with parents outside the U.S.

RESEACH QUESTIONS

1. What are the characteristics of parent/teacher communication in regard to NGSS implementation?
2. To what extent do teachers feel that parents have influenced implementation of NGSS?
3. To what extent do parents understand NGSS and how implementation of those standards will influence their students' classroom experiences?
4. What areas of approval and concern do parents have in regard to NGSS?

METHODS

Instrumentation

As this study utilizes two populations, teachers and parents, two sets of survey and interview questions were formed. The teacher questions were formed to gather teachers' comments on their experiences with parents during NGSS implementation following PD, while the parent questions were constructed to gather parents' comments on their understanding and support of NGSS. For validation, the teacher instruments were piloted with a practicing elementary teacher, middle school teacher, and high school teacher before formal use, while the parent instruments were piloted with parents of an elementary student, a parent of a middle school student, and a parent of a high school student. The researchers modified both sets of questions based on feedback from teachers and parents about the clarity and quality of the questions before formal use within the study. The data for this study include survey results, audio recordings, and coded transcripts of interviews, and were approved by the institutional review board. The surveys included an informed consent statement, and only survey data from those consenting were considered. Participants in the survey were recruited for a follow-up interview and could choose not to participate if desired. Participant names were masked within the data files and data collection matrix to ensure confidentiality.

Participants and Data Collection – Teacher Group

Teachers who attended NGSS PD within the last two calendar years (2017 or 2018) were recruited from four Midwestern school districts. All recruited teachers experienced the same PD program, called NGSX, as a mandatory requirement by their districts of employment. The PD sessions occur outside of the buildings in which the teachers work with a total of 36 h spread over the course of 2–3 weeks. NGSX is described by the PD practitioner who administered the training as follows:

NGSX is an immersive experience for teachers that help them see how utilizing the science and engineering practices benefit student learning in the classroom. Teachers put themselves in the role of the student, then reflect on their experience and the facilitation techniques used throughout the training.

When teachers were placed into the role of students during NGSX PD, they performed NGSS-aligned activities that included modeling, explanation, and argumentation. Teachers also viewed classroom video cases that demonstrated NGSS-aligned activities taking place. The content of the NGSX sessions revolved around the behavior of matter and air pressure phenomena.

Sixty-five teachers were emailed an invitation to participate in a Qualtrics survey and a phone interview, to which fourteen teachers agreed to participate (Table 1). Fourteen participants were adequate to reach the saturation point as described by Guest et al. (2006) where unique opinions discontinued to surface. All other non-participants were contacted to explain their reasoning as to why they would not participate, and those who responded cited that they lacked time in their schedules. The invitation email explained the purpose of the study, the process of financial compensation, and included a statement of confidentiality.

Participants and Data Collection – Parent Group

Parents of K-12 students from four Midwestern school districts were recruited through email. They received an invitation to participate in a Qualtrics survey and a phone interview, coupled with an explanation of the purpose of the study, the

Table 1: Descriptive statistics for the teacher study population (n=14)

Demographic	% of total responses
Gender	
Male	50.0
Female	50.0
Grade bands taught	
K-5	21.4
6–8	21.4
9–12	57.1
Years taught full-time	
0–4 years	21.4
5–10 years	7.1
11–15 years	35.7
16+ years	35.7
Type of district employed within	
Suburban	14.3
Rural	71.4
Math and science specific	14.3

Science Education International
32(1), 72-79
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process of financial compensation (Table 2), and a statement of confidentiality. Fifteen participants were adequate to reach the saturation point as described by Cobern (2018) where unique opinions discontinued to surface. For the parents to receive financial compensation, they were required to participate in both the survey and interview associated with this study.

Data Analysis and Trustworthiness

Based upon previous pilot work related to the research questions of this study, initial coding structures were created for analysis of the responses to the open-ended questions of the survey and to the interview for the teacher group and the parent group. As the codes were applied during the data analysis, the need for additional codes emerged. The resulting coding structures were applied to the participant responses to highlight significant findings. The codes applied to the teacher group dealt with interactions and challenges, they faced with regard to parents during NGSS implementation, while the codes for the parent group involved parent understanding and support for NGSS. Throughout this process, a second university researcher reviewed the codes and their application to the survey and interview data as a measure of rater reliability. The Likert-scale items from the survey were not used in the results section of this study because of the small sample size of participants. However, participant responses to these items were used as a measure of the reliability (consistency) of their responses.

RESULTS

Four themes were derived from the data. These themes include parent awareness of NGSS, parent feedback, parent concerns, and teacher suggestions for improving parent understanding of NGSS.

Parent Awareness of NGSS

Data suggested that the majority of teachers felt parents were unaware of the existence of NGSS, and almost all parents claimed that they were unaware that NGSS existed. "I know nothing. And I'm embarrassed to say that. I'm on PTA and everything, so I'm a little surprised that I don't know anything," said Parent 12. Teacher 8 shared the perspective that parents may not be against the idea of a new set of standards, they may simply be uninformed. Teacher 8 worried that an uninformed parent could jump to conclusions about NGSS by associating the new standards with Common Core:

I think parents hear NGSS, they sort of piggyback it onto the Common Core, and there's a lot of fear in that. So, I think that if this kind of became more mainstream, the name alone, having a bit of that fear reaction could be a problem.

If parents are uninformed about NGSS, a logical question is who within school districts should be sharing information with parents. Unfortunately, data suggest that this is not one single party, as school employees in general have done a poor job in sharing information about NGSS. All but one teacher participant commented that administrators, counselors, and teachers have done a poor job informing parents about NGSS. Nearly every parent participant claimed that school staff had made no effort to communicate information about NGSS. Parent 11, who works as a special education teacher in science classrooms, offered a unique perspective on the lack of communication about NGSS as both a parent and a teacher:

I really don't think the parents have been informed. I have kids in the district, so I get everything they send out to parents, but working here, I even get more stuff through my staff email. Things saying like, "hey, this is going on." I get a heads up on it, but I still feel like there's just no effort to get the information out there about what's really going on in science classrooms, how they're being run, how they're different. The parents aren't getting it. There isn't even like a district-wide email mentioning this stuff, it just doesn't happen.

Moreover, all of the participants from both the teacher and parent groups agreed that none of the parents were aware of NGSS resources for parents. Teacher 5 noted, "I don't think parents are aware of those resources at all." When teachers were asked to comment on the adequacy of the NGSS resources available for parents, most teachers did not know that resources for parents existed at all. As Teacher 9 put it, "Even I don't know about those. It would be great if I knew what those were!" Several teachers related the situation back to their PD training about NGSS and felt that parent communication and getting parents to buy into new methods should have been addressed in their sessions. Teacher 1 noted, "I think that the PD that we get should encompass quite a bit more. Like include more resources. Or show more things out there. Since I didn't even know that there was anything for parents for NGSS."

Parent Feedback

Given that the teachers believed parents to be unaware or uninformed about NGSS, it is not surprising that most of the teachers had not received feedback from parents that specifically addressed NGSS. "I don't think there's really been positive or negative feedback in either way, specifically

Table 2: Descriptive statistics for the parent study population (n=15)

Demographic	% of total responses
Gender	
Male	26.7
Female	73.3
Level of education	
High school diploma or GED	6.7
Some college	13.3
Bachelor's degree	40.0
Master's degree	40.0
Oldest child's grade band	
K-5	25.0
6–8	16.7
9–12	58.3
Children qualify for free and reduced lunch	
Qualify	6.7
Do not qualify	93.3

about NGSS," reported Teacher 5. Teachers who did receive feedback from parents reported that parents are relieved that science education is different than when they were students. As Teacher 12 explained, "The parents like to see that their child is "doing" science, instead of just learning about it." Despite a lack of knowledge about NGSS, parents are generally pleased with the instruction their children receive. Parent 1 said:

I think my daughter is more open to learning about science than she's ever been. Maybe it's the teacher, maybe it's this NGSS program that he's applying, I'm not sure. But more this year than ever before I've heard more from my kids that they are loving science.

Many parents were simply happy with the differences between their perception of how science is taught now in comparison to their experiences with science education growing up. Parent 14 explained:

Oh, well I think things have changed a lot, and for the better. When I was in school, I felt like it was much more text-based. Things are more hands-on now. Hence, students learn more by doing things, rather than just being told things.

Several parents were able to identify features of NGSS-style learning within their children's science education without knowledge of the existence of the standards. Parent 13 noted that her high schoolers were often engaged in building models, and Parent 11 commented that solving problems were emphasized in his daughter's middle school science class. Parent 2 observed shorter units and fewer topics for her children, and Parent 10 was happy with the reduction of rote memorization and increase in project-based learning in science. Parent 2 said that her daughter has expressed that she often, "feels like she gets to be a scientist." Many parents reported that these types of experiences have not only made their children appreciate science but have also steered them toward pursuing a science career, as Parent 14 pointed out:

Like I said, my older daughter's science teaching was influential enough to where she entered into pre-med. I can't say that was attached to any sort of standards, but since they've been around since 2013 like you said, they must've had some kind of impact.

Parent Concerns

While nearly all of the parents in this study had positive feedback concerning their children's experiences learning science, there were some areas of concern. Some parents reported issues with the teaching methods their child's science teacher has been using. Parent 11 was able to offer insight into what he felt the largest area of parent concern is about NGSS-style instruction. He explained:

The battle we're fighting right now with kids…is that they are saying, "just tell me what I have to do." And we're saying, "No, I'm not going to tell you what you have to do, you gotta work through this, you gotta problem solve." And the kids really get frustrated. And so do the parents, because their kids are struggling.

Teacher 10 believes that the use of NGSS-aligned activities directly contributed to student and parent frustration: "Some of the projects and stuff that we do are way over the kids' heads. So sometimes that frustrates the kids, and their parents want to know why they aren't understanding things." Parent 6 expressed frustration that NGSS was used by her daughter's science teacher as reasoning for poor scores: "I've never heard the standards be used as that term, but at my daughter's parent/teacher conference, her teacher was explaining why her grade was so low, and the standards were used as a justification purpose."

Many parents expressed that it is during these transitional periods that they are most worried about their children succeeding. When students initially encounter a new grade level and subject area, they face not only new science content but also new NGSS-aligned practices. Teacher 9 explained:

I think the challenges are most in the beginning of the year, when their grades are low, because they're used to their high-flier students getting A's, and then they jump into a whole NGSS-modeling biology curriculum and they have a C. Parents don't understand that kids need to learn that way, because they aren't used to it either, and then the grades start to come up and they do OK with it after that. Probably around Christmas. But the first couple months are rough.

Teacher 9 went on to describe that while things tend to turn out alright for students in the end, the initial learning curve for students can lead to parent frustration. Teacher 9 suggested that if schools were more proactive with educating parents about challenges students will face between grade levels and subjects, such as a potential dip in student scores early in a new class, that level of parent frustration might be lessened.

Outside of the classroom, many parents felt confused and uneasy about the lack of a textbook. As Parent 10 noted:

They don't have science books that are used, like textbooks, I guess that's different than from what I had as a kid. I sort of expect there's going to be a textbook. The way they explained it is that they do different projects or different worksheets, and then they are building a textbook of sorts. Hence, all these worksheets that they do on these topics are then put into the workbook that they're building, or the journal.

With the introduction of NGSS, many science teachers and departments have moved away from textbooks that contain practice problems for students. However, this information does not seem to be relayed to parents. As Teacher 6 explained:

I get two forms of feedback. It's either, "hey, my kid loves what you're doing", because we teach with phenomenon. Or, "why is there not a textbook that my kid is getting that I can follow so I can help them with practice problems?" Those are my two different forms of feedback that I get…they just want to feel as though they can help their kid.

Other districts have not abandoned textbooks but are delaying the purchase of NGSS-aligned textbooks in an effort not to

waste funds before their science department can choose a text that they feel is adequately developed. In the meantime, students in these districts are being given old textbooks that are not aligned to NGSS. The use of an outdated text has caused issues with parents understanding how to help students, as they do not correlate well with the NGSS-aligned lessons performed in class. Teacher 12 explained:

> We know that students and parents want to have a textbook associated with our classes. They need to be able to see things and have some place where they can get some information or study for tests. Some of that information is in their textbook, but it is not exactly how I'm teaching it every day. So that's where a lot of the parents don't quite understand that, and they think they should be doing written skill sheets, fill in the blank, and that sort of thing. But those things aren't happening.

Finally, parents expressed confusion as to why they were not seeing science homework and take-home resources such as worksheets and study guides. "She has not brought any science homework home. She will study before tests, but I don't really know why she doesn't have any homework," said Parent 6. Parent 10 expressed frustration because of the lack of homework:

I have never seen either one of them bring home homework for science. Which is another pet peeve of mine. They'll have math homework or reading homework, but I've never seen them with science homework. But they both have A's in science, and they've both maintained A's in science, so it's not like they aren't doing their work. They have no issue getting an A. Which I think is bad.

Teachers reported parents claiming that they are unsure as to how to help their child study before exams without practice worksheets. Teacher 6 explained:

I think with the parents, they want their kid, the night before a test, to have a whole drill and kill. Like, this is exactly what the test is going to be. And so, working with phenomenon, it's hard to come up with like, 20 new phenomena for them to explain. Since all of our tests are about, explain this new scenario with knowledge that you already have. I'll tell you, though, the majority of the parents love it after they're done. They're like, "oh yeah, my kid can think through these problems." And they love the interaction, and they love what they're doing. But going through the process, the parents feel helpless.

Teacher Suggestions for Improving Parent Understanding of NGSS

Teachers offered their opinions as to how to better inform parents about NGSS in the future, such as posting resources on the school website or having handouts at school events where parents would be present. However, some teachers offered more innovative suggestions. One of these was to set up short, teacher-led presentations at school events such as parent/teacher conferences or open house. Teacher 4 explained how this would be more effective than handouts at such events:

If you just have handouts, they're just going to say, "whatever." But if you have this cool activity you could stop and try, and say, "this aligns with the new NGSS standards, and this is what we are pushing here." or making parent resources more visible online in the form of the school webpage and social media.

Teacher 1's district had already created an entire science evening for parents to meet their student's science teachers and engage in some examples of in-class activities, but at this point, the evening is not related to NGSS. However, this seems to be in the works: "I think you could take that one step further…and have an NGSS room where somebody is kind of going, "this is what's happening in science." Teacher 11 suggested making better use of social media on a weekly or monthly basis to give parents a visual of what is going on within their classroom:

I do a lot of parent communication every week through email or Facebook so that would also be a great way to show parents what we're doing. We do a lot of interactive stuff so that would be a good way to show them.

All of these suggestions are largely teacher-led, but some districts have been proactive in how they have presented or are planning to present, a new NGSS-align curriculum to their parent body. According to teachers within these districts, the idea is to be transparent with parents about NGSS in an effort to avoid pushback. Teacher 12's district already formally presented their new curriculum to parents, explaining that: "It looks very different, what the kids are doing…from someone on the outside looking in, one of the things that could be disturbing is that it looks like you're letting the kids struggle."

Some districts simply are not ready to present a full curriculum at this point in time and are waiting for teachers to complete the NGSS alignment process before making an announcement to the community. Teacher 5's district was close to being ready to present their new curriculum to parents and was able to offer a unique perspective as he was one of six teacher representatives for the district's science learning collaborative in charge of aligning to NGSS:

So right now, we've gotten all the teachers to buy-in, we're unpacking our performance expectations, we're figuring out what's going to look best for our district, and where to put those performance expectations. After we get that set, our next step is going to be how we get it board approved, but number two, how we roll this out to our community. We have counselors involved and our admin team involved in the sequencing process to kind of help prevent some of those issues later where we might get pushback.

DISCUSSION

The results of this study suggest that parents were generally unaware of NGSS. The blame can be spread broadly because while the teachers imply that administrators and counselors were not doing an adequate job informing parents about NGSS, neither did they think that teachers were doing any

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better. Moreover, many teachers were not even aware that NGSS parent resources exist. Teacher 8 expressed concern that without information being shared with parents, NGSS could be wrongly associated with the negative perceptions that parents may have about the Common Core standards. However, according to some participants in this study, there were districts that were carefully planning the rollout of their new NGSS-aligned science curriculum, including presentations for parents.

Despite a lack of parent knowledge of the new standards, teachers reported little feedback directly relating to NGSS and little pushback or challenges from parents that might impede NGSS implementation. The majority of parents had positive comments about their children's science education. Many parents noted that their son or daughter's experiences in science classes were so influential that they have entered into, or are considering, science careers. Teachers and parents reported parent approval of the way science is being taught and how different it was when they were students. However, these differences have led to some issues of confusion and concerns for parents.

Parents in this study shared their concern for students struggling in class. As explained by Duschl and Bybee (2014), NGSS embraces the struggle of doing science to give students a more authentic science learning experience than what students had with inquiry-based learning. Essentially, parents are not aware that students may struggle in the process of explaining phenomena and solving problems in an NGSS-style curriculum, and that this is intentional. Parents may expect a more traditional instructional style, similar to what they experienced as students, where teachers deliver content and then score students on their ability to recite the answers. Parents need to be aware that a science teacher's role has shifted from presenting ideas through lectures and textbook readings to helping students solve problems, form explanations and arguments, and form conclusions (Reiser, 2013). In addition, parents need to be aware that teachers are still learning how to use NGSS in the classroom. Implementation of the three-dimensional learning approach brings many new challenges for teachers (Shernoff et al., 2017), and the implementation phase of new strategies is documented to be when teachers struggle the most following PD opportunities (Han et al., 2015). Parents should understand that many teachers need time to experiment with new materials and techniques in an effort to build a better learning environment for students (National Academy of Sciences, 2015).

Parents can be a valuable resource for science learning outside of the classroom. However, a recent study by Silander et al. (2018) suggested that while most parents are working hard to help their children learn outside of the classroom, many parents do not know how to help organize and support science learning surrounding their daily lives. Textbooks and homework represent safe places for parents to turn to in the past for guidance in aiding their children with learning science. However, many parents in this study shared that textbooks and homework are not used in their child's science courses. This has led parents to be confused about why this is the case and has prevented them from feeling like they can support their student's science learning, despite being motivated to do so. One explanation for the lack of textbooks that parents should be aware of is that many schools have either moved away from textbooks altogether, or the district is waiting on investing into NGSS-aligned texts until a book that best fits with the school's new curriculum is identified. In addition, NGSS represents a move away from "drill and practice" style worksheets and rote memorization on exams, and have shifted science learning to using classroom time to solve problems and explain phenomena (Krajcik and Merritt, 2012). Since much of this work, such as group discussion and argumentation or model building and revision, is meant to be performed within a science classroom, it is not surprising that the amount of homework being assigned by teachers have decreased. Without an understanding of changes like this that accompany NGSS, parents have been left as confused and unsure as to how they help their students at home.

CONCLUSION

The results of this study suggest that without the traditionally safe resources to help students learn science outside of the classroom, in the form of a textbook or regular homework, parents need communication from their districts and science teachers about NGSS and direction toward resources that will allow them to be of service. Silander et al.'s (2018) study supports this, as they found that parents want ideas, resources, and everyday materials to build their knowledge and confidence to help their children learn science. The NGSS Parent Guides available at the NGSS website (Achieve, 2017) include suggestions for parents to help support their children be successful in science such as speaking to a teacher or principal about how NGSS bring changes to the school, asking a teacher thoughtful questions based on the information provided in the Parent Guide, and learning how parents can help reinforce classroom instruction at home. However, parents in this study would only encounter these suggestions found on the NGSS website if parents were aware that the site, or NGSS in general, existed in the first place. That said, the responsibility to inform parents about NGSS must fall upon school district staff members. Silander et al. (2018) say that schools should be providing parents with ideas for activities that encourage conversations amongst family members that help children make connections between science experiences at home, school, and within the community.

While enriching science learning experiences for students by increasing parent involvement at home would be enough of a justification for the benefits of informing parents about NGSS, teachers and school administrators would see benefits as well. For teachers, highly-involved parents can act as a valuable resource for identifying phenomena and provide experience that teachers can leverage in their classes (Furtak and Penuel,

2018). However, parents can also become a hinderance for teachers by logging complaints and taking up valuable time that could be spent preparing or scoring lessons. If parents were better informed about NGSS, parents could become more likely to be allies for teachers as opposed to barriers to NGSS implementation. Administrators should be aware that the literature provides evidence that students with involved parents tend to perform higher on standardized tests when compared to students with less involved parents (Remillard and Jackson, 2006). For parents to be involved, they need to be well-informed. Thus, if administrators are interested in higher scores on standardized testing for their district, it would be wise to be proactive with an increase in shared information and resources related to NGSS. To summarize, the data from the teachers in this study suggest that the following would be good practice:

- Districts should have a planned, deliberate method of presenting new, NGSS-aligned curricula to parents.
- Before presentation of new curricula, districts should share general information about NGSS to parents, such as the parent guide and Q&A documents available online.
- If textbooks and regularly assigned homework are not being used, teachers should provide parents with resources to help with science learning at home.

These insights could be beneficial to other countries adopting new science standards. The findings of this study show that parents want to be involved in their children's science education, therefore, schools would be advised to provide parents with a breakdown of the new curriculum, a summary of the activities the students will be performing in class, and resources that detail how to support student learning at home.

Limitations and Future Work

A limitation of this study includes the use of teachers and parents in Midwestern districts, preventing the findings from being generalized to other geographic regions. However, participating teachers did come from a variety suburban, rural, and math and science specific districts. In addition, PD sessions for teachers took place at different points in time (2017 vs. 2018) for the participants. Teachers who had undergone PD more recently may not have had as long to attempt to align their practices with NGSS, and thus may have had fewer opportunities to interact with parents. Furthermore, only one parent in this study has children that qualify for free and reduced lunch, so the results of this study could not be applied to lower-income families. Finally, 80.0% of the participants in this study hold either a bachelors or graduate degree, meaning that parents with lower levels of education are not well-represented in this study.

The results of this study give direction for areas of future research. Parents were shown to not have an adequate understanding of NGSS, and districts had not made efforts to inform the majority of parents in this study about NGSS. Future research could involve creation of strategies to inform parent bases about NGSS before a full curriculum layout. In addition, construction of strategies for how parents can help continue their students' learning at home could be helpful to better utilize parents as educational partners. A follow-up study with parents in both of these areas could then be performed.

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