FOLLOW-UP TO THE REPLICATING THE CGI EXPERIMENT IN DIVERSE ENVIRONMENTS

CGI Principles of Teaching Practice: Classroom Observation Scoring Guide

Walter G. Secada
School of Education and Human Development, University of Miami
January 14, 2020

The research and development reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grants R305A120781 (Replicating the CGI Experiment in Diverse Environments) and R305A180429 (Follow-up to the Replicating the CGI Experiment in Diverse Environments Study) to Florida State University. The opinions expressed are those of the author and do not represent views of the Institute or the U.S. Department of Education.

ACKNOWLEDGEMENTS

This *Classroom Observation Scoring Guide* seeks to provide a real-time means of operationalizing the coding framework developed for the ***CGI Principles of Teaching Practice.***

The *CGI Principles of Teaching Practice* were first articulated by Robert Schoen; developed into a coding *Framework* based on conversations among himself, Amanda Tazaz, Hua Ran, Naomi Iuhasz, and myself; and have been used to score the Year-1 and Year-2 videos collected as part of the *Replicating the CGI Experiment in Diverse Environments* study. The *Framework* and an initial set of results were presented to and discussed by the Advisory Board for the *Follow-up* study. A more complete (but as yet finalized) set of results was presented at the IES 2020 Annual Principal Investigators Meeting (Secada, Ran, & Schoen, 2020).

This guide builds upon and has a look and feel that is similar to what can be found in earlier observational protocols and scoring guides such as the:

- scales for authentic instruction and the scoring of student work developed by the OERI Center for Organization and Restructuring of Schools under the direction of Fred Neumann (Newmann et al., 1995; Newmann et al., 2016);
- classroom visitation scales developed with Lisa Byrd Adajian in the OERI National Center for Research in Mathematical Sciences Education (Secada & Adajian, 1997);
- Early Childhood Classroom Visitation Measure developed by Deborah Stipek (1999) in the Macarthur Middle-Childhood Transitions study;
- classroom observation scales developed with Okhee Lee (Secada & Lee, 2000) and later revised by Dominic Peressini (2001) for the NSF Highly Effective Schools: on Outlier Study; and,
- classroom visitation guideline in science instruction for ethnolinguistically diverse students developed with Okhee Lee (Lee & Secada, 2003) in the original P-SELL study.

OVERVIEW OF CLASSROOM OBSERVATION SCORING GUIDE

The Classroom Observation Scoring Guide provides a high-inference summary of the instructional environment in an elementary-school mathematics classroom during a single mathematics lesson.

The guide operationalizes a demanding set of standards in terms of how closely a classroom's instructional environment matches the principles of CGI instruction. It does not exhaust all very-worthwhile possibilities for a classroom's instruction, which depend on the teacher's curricular intentions, the students' responses to those intentions, and their subsequent interactions.

This guide's purpose is to better-understand how closely or how well a set of classroom processes match the principles of what a CGI classroom might look like. It includes indicators that focus on teaching practices; but also, it includes indicators that focus on other facets of classroom instruction. ***This guide should not be used to assign a grade to teaching nor should it be used to evaluate "how well" teachers teach students***.

Prior to using this guide, an observer should try to get an idea of the mathematical focus of the particular lesson that they will be observing. That focus can be determined by asking the teacher, looking at the textbook, even asking students what will be covered in the class. Scoring should be based on that *mathematics.*

TRANSITIONS AND WARM-UP ACTIVITIES

Elementary-school teachers commonly implement activities to help students transition from one to another class, from one subject to another, or from recess to class. Also, teachers might routinely implement activities that are intended as warm-ups to the lesson. Those activities might or might-not incorporate mathematics tasks and/or be aligned to the lesson's curricular intent. For example, students returning from recess may do a timed facts-memorization test while background music is playing as a way of calming down and transitioning back into class. Such ancillary activities should be excluded from the actual mathematics lesson that is observed and scored.

SCORING

An observer should calibrate expectations and scoring based on the grade-level. A demanding mathematics problem at one grade may be little more than a warm-up exercise at another. Responses indicating minimal student effort at one grade may provide evidence of deep thinking at another.

Though the guide uses the term "classroom processes," from time to time, the coder may focus on the workings of a single group. If that is so, spend enough time with that group to get a good fix on how it is implementing these practices. Though you may look up at the rest of the class, the inference is that what you are observing in this group is somehow "typical" of what you would observe across the entire class. If you determine that what you observe is not typical of what is taking place during the lesson that is being observed, make a notation to that effect and exclude – to the best of your ability – the group-observation from your final codes for the lesson.

A lesson should be scored as soon as possible after the conclusion of a class. When determining a lesson's scores, do not depend ***only*** on your memory or impressions of the class; such impressions tend to miss important details and to merge dimensions of a class. A lesson that is judged to be good based solely on impressions may demonstrate particular strengths along one or a few dimensions; but when the evidence is reviewed, the lesson might not score ***uniformly high*** along all four. Hence, be sure to review your notes as providing evidence in support of one or another score for each scale taken individually.

Do not score down based on missed opportunities or what might have happened if some else might have happened. Restrict yourself only to actually did happen during the lesson.

Score for each scale based on the ***preponderance*** of the evidence that you see; this is not like a trial in which we seek evidence beyond a reasonable doubt. When applying a score, do so only if you are convinced that the score properly describes the instructional processes. If in doubt, it may help you to ask yourself "what would I need to have seen within this lesson's processes or as a component of the classroom's environment in order to score the lesson at the higher level along this particular scale?"

In general, this protocol codes for how widely a particular set of practices is distributed among the students in a class (breadth), how deeply it is pursued during the time that it is observed (depth), and the transfer of authority for implementing this particular set of practices from the teacher as the sole source to shared authority between teacher and students. These constructs are combined into a single code that follows a regular pattern:

0. Evidence that the classroom environment is working against and/or actively undermining this principle's implementation. The teacher or students may "call back" students who engage in activities that are consistent with a given principle; for example, a student may wonder why something is true and someone says that the question is not relevant to the lesson's focus.
1. Evidence that the class is neutral or that there is, at most, minimal implementation of a principle. A teacher may pose a problem but quickly reduce it to computations with minimal-to-no attention to ensuring that students actually understood the problem.
2. There are some efforts to implement a principle, usually by the teachers, with some uptake by a few students (at most, about a quarter of the class). A teacher may direct students to ask questions of each other; but, aside from perfunctory questions-and-answers, students fail to engage each other.
3. A principle is implemented, even if sporadically and unevenly, among a substantial number of students (say about half of the class). For example, a teacher may pose the next problem based on an interesting point raised by a student and about half of the class follows her onto that problem.
4. A principle is implemented, in some depth, with a group of students. For example, students may engage in an extended discussion about odd and even numbers, pose a number of tests for determining whether a number is odd or even, and spend some time discussing whether zero can be an odd or an even number.
5. A principle is implemented in depth across more than half of the class. The solution to a given or a set of problems could engage either multiple groups, each having their own in-depth conversations about a problem's solutions, over a substantial portion of the lesson.

INDICATORS AND EVIDENCE

The guide's scales are conceptually distinct from each other. The empirical evidence that is used to judge how closely instruction matches one CGI instructional principle should be kept distinct from the evidence that is used to make similar judgments vis-à-vis a different principle.

During the lesson, the observer should jot down notes or ideas of the activities that are taking place and which should serve as the evidence produced for how the scores are derived at the end of each lesson. The indicators, which appear after each principle, below, are meant to help the scorer notice when a principle is being implemented. When you see an indicator, you must still fit that event into the overall pattern of other events in this class and then apply your judgment to the overall pattern of evidence.

The existence of an indicator is, in some cases, a positive event; in other cases, it might constitute negative evidence for that principle. For example, if a teacher asks students to share their reasoning with the rest of the class, it might provide evidence that the teacher is trying to "provide students with opportunities" based on the third principle, below. However, if sharing is done ritualistically, includes everyone in the class, and provides very little opportunity for follow up discussion that actually show that the sharing is meaningful or that it provides the basis on which student discussion(s) might develop, this indicator might constitute negative evidence vis-à-vis the third principle.

Sometimes, indicators might fit under multiple principles. For example, if a teacher calls attention to how a student solves a problem, it might be evidence that problem solving is central to class activity; that the teacher is making decisions based on student reasoning and thinking; and/or that the teacher is trying to provide students with opportunities to share their reasoning with one another. These events require careful interpretation based on the context in which they take place as well as the events that have come beforehand and those that come afterwards.

After the lesson has been scored, summarize your evidence with clear examples in support of your conclusion. Also, include notations (e.g., if a score is based on a group's interactions) and other facets of the lesson that support the score (e.g., what would have been needed to give a higher score).

THE FOUR PRINCIPLES

The four principles of CGI that we hypothesize distinguish an elementary classroom in which Cognitively Guided Instruction is being implemented are:

1. Problem solving is the center of class activity;
2. Teachers attend to students' thinking and make instructional decisions accordingly;
3. Students have opportunities to share and to discuss solutions with one another; and,
4. Teachers press students to express their thinking using formal/informal mathematical terminology and notations.

These principles are discussed in greater detail, below.

THE FOUR CGI PRINCIPLES OF TEACHING

Principle 1:
Problem solving is the center of class activity.

Problems are used purposefully to engage students in meaningful mathematical thinking and sense making. High cognitive demand and quality of engagement with mathematical concepts is preferred over quantity of problems solved. Students are encouraged to use their own emerging mathematical understandings to choose and to implement solution paths.

Indicators

This principle should be analyzed on a per/task basis. A final score should be based on the cumulative evidence provided across all instances of problem solving.

A mathematics task is something that is posed either by the teacher or by students wherein an individual student, a part of the class, or the entire class, engage in solving or doing something mathematical. A task ends when a new task is posed. The new task can be related to the original task or it can be a completely new task.

Code for the number of mathematics tasks in a lesson, each of which is referred to as a single task/problem segment. If possible code for how much time is spent on each task.

Problem type. In primary grades (Kg – 3), most mathematics tasks that are focused on numbers and operations can be classified and should be coded as one of the following:

- Number facts task
- Numerical task
- Represented task
- Word task
- Other task (explain)

Tasks can be posed by the teacher and/or students at different cognitive levels. In the Instructional Quality typology (Stein, M. K., et al., 2009) per below, problem types 1 and 2, if maintained as the exclusive focus of a lesson could be seen as actively working against problem solving, i.e., a lower score. Tasks posed a types 3, 4, and 5 can move the scoring in the direction of requiring depth when they are implemented, i.e., towards a higher score on the scale. Problems that are type 2 can move the lesson in either direction. ***Ultimately***, final decisions about how these indicators are used as evidence will depend on how each problem is solved and how it is discussed by the class:

1. Posed task entails memorization
2. Posed task entails the performance of prescribed mathematical procedures without connections to one another and/or to anything in the world
3. Posed task entails the performance of mathematical procedures that are connected to one another and/or to something else
4. Posed task entails the performance of mathematical procedures (with or without connections) in such a way that students are given independence on which procedures to implement and how to implement them

5. Posed task entails "doing mathematics" in the sense that students work on a problem that is generated based on earlier class discussion

Tasks can be implemented at different cognitive levels, as per above. If a task's cognitive level ***drops*** between how the teacher poses it and how it is actually implemented, that would indicate less deep implementation of this principle. On the other hand, if a task evolves and its cognitive level increases as it is implemented, that would indicate deeper implementation of this principle.

Scoring

0. The classroom environment contravenes and/or actively undermines problem solving. For example, students work almost exclusively on the textbook's computational exercises while ignoring the text's most basic problems.
1. The classroom environment is neutral or is, at best, ritualistic in its focus on problem solving. For example, a teacher may pose a textbook problem but quickly reduces that problem's demands to computations with minimal attention to ensuring that students actually understood how the computations are related to the problem in question.
2. Minimal efforts at problem solving result in minimal uptake by just a few students (at most, about a quarter of the class). For example, a teacher may pose one or more problems for class discussion; but aside from perfunctory questions-and-answers, "I don't know's," or routine recitations, students fail to actually engage in the problem(s) at hand.
3. Problem solving is sporadic and unevenly treated in the classroom; but a substantial number of students (say about half of the class) attempt to solve the problems. For example, a teacher may pose a problem that seems interesting; about half of the class tries the problem; there are minimal efforts to bring in the other half seems; and there is no class discussion, beyond stating the right answer, even among the students who attempted the problem.
4. Problem solving engages a group of students, in some depth. For example, a group of students may have an extended discussion (among themselves or with the teacher) about the nature of odd and even numbers, pose a number of tests for determining whether a number is odd or even, and discuss whether zero can be an odd or an even number.
5. Over half the class engages in problem solving in some depth. This could entail a single full-class extended conversation or it could entail multiple short conversations distributed among groups of students that, in the aggregate, involve more than half of the class. For example, multiple groups could have their own in-depth conversations about a problem's solutions, over a substantial portion of the lesson.

Principle 2:
Teachers attend to students' thinking and make instructional decisions accordingly.

CGI focuses on developing students' mathematics thinking. Teachers attend to their students during the problem-solving process and make real-time instructional decisions based on observed thinking. Teachers may change the structure of, context referred to, or numbers found in a problem; however, to be implementing this principle, *they must be doing so in response to their students' understandings and reasoning*. If students can choose among numbers or contexts for the problems that they solve, this principle is being addressed.

Indicators

To ensure that students understand a problem and to assess how students are interpreting the problem as posed, a teacher may:

- Reread a problem
- Ask students to explain a problem in his/her words
- Ask students about specific quantities in problem
- Rephrase/Elaborate a problem without changing the mathematical structure

In response to students' understandings of a problem and the reasoning that they used when solving it, a teacher may change mathematics of problem to match student level of understanding by:

- Using easier or harder numbers depending on the situation
- Using an easier or a more difficult problem structure depending on the situation

In response to an individual student's understanding or a problem and the reasoning used in solving that problem, a teacher may provide individualized support or scaffolding by:

- Exploring what the student did up to that point
- Praising students for a specific *mathematical* aspect of work
- Providing hints, cues, or questions specifically designed to support the student's reasoning
- Interrupting or redirecting student(s) strategy to suggest a different solution path
- Manipulating the tools (representations, pen, cubes, or other) that are being used in explaining the solution
- Calling attention to what another student has done as a form of modeling

Scoring

0. The teacher consistently shows a lack of interest in (if not outright antipathy to) how students solve problems. For example, a student may wonder why something is true but is told that the question is not relevant to the lesson's focus.
1. Except for diagnosing and correcting wrong answers, the teacher goes through a lesson paying minimal attention to student reasoning. For example, a teacher may pose a problem but quickly reduce it to computations with minimal attention to whether students actually understood the problem or can apply their computations to the original problem.
2. From time to time, the teacher's instructional decisions show sensitivity to a few students' understandings of a problem, explanations of how they solved problems, or their efforts to generalize a problem. For example, the same few students can be depended on to solve and to answer problems; their superficial explanations are met with "well done;" and they may steer the class in one or another direction.

3. A teacher's instructional decisions show some sensitivity to inputs from a wide range of students. For example, the teacher may provide multiple versions of the same problem that vary along superficial characteristics (such as the kinds of items that are being shared in a word problem) in an effort to engage a wide number of students. However, such efforts also include practices that undermine the teacher's ability to respond to the students; for instance, every student reports how they solved a problem in an almost ritualistic manner while the teachers makes no instructional decisions based on what the students are saying.
4. A teacher's instructional decisions are based on in-depth information about how many students reason about problems. For example, a teacher may provide multiple versions of the same problem where the size of the numbers being used is different in each version. By attending to the number-size choices that the students made and their reasoning as they engaged in those numbers, the teacher may make mid-lesson adjustments either in the next problem that is posed, by directing students' attention, or in setting the class onto a completely new direction based on a surprising "interesting" answer. For example, a student's explanation about regrouping when taking 23 away from 508 could lead to an exploration of place value that engages a small group of students.
5. The teacher makes sustained efforts to obtain information about how students reason, throughout the class and lesson; and, resulting from those efforts, the teacher constantly makes adjustments in the lesson as planned. Students seem to understand that the class may change direction based on their responses and they do their best to follow and to help one-another follow these changes.

Principle 3:
Students have opportunities to share and to discuss solutions with one another.

This principle purposefully shifts the academic control for discussions about a problem away from the teacher and over to students engaging one another on how they solve problems and their justifications for their solutions. Students have real opportunities to describe, explain, and justify the solutions and/or strategies that they use to solve a problem. They actually discuss their solutions with their peers in small groups or whole-class discussion. They can ask one another follow-up questions.

Indicators

To facilitate peer discourse during the discussion of a problem, the teacher or students may:

- Encourage the class to listen to a specific student
- Ask a student to restate someone else' idea
- Ask students to reference/add details another students idea
- Direct students to explain their idea to one another
- Ask students if they agree/disagree with a peer's response(s)

To encourage students to share their solutions with one another, the teacher or students may ask a student to share his/her method/solution during discussion; and then, the teacher or student(s)

- Listen carefully to student solution

Scoring

0. The teacher or the book are the sole sources of information. Students who show their work to each other or who talk to one another, in class, are called back as a matter of classroom management.
1. Students may show how they solved problems to each other; however, discussions of how they solve problems are perfunctory since the teacher determines what is right or wrong.
2. The teacher directs students to discuss some problems with one another. But aside from superficial discussion of what they did, students fail to engage each other about their reasoning.
3. The teacher directs students to discuss problems with one another. A few students may engage in somewhat deep discussions on how they solved problems; but the discussion goes no farther. For example, the teacher may notice that two students disagreed on their answer to a problem so they are told to talk about it and to report back to the rest of the group/class when they agree. Later in the lesson, the students return with their agreed-upon answer. However, the rest of the class does not hear how they came to their agreement.
4. The teacher reminds students that they should discuss problems with one another and, from time to time, students do so without prompting. Most students listen attentively while others in the class relate their reasoning. The teacher tries to ensure that the rest of the class have the opportunity to have their questions answered; though the teacher may also restate what the discussants said in an effort to ensure widespread understanding.
5. Students act as if it's just understood that they are to engage in discussions about how they solve problems. They may ask one-another questions. They may disagree and provide reasons for their disagreement. They may remove themselves from the class to discuss something in depth; but when they return to the class, they explain their discussion to the rest of the group/class. The solution to a given or to a set of problems could engage multiple groups of students, each having their own in-depth conversations about a problem's solutions, over a substantial portion of the lesson.

Principle 4:
Teachers press students to express their thinking using formal/informal mathematical terminology and notations.

Teachers prompt students to use and apply mathematical words, symbols, and diagrams to express their thinking. They press students to provide complete, coherent, and understandable explanations that make use of a range of artifacts and notational systems so that others can understand what they mean and are saying.

Indicators

A teacher or other students may extend student thinking by:

- Pursuing further clarification/elaboration/justification of student response
- Connecting solution to symbolic notation
- Connecting/comparing different problems
- Connecting/comparing multiple strategies
- Connecting/comparing multiple representations
- Connecting a problem to real life
- Connecting a problem to other concepts within mathematics
- Connecting a problem to other subjects

Scoring

0. Students are discouraged from providing age-appropriate mathematical explanations. Their efforts to do so are interrupted or cut short so that the teacher can move on with the lesson.
1. The teacher may ask students to provide explanations; but incomplete or even wrong explanations may be accepted without encouragement and support to do better. For example, the teacher may accept student responses that answers just come to them without any effort to understand how that may have happened.
2. The teacher asks students to explain how they figured out their answers and a few students may provide these explanations; but their explanations remain incomplete.
3. The teacher follows-up on incomplete explanations with requests for clarification that may expand student responses or insert terminology in order to model what is expected. For example: a student manipulates a set of blocks without explanation. The teacher asks the student to explain how they used the blocks to solve the problem. If the student seems stumped, the teacher may provide a hint or a nudge (what did you do next? What number did you say when counting this block?) to help move the student along.
4. In response to question about how they figured problems out or to efforts to extend student thinking along the lines above, many students tend to provide more-or-less coherent explanations that may lack some minor details. Some students may require support to extend and to clarify their explanations which the teacher or other students help to provide.
5. Most students, with some reminders, try to express themselves coherently, in complete thoughts, and to use appropriate terminology. Their questions to one another also help to extend each other's thinking and to express themselves coherently.

References

Lee, O., & Secada, W.G. (2003). *Classroom observation guideline.* University of Miami, School of Education: Promoting Science learning among English Language Learners (P-SELL).

Newmann, F.M., Carmichael Tanaka, D.L., & King, M.B. (2016). *Authentic Intellectual Work: Improving teaching for rigorous learning*. Thousand Oaks, CA: Corwin.

Newmann, F.M., Secada, W.G., & Wehlage, G.G. (1995). *A guide to authentic instruction and assessment: Vision, standards, and scoring.* Madison, WI: Wisconsin Center for Education Research, University of Wisconsin.

Perresini, D.P. (2001, February). *Individual student rating scales for classroom observations.* University of Miami, School of Education: Highly Effective USI Schools, An Outlier Study.

Secada, W. G. & Adajian, L.B. (1997). *Mathematics Classroom Observation Scales.* Madison, WI: NCRMSE, Wisconsin Center for Education Research, University of Wisconsin.

Secada, W.G. & Lee, O. (2000, June). *Classroom observation scales.* University of Miami, School of Education: Highly Effective USI Schools, An Outlier Study.

Secada, W.G., Ran, H., & Schoen, R. (2020, January). *The effects of cognitively guided instruction (CGI) professional development on first and second grade classroom instruction* (Poster presentation). Washington, DC: IES Annual Principal Investigators Meeting.

Stein, M. K., Smith, M. S., Henningsen, M., & Silver, E. A. (2009). *Implementing standards-based mathematics instruction: A casebook for professional development* (2nd ed). New York: Teachers College Press.

Stipek, D.J. (1999). *CCDP Follow-up Study: Instructional environment observation scales.* Los Angeles: Author.

Classroom Visitation Instruments

School district: ____________________ School: ____________________________

Date: ________________________________ Time (begin and end): _________________

Teacher's name: ________________________ Observer's name: _____________________

Mathematics area or topic: ____

Focus of Instruction

•Mathematics concepts: ____

•Class Activities: ____

Problem solving is the center of class activity

Score:

Evidence:

Teachers attend to students' thinking and make instructional decisions accordingly.

Score:

Evidence:

Students have opportunities to share solutions with one another.

Score:

Evidence:

Teachers press students to express their thinking using formal/informal mathematical terminology and notations

Score:

Evidence: