Using Survey Data to Measure Teaching Practices and Network Effects in Carbon TIME

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Abstract

We use longitudinal survey data to examine the patterns of teachers’ teaching practices and the structure of teachers’ professional networks in science. We are studying collegial interactions in the Carbon TIME and school professional networks, as well as their relationship with changes in classroom teaching practices. By asking all Carbon TIME teachers about their backgrounds and goals, science teaching knowledge and practices, as well as interactions with close colleagues, we use survey data to help us explain variations in teachers’ implementations. In this analysis, we found that teachers showed more pronounced change in Carbon TIME featured practices after one year of Carbon TIME. And their network structures may help explain different patterns in their practice changes.

Teaching Practices

The data reported here are from surveys 2015-16 and surveys 2016-17. There are 33 teachers who started participating Carbon TIME in 2015 and completed both these two years’ surveys. The first face-to-face professional development (PD) was held in between these two years’ surveys. Therefore, the 2015-16 survey data are the measures for Baseline Year and the 2016-17 survey data are the measures for teaching practices after attending the Carbon TIME PD and implementing Carbon TIME in class for some time. By comparing the two measures, we study the change after one year of Carbon TIME.

In total we have 39 teaching practice survey items developed from A Framework for K-12 Science Education. We asked teachers how frequently they engaged in each practice. We divided these items into two groups. One group includes 13 items that are highly emphasized in Carbon TIME PD and curriculums (alpha=0.88). The other group includes 26 items that are not featured by Carbon TIME (alpha=0.78). We created two composite scores for each group by calculating the average frequency of practices included in each group.

Practices Emphasized in Carbon TIME:
- Ask students to explain potentially incorrect ideas at the beginning of a unit.
- Record students’ ideas to use again in later lessons.
- Search for better ways to elicit and respond to students’ ideas.
- Reflect on the ways in which you interpret students’ ideas.
- Ask students to make a prediction about what will happen in an experiment they are about to conduct.
- Ask students to find patterns in data collected through multiple observations.
- Ask students to explain patterns in data that they have collected.
- Have students identify unanswered questions at the end of an investigation.
- Create a visual diagram and explain in text form.
- Revise an explanation in light of new evidence.
- Use a scientific law that applies to the microscopic scale to explain a phenomenon at the macroscopic scale.
- Conduct whole-class discussions with the goal of collective consensus.
- Practice using a model to explain different phenomena.

Practices NOT Emphasized in Carbon TIME: These practices are also good practices and socially desirable but they are not emphasized in Carbon TIME PD and curriculum.

Conclusions and Emerging Questions

To summarize, the survey data showed that teachers reported higher frequency increase in Carbon TIME featured practices after their first year of Carbon TIME. By studying focal teachers’ network structures and their teaching practices, we also learned that teachers tend to align with their close colleagues. The more the teacher interacts with Carbon TIME colleagues, the more probable that this teacher may implement Carbon TIME practices.

We are still in the process of collecting more follow-up survey data from Carbon TIME teachers. Meanwhile, we keep editing our surveys based on previously collected survey data as well as other qualitative data. We are trying to check the reliability and validity of our survey data by comparing with qualitative data from class observations and interviews.

One limitation of this analysis is that we do not have complete survey data from those close colleagues or help providers nominated by our Carbon TIME teachers. Without knowing their teaching practices, it is difficult to have a more precise measure of the network effects they have on our Carbon TIME teachers.

Acknowledgements

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References

Penuel, W. R., Frank, K., Sun, K., Kim, C. M., & Singleton, C. (2013). We may also see a similar pattern here if we relate our focal teachers’ network structures to the changes in their classroom teaching practices.

Focal Teachers’ Patterns

Previous research have shown that teachers have a tendency to align with the close colleagues they interact with and receive help from (Penuel, Frank, Sun, Kim, & Singleton, 2013). We may also see a similar pattern here if we relate our focal teachers’ network structures to the changes in their classroom teaching practices.

Ms. Nolan has the most mixed network with close colleagues and help providers both from Carbon TIME and her school professional networks. Her exposure to both school and Carbon TIME norms could be related to her frequency increase in all practices. (Figure 1 and 2)

For Ms. Callahan, if we compare her network structure in her first year of Carbon TIME with that before she joined, we can see her naming a new close colleague who also worked on Carbon TIME and a new help provider who is her Carbon TIME coach. This may help explain the increased frequency with which she engaged students in practices emphasized in Carbon TIME.

The pattern of Mr. Ross’s practice change is just the opposite of Ms. Callahan’s. His frequency decrease in Carbon TIME featured practices and frequency increase in others might be a reflection of his school-oriented network structure.

Ms. Apol has a network structure similar to Mr. Ross’s, but Ms. Apol reported increases in ALL practices. This might be due to different school norms for Ms. Apol and Mr. Ross. Another explanation might be that Ms. Apol is reporting high frequencies of all practices because all of these practices are socially desirable.