RESEARCH BRIEF

TEACHER COGNITIVE COMPLEXITY

ABSTRACT

Research shows that increases in the cognitive complexity measures of teachers is correlated with increases in both student engagement and student outcomes. In testing conducted during NAATE program sessions, cognitive complexity scores increased.

NAATE STUDY

NAATE was designed to serve high-performing teachers who have demonstrated success in the classroom and who have the capacity to lead their peers. Teachers who are selected for NAATE are the most experienced, highest performing, and most influential teachers in their schools/organizations. Most partner organizations see NAATE as a way to retain their best teachers and build their capacity to influence colleagues. They also see NAATE as a way to continue to deepen their teachers' instructional practice. In turn, NAATE's coursework falls into two domains: supporting and leading and teaching and learning.

Given its audience, NAATE's coursework in the domain of teaching and learning focuses on deepening higher-level instructional practices, cultivating their capacity to deliberately design and facilitate rigorous learning experiences for their students, and strengthening their understanding of how to serve each and every student. It should be recognized that NAATE's approach leads to changes in teacher mindsets and is less about driving short-term student achievement gains. At the same time, principal surveys and teacher evaluations point to improvement in teacher practice based on partner-level methods of teacher assessment.

NAATE's central pedagogy, the case study method, and the program more broadly, serve as means for critical thinking, problem solving and decision-making. The NAATE pedagogy is inductive in nature and models for teachers how to shift the cognitive work of learning to learners through peer-to-peer exchange. It builds teachers' appreciation for multiple perspectives through the exploration of the elements of a problem or situation described in each case study. In addition, it develops the habit of using evidence and research to justify one's opinion. All of these skills and habits of mind are highly aligned with (and perhaps are even a model of) the Common Core Standards to which the majority of NAATE participants are held accountable.

Given the challenges of gathering data and attributing causality of participation in NAATE to improved student outcomes, NAATE engaged researchers from the University of Connecticut to develop ways to assess shifts in teacher practice. The team of UCONN researchers identified teachers' cognitive complexity as a critical precursor to student outcomes based on NAATE's theory of action. At the most basic level, the line of reasoning is that by cultivating teachers' cognitive complexity and their ability to think and analyze critically, NAATE will strengthen their ability to design and deliver learning experiences that deepen the cognitive work students engage in, and shift it so that students are doing this cognitive work.

COGNITIVE COMPLEXITY

Cognitive complexity is the ability to reason at a high level including integrating and differentiating difficult and often interrelated information. It is not the same as content knowledge (i.e. knowing a body of knowledge), but is indicative of how a person thinks. "The underlying assumption of the cognitive complexity perspective is that cognitively complex individuals

process information differently, and perform certain tasks better than cognitively less complex individuals because they have more categories or dimensions to discriminate among stimuli and see more commonalities among these categories or dimensions" (Hooijberg, Hunt & Dodge, 1997).

Educational research provides insight into how cognitive complexity relates to students' capacity to develop into thinkers themselves. A meta-analysis showed that students whose teachers use higher cognitive questions in the classroom have greater achievement gains (Redfield & Rousseau, 1981). Experienced teachers use more strategies that demonstrate cognitive complexity, which, in turn, enables them to adapt to, differentiate, and best address students' changing needs in the classroom (Leinhardt & Greeno, 1986). Cognitive complexity, in sum, is a precursor for higher levels of student learning, as it enables teachers to ask questions, admit uncertainty, examine their own beliefs, listen carefully, suspend judgments, look for evidence, tolerate ambiguity, and adjust hypotheses when new information becomes available (Elder & Paul, 1994; Granello, 2010).

For the purposes of NAATE's research, cognitive complexity is comprised of two key elements:
- Discriminant thinking, which is the ability to hold multiple and sometimes divergent ideas together at once.
- Convergent thinking, which is the ability to hold complex and different opinions simultaneously and interactively.

HOW DOES NAATE MEASURE IT?

NAATE contracted the University of Connecticut to develop a set of instruments to measure teachers' cognitive complexity over the course of the program. The trio of instruments being

[1]The instruments used include: 1) The Modified Role Construct Repertory Rest (MRCRT; Bieri, 1955, 1971; Bieri, Atkins, Briar, Leaman, Miller, & Tripodi, 1966; Tripodi & Bieri, 1964); 2) Schroder et al.'s (1967) Paragraph Completion Test (PCT) and 3) The final measure of cognitive complexity is the cognitive reflection test (CRT) as created by Fredrick (2005).

employed are reliable psychometric survey instruments and are based on the research base. Together they serve to measure and evaluate teachers' own cognitive complexity.[1] NAATE examines the change in teacher performance on these instruments, and has seen an increase in teachers' cognitive complexity over the course of the program for each of the cohorts that has participated in the study.

LATEST RESULTS

The first round of results were completed in October 2016. It presents the results from the first two cohorts (VI and VII) for which we have a complete set of data, covering the beginning through the end of their time in the NAATE program.

There were two aspects of cognitive complexity assessed. The first is discriminant thinking, which is the ability to hold multiple and sometimes divergent ideas together at once. Using an ANOVA to track the changes over time for both cohorts, there was a statistically significant negative difference in participants' responses over time ($f \leq 0001$). In other words, participants in both cohorts had higher levels of cognitive complexity in the area of discriminant thinking at the conclusion of the program than its beginning.

The second aspect of cognitive complexity assessed is convergent thinking, which is the ability to hold complex and different opinions simultaneously and interactively. This was measured with Schroder et al.'s (1967) paragraph completion test (PCT). The lowest score possible on the PCT was a 4 and the highest a 28. Between time 1 and time 3, for Cohort VII there was a positive and statistically significant difference in mean score of approximately 3.5 points. For Cohort VI this mean difference

was approximately 7 points and was also statistically significant. Again, this suggests that participants' convergent thinking was, on average, higher at the conclusion of the program.

In both measures of cognitive complexity, Teacher Leaders who participated in NAATE showed a statistically significant increase from the beginning of the program to their graduation. This indicates that NAATE teachers are growing in the skills integral to effective teaching that will allow them to ask questions, admit uncertainty, examine their own beliefs, listen carefully, suspend judgments, look for evidence, tolerate ambiguity, and adjust hypotheses when new information becomes available (Elder & Paul, 1994; Granello, 2010).

REFERENCES

Elder, L., & Paul, R. (1994). Critical thinking: Why we must transform our teaching. Journal of Developmental Education, 18, 34–35.

Granello, D. H. (2010). Cognitive complexity among practicing counselors: How thinking changes with experience. Journal of Counseling and Development, 88(1), 92–100.

Hooijberg, R., Hunt, J. G., & Dodge, G. E. (1997), "Leadership Complexity and Development of the Leaderplex Model", Journal Of Management, Vol. 23, pp. 375-408.

Leinhardt, G., & Greeno, J. G. (1986). The cognitive skill of teaching. Journal of educational psychology, 78(2), 75.

Redfield, D., & Rousseau, E. (1981). A Meta-Analysis of Experimental Research on Teacher Questioning Behavior. Review of Educational Research, 51(2), 237-245. Retrieved from http://www.jstor.org/stable/1170197

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