Methodological Factors in Addressing Middle Grades'

Teaming Structures and Organization

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Abstract

The purpose of this paper is to present a set of procedures, processes, and decision rules used to integrate information pertaining to the structure of interdisciplinary teams in middle schools from multiple sources into a single coded value. This paper is part of a larger study of the impact of middle schools restructuring on student outcomes. Eight items regarding middle-level teachers' teaming practices were coded in an effort to strengthen the reliability of the data through triangulation of data sources, and reduce the variance of item responses within each team by assigning a common value to members of the same team. By reviewing responses across three data sources, and using a predefined set of decision-making criteria, a group of three researchers created two new variables and recoded six variables. Each school's data was coded by at least two researchers, and ensuing coding discrepancies were reviewed by all three team members. The coded data were then merged back into the original data file. Concordance rates for the eight variables ranged from 90% to 97%.

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The purpose of this paper is to present a set of procedures, processes and decision rules used to integrate information pertaining to the structure of interdisciplinary teams in middle schools from multiple sources into a single coded value. This paper is part of a larger study designed to examine the impact and effect of various components of middle school restructuring on student outcomes (Hesson-McInnis, Bishop, Mertens, & Flowers, 2007; Mertens, Flowers, Hesson-McInnis, & Bishop, 2007; Flowers, Hesson-McInnis, Bishop, & Mertens, 2007). There are three reasons that the data were coded:

1) To strengthen the reliability of the data by combining information from three different data sources into the value for each coded variable.
2) The variables that were recoded all refer to team-level behavior for which all staff on the same team should have experienced the same value (e.g., frequency of team meetings, number of students on the team). Since each team member should be experiencing the same levels of these behaviors, each team member should have the same value for each behavior
3) Assigning each team member the same value reduces the amount of error in the data, thereby strengthening the power of the statistical analyses.
4) The variables that were coded were hypothesized by the researchers to be important exogenous variables in the SEM model.

Methods

Data Sources

Three sources of data were utilized in the coding of the structure of interdisciplinary teams. These included two quantitative surveys—an Administrator Survey completed by the school principal and a Staff Survey completed by teachers. The third data source was a Data Collection Sheet (DCS), a registration form sent to each school prior to the survey data collection. The DCS is typically completed by the school principal or staff secretary. Upon return of the DCS, if any information is missing or contradictory, the school is contacted via phone or fax in an effort to gather the missing information.

Sample

The data were collected in 2003 from teachers and administrators in middle level schools in four states—Arkansas, Louisiana, Michigan, and Mississippi. The final sample consisted of 199 schools containing combinations of grades five through eight. From these 199 schools, 173 Administrator Surveys and 163 Data Collection Sheets were returned. In addition, there were 3,142 Staff Surveys from staff who were designated as core teachers. Core teachers are identified as teachers who teach the following subjects: English, language arts, reading, math, science, or social studies. While each school could be represented by one Administrator Survey and one Data Collection Sheet, the number of Staff Surveys completed by core teachers ranged from 3-39 per school (mean=15.8, median=15.)

Variables

A total of eight staff variables were either created (n=2) or recoded (n=6). These variables are listed in Figure 1 below. In order to create or recode the staff variables, it was necessary to review the responses to 21 variables across the three data sources (Figure 2).

Responses to each of these variables were in reference to either the school, the grade within the school (5^{th}, 6^{th}, 7^{th}, or 8^{th}), or the team within the school.

Figure 1. Coded variables

Variables	Coding
Teaming status of school (teaming in all grades, teaming in some grades, not teaming, cannot determine)	Created
Type of Team (one team per grade, multiple teams per grade; cross-grade team, not teaming, cannot determine)	Created
Number of teachers per team	Recoded
Number of students per team	Recoded
Number of team meetings per week	Recoded
Length of team meetings	Recoded
Grade teacher teaches	Recoded
Team Code	Recoded

Figure 2. Variables reviewed during the coding process

Data Source[1]	Level	Variable Type	Variable Description
Admin	School	Teaming status	School's teaming status (all grades, some grades, not teaming)
DCS	School	Teaming status	School's teaming status (all grades, some grades, not teaming)
Staff	Team	Teaming status	Staff member's teaming status (teaming or not teaming)
Admin	Grade	Number of students	# students in each grade (5th-8th)
DCS	Grade	Number of students	# students in each grade (5th-8th)
DCS	Team	# students	# students on each team (teams 1-15)
Staff	Team	# students	# students on staff member's team
DCS	School	# teachers	# teachers at school
DCS	Team	# teachers	# teachers per team
Staff	Team	# teachers	# teachers on staff members' team
Admin	Grade	# teams	# teams in grade (5th-8th)
Admin	Grade	# team meetings / week	# team meetings per week in each grade (5^{th}-8^{th})
DCS	School	# team meetings / week	# team meetings per week (school average)
Staff	Team	# team meetings / week	# team meetings per week for staff member's team
Admin	Grade	Length of team meetings	# minutes of team meeting (grade average)
DCS	School	Length of team meetings	# minutes of team meeting (school average)
Staff	Team	Length of team meetings	# minutes of team meeting (staff's team)
DCS	Team	Grade of team	Grade level of each team (teams 1-15)
DCS	Team	Team name	Team name (teams 1-15)
Staff	Team	Team type	Team type (e.g., interdisciplinary, special education, gifted)
Staff	Team	Team code	Team code associate with staff member's team

1 Staff = Staff Survey; Admin = Administrator Survey; DCS = Data Collection Form

Coding Materials

Administrator data

The 173 Administrator Survey data records were sorted in ascending order in SPSS by the School ID—a unique ID number associated with each school—and then exported to MS Excel. In Excel, alternating rows were shaded to visually aid inspection of the data. For each variable reported at the grade level, vertical lines were drawn to enclose the four grade-specific values for the variable. Additional bold vertical lines were drawn to help draw the reviewer's eyes to the most important variables and break the page into sections. The data were sized to fit widthwise on landscaped 11"x17" paper, such that 67 data records would fit on each page. The data were printed on three landscaped sheets of 11"x17" paper.

Data collection sheet data

The 163 DCS data records originated in an MS Access database, where they were sorted by the School ID and exported to Excel. Alternate rows were shaded, and for each variable reported at the grade/team level, vertical lines were drawn to enclose the four grade/15 team-specific values for the variable. Because of the large number of grade-specific and team-specific values accounted for by the four team-level variables and one grade level variable, the data were sized to fit widthwise on three landscaped 11"x17" sheets of paper. So that data records could be readily matched across the three sheets of paper, each school's code was printed in the leftmost column of each sheet of paper. Sixty-seven records were printed on each page, such that a total of nine landscaped sheets of 11"x17" paper were used to print all 163 data records.

Staff survey data

The 3,142 Staff Survey data records were sorted ascending in SPSS by the following variables: School ID, *grade*, *teaming*, and *team code*. A new numeric variable, which ranged in

value from one to 3,142, was created to uniquely identify each record by its sort order and saved in the SPSS dataset. The data were then exported to MS Excel.

Figure 3. Example of *Staff Survey Data Booklet*

School ID	Grade levels	Grade taught	Teaming	Team code	Type of classes taught	Teachers per team	Team meetings / week	Length of team meetings	Students / team	School enrollment
20006	678	6	1	1	1	6	0		120	365
20006	678	6	1	1	1	6	0		120	365
20006	678	6	1	1	1	6	0		120	365
20006	678	7	1		1	7	0		120	365
20006	678	7	1	1	1	5	1	4	115	365
20006	678	7	1	1	1	7	0		107	365
20006	678	7	1	7	1	7	0		99	365
20006	678	7	2							365
20006	678	8	1		1	6	0		110	365
20006	678	8	1		1	5	1	3	120	365
20006	678	8	1		1	5	0		115	365
20006	678	8	1	3	1		1	3	112	365
20006	678	8	2							365
20013	678	6	1	1	1	5	6	4	114	340
20013	678	6	1	1	1	5	5	3	114	340
20013	678	6	1	1	1	5	5	4	114	340
20013	678	7	1	2	1	5	5	4	107	340
20013	678	7	1	2	1	5	5	4	109	340
20013	678	7	1	2	1	5	5	4	110	340
20013	678	8	1	3	1	5	5	4	110	340
20013	678	8	1	3	1	5	5	4	113	340
20015	678	6	1	1	3	2	4	4	52	478
20015	678	6	1	2	1	2	6	4	50	478
20015	678	6	1	2	1	2	6	4	50	478
20015	678	6	1	3	1	2	3	2	52	478
20015	678	7	1	4	1	2	6	2	65	478
20015	678	7	1	4	1	2	2	4	58	478
20015	678	7		5	1	4	1	4	126	478
20015	678	8	1		6	6	3	4	120	478
20015	678	8	1		1	7	2	4	150	478
20015	678	8	2							478
20015	678	8	2							478
20015	678	8	2							478
20015	678	8	2							478
20015	678	8								478

As can be seen in Figure 3 (above), boxes were drawn around records with the same School ID value to visually separate the schools, and the records were shaded according to the grade level. A 32-page double-sided letter-sized booklet was created.

Researcher's documentation booklet for the eight coded variables

An identical coding documentation booklet, including all 199 schools, was created for each researcher to use to record their coding decisions. Because the ultimate goal of the data coding was to attribute the same team-level data value to every staff member on a given team, the 3,142 staff data records were aggregated in SPSS by the School ID, *grade*, and *team code* to determine the number of teams per grade level within each school, as well as the number of staff survey responses associated with each team. From the 3,142 individual staff responses, this aggregation of the data yielded 1,234 unique combinations. For example, note that the 15 records in the sample *Research Documentation Booklet* in Figure 4 below represent the aggregated form of the 35 Staff Survey Data records shown in Figure 3 above.

Figure 4. Example of *Researcher's Documentation Booklet*

School ID	Grade	Team code	Number surveys	Teaming status	Team Type	Teachers / team	Students / team	Team meetings / week	Length of team meetings
20006	6	1	[3]						
20006	7	.	[2]						
20006	7	1	[2]						
20006	7	7	[1]						
20006	8	.	[4]						
20006	8	3	[1]						
20013	6	1	[3]						
20013	7	2	[3]						
20013	8	3	[2]						
20015	6	1	[1]						
20015	6	2	[2]						
20015	6	3	[1]						
20015	7	4	[2]						
20015	7	5	[1]						
20015	8	.	[7]						

The Documentation Booklet was created by exporting the SPSS aggregate data file with 1,234 records to MS Excel, adding the ID number, and formatting the document. The names for the last six variables in Figure 4 were then added and boxes were drawn around records with the same School ID. For each school, the individual cells within the column labeled *School's teaming status* were merged to create a single cell to facilitate entry of a single value. The Documentation Booklet was printed single-sided, in booklet form, on letter-sized paper.

Analysis

Developing the Coding Rules

The initial goal of the coding task was to recode four variables: *number of teachers per team, number of students per team, number of team meetings per week,* and *length of team meetings*. When the researchers first met to develop and document the criteria for coding these four variables, they quickly realized that it would first be necessary to decide which schools (and grades within these schools) were definitively teaming or definitively not teaming. For this reason, two new variables, *school's teaming status* and *type of team* were created. As the researchers again shifted their focus to defining the coding criteria, it became apparent that in some instances the *team code* and *grade* values were clearly inconsistent with the values of the other variables. Therefore, the researchers decided that when patterns in the data made it clear that a staff respondent very likely filled in the wrong value for *team code* or *grade* (for example, the responses to all or most of the variables suggested that the teacher was on Team 2, not Team 3), it was acceptable to change the values of these variables (see *Visual Inspection of the Staff Survey Data* section below). The addition of these two variables resulted in the final total of eight variables to be created or recoded.

The goal of the researchers was to define rules-based, coding criteria with the following qualities:

1) Lack of ambiguity;
2) Comprehensiveness, such that they are applicable to the wide spectrum of teaming practices across schools, from schools that do not team at all to schools that have multiple teams at each grade level, to schools that have teams with multiple grade levels; and
3) The ability to account for instances where it is simply not possible to code the data, due to too few data or too much inconsistency among the variables reviewed during the coding process.

Definition of the coding rules was an iterative process that was always performed and agreed upon by the three researchers. Coding rules were generated, discussed and documented, and then applied to the data. The researchers made every coding decision in collaboration and documented the data sources that they used to make the decision. Every time a researcher voiced a concern that a coding rule was not meeting one of the three criteria listed above, the coding process stopped, and the researchers modified the coding rule until all researchers agreed that it was meeting all three criteria. The researchers worked together in this manner until they had coded a sample of 13 schools. At that point, they were confident that they had clearly defined the coding rules, and each coding rule met all three criteria.

Four general coding rules were defined:

1) Assign more weight to Staff Survey data than to DCS or Administrator Survey data, because staff are more familiar with the day-to-day happenings on their team and/or in their grade.

2) Due to the weighting of the staff data, if any school has an inadequate Staff Survey response rate at the team level (see *Determining whether there are enough staff surveys to code the team* section below), all six coded variables in every staff record associated with the team will be coded as "X", meaning it could not be determined.
3) Despite the extra consideration given to the Staff data, in instances where there is an adequate staff survey response on a team, but only one staff member has reported the number of teachers on the team or the number of students on the team, then the DCS must be examined. If the DCS value for the variable is within 10% of the Staff value, then the coded variable is assigned the Staff value. If the DCS value for the variable is not within 10% of the Staff value or is missing, then the variable is coded as an "X" (cannot determine).
4) If it is determined that a school is not teaming, then the remaining variables are coded as an "X" (cannot determine.)

Visual Inspection of the Staff Survey Data

After becoming familiar with the coding process and the characteristics of the Staff survey data, the researchers soon acquired the capacity to notice patterns in the Staff data. For instance, in Figure 5 observe that there are four teachers who report teaching in the 8th grade. All but one of these teachers report that they are members of Team 3 (*team code*=3). These teachers also report that there are five teachers on Team 3 (*number of teachers per team*=5) who met for common planning time one time per week (*number of team meetings per week*=1) for 21-30 minutes (*length of team meetings*=2).

Figure 5. Example of Patterns in Sample Staff Data

School ID	Grade	Teaming	Team code	Type of classes taught	Teachers / team	Team meetings / week	Length of team meetings
20042	6	1	1	1	3	5	3
20042	6	1	1	1	3	5	4
20042	6	1	1	1	3	6	4
20042	6	1	2	1	4	3	3
20042	7	1	2	1	4	3	3
20042	7	1		1	4	3	3
20042	7	1		1	4	3	3
20042	8	1	8	1	5	1	2
20042	8	1	3	1	5	1	1
20042	8	1	3	1	5	1	2
20042	8		3	1	5	2	2

When such patterns of within-team consistency existed for two or more teams in a school, the researchers were able to recognize instances where it was apparent that a staff member indicated the wrong *grade* or *team code*. For instance, in the example above, because Team 1 is a 6th grade team and Team 2 is a 7th grade team, we know that in the 4th row of data an inconsistency exists in either the *grade* value or the *team code* value. Because the *number of teachers per team, number of team meetings per week, and length of team meetings* values are all consistent with the records where *grade* is 7, it is very likely that the *grade* value of the 4th row should be 7, not 6. Additionally, the blank *team code* values should probably be coded as a "2," and the *team code* value of "8" should be "3." In such instances, when the patterns were very clear, the researchers would make the changes described above to the values of *team code* or *grade*. Under no circumstance would the values of both *team code* and *grade* be changed. Note that these changes to *team code* or *grade* values result in the changed record being associated with a different team and the yet-to-be-determined values of the coded variables associated with the different team.

Changes to *team code* or *grade* were documented in the Researcher's Documentation Booklet in the manner depicted in Figure 6. If the *grade* or *team code* value was deemed

incorrect, it would be crossed out and the recoded *grade* or *team code* value would be documented next to it. In addition, the value of *number of surveys* would be corrected to document the new number of records that should have the *grade* and *team code* values.

Figure 6. Documentation of modifications to *team code* or *grade* values

School ID	Grade	Team code	Number of surveys	Teaming status	Team Type	Teachers / team	Students / team	Team meetings / week	Length of team meetings
20042	6	1	[3]						
20042	~~6~~ 7	2	~~[1]~~ 0		X	X	X	X	X
20042	7	~~-~~ 2	~~[2]~~ 0		X	X	X	X	X
20042	7	2	~~[1]~~ 4						
20042	8	3	~~[3]~~ 4						
20042	8	~~8~~ 3	~~[1]~~ 0		X	X	X	X	X

Once any changes to *grade* or *team code* were documented, the researcher then coded the six remaining variables for each record that had not been crossed out. The coded variable values for 6th grade Team 1 would be recorded in the first row, while the values for 7th grade Team 2 would be recorded in the fourth row and 8th grade Team 3's values would be written in the fifth row. Note that the 11 original cases in Figure 5 were aggregated into the to six grade/team permutations found in Figure 6. Further note that while all 11 records in Figure 5 were coded, four of these records were not coded as belonging to the *grade* or *team code* with which they were initially associated in Figures 5 and 6. In other words, the six records in Figure 6 could be reduced to three records representing one team per grade level, with three teachers on the 6th grade team, and four teachers each for the 7th and 8th grade teams.

Explanation of coding rules for each variable

Number of teachers per team

The variables listed in Figure 7 were reviewed in order to code the number of teachers per team. For each team, the most frequent (modal) staff response to *number of teachers per team* was chosen as the value. In instances where more than one value was most frequent, the DCS value was chosen as the tiebreaker. If the DCS value matched neither of the modes, then the modal value closest to the DCS value was chosen. The value chosen for each team would eventually be attributed to every Staff member on the team. In this way, the *number of teachers per team* variable would eventually be recoded for Staff whose responses differed from the response coded for their team.

Figure 7. Variables reviewed to code the *number of teachers per team* variable

Variable Description	Data Source
Number of teachers	DCS
Number of teachers / team	DCS
Number of teachers on staff members' team	Staff Survey

Determining adequate staff sample size

Once the *number of teachers per team* was coded, it was necessary to determine whether the number of staff surveys returned for each team was adequate. Figure 8 (below) depicts the minimum number of staff surveys required per team. In instances where the minimum required number of staff surveys was not met, all records associated with the team received values of "X" (cannot determine) for the remaining five variables.

Figure 8. Minimum number of staff surveys required per team

Number of teachers on team	Minimum number of staff surveys required
2	1
3	2
4	2
5	2
6	3
7	3
8	3

School teaming status

While all variables listed in Figure 9 were reviewed by the research team in order to create the new *school teaming status* variable, the first three variables were considered most important. In instances where all three data sources were in agreement on this variable, the common value was chosen. Alternatively, in instances where the first three variables were not in agreement regarding *school teaming status*, two additional decision-making criteria were employed: 1) the variables *number of team meetings per week* and *length of team meetings* were considered, and 2) the Staff data were given more consideration than the other two data sources. If the teaming status values on the Staff Survey and one other data source were in agreement and inspection of *number of team meetings per week* and *length of team meetings* suggested that the amount of common planning time was consistent with the Staff Survey teaming status value, then the data were coded based on this information. In instances where there was little consistency within the Staff teaming status variable and inspection of all the other variables listed below did not clearly and cohesively point to a single coding value, the *school teaming status* was coded as an "X" (cannot determine). Four categories for the *school teaming status* variable were created: teaming in all grades, teaming in some grades, not teaming, and cannot determine.

Figure 9. Variables reviewed to code school's teaming status

Variable Description	Data Source
School's teaming status (all grades, some grades, not teaming)	Administrator Survey
School's teaming status (all grades, some grades, not teaming)	DCS
Staff member's teaming status (teaming or not teaming)	Staff Survey
Team name (teams 1-15)	DCS
Number of teams in grade (5th-8th)	Administrator Survey
Number of students in each grade (5th-8th)	Administrator Survey
Number of students in each grade (5th-8th)	DCS
Number of students on each team (teams 1-15)	DCS
Number of team meetings per week in each grade (5th-8th)	Administrator Survey
Number of team meetings per week (school average)	DCS
Number of team meetings per week for staff member's team	Staff Survey
Number of minutes of team meeting (grade average)	Administrator Survey
Number of minutes of team meeting (school average)	DCS
Number of minutes of team meeting (staff's team)	Staff Survey
Grade of each team (teams 1-15)	DCS
Team code associate with staff member's team	Staff Survey

Type of team

The variables listed in Figure 10 were examined in order to create the *type of team* variable. The number of *team code* values reported for each grade on the Staff Survey was compared to the values of *number of students per team* and *number of students per grade* from the DCS. If these three indicator variables all pointed to the same conclusion (e.g., one team per grade, multiple teams per grade, etc.) then the variable was coded accordingly. If a discrepancy existed among these indicator variables, the Staff variable *team code* was given extra consideration in the decision-making process. If the Staff data and either the DCS or Administrator survey data were in agreement, the team would be coded accordingly. If the Staff data were not in agreement with either the DCS or Administrator survey, then the rest of the variables in the figure below were examined. If all of the remaining variables were in accordance with the Staff data, then the variable would be coded in line with the Staff data; otherwise, *type of team* would be coded as an "X" (cannot determine). Four categories for the

school teaming status variable were created: one team per grade, multiple teams per grade, cross-grade team (e.g., 6/7 team), not teaming, and cannot determine.

Figure 10. Variables examined to code the *type of team* variable

Variable Description	Data Source
Team code associated with staff member's team	Staff Survey
Number of teams in grade (5th-8th)	Administrator Survey
Number of students on each team (teams 1-15)	DCS
Number of students in each grade (5th-8th)	DCS
Grade of each team (teams 1-15)	DCS
Team name (teams 1-15)	DCS
Type of Team (interdisciplinary, special education, gifted, etc.)	Staff Survey

Number of students per team

The three variables listed in Figure 11 were inspected in order to code the *number of students per team* variable. As is true of the coding of other variables, the staff variable that referred to the number of students on the staff member's team was given the most weight in deciding the recoded value. The other variables were utilized when there were discrepancies between the Staff values of number of students on their team.

Figure 11. Variables examined to code the *number of students per team* variable

Variable Description	Data Source
Number of students on each team (teams 1-15)	DCS
Number of students enrolled in school	Staff Survey
Number of students on staff member's team	Staff Survey

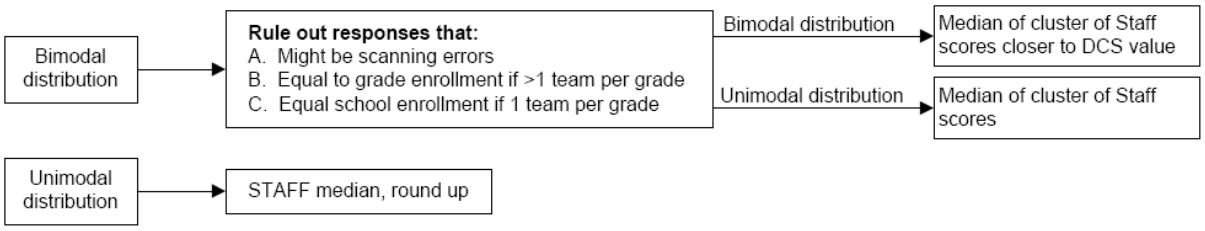
If the distribution of staff members' students per team responses on a given team was unimodal, then the value of the variable was coded as the median of the staff response, and rounded up if necessary. The distribution was always considered unimodal if there were three or less staff responses to students per team. If there were 4 or more staff on a team, and the

reported students per team values are bimodal with at least two staff responses per mode, then further investigation is required. Students per team values were ruled out for any of the following possibilities:

1) A survey scanning error (e.g., a value of 10 rather than 100, or 9 rather that 89),
2) On teams with more than one team per grade, the respondent mistakenly indicated the number of students in the grade instead of the number of students on the team, or
3) On teams with one team per grade, the respondent erroneously specified the number of students at the school, rather than the number of students in the grade.

After responses are ruled out based on these criteria, the distribution of the remaining responses is examined. If the distribution remains bimodal (without the stipulation that each mode consist of at least two responses) the median of the modal cluster of responses that is closer to the DCS value is chosen as the value. On the other hand, if the new response distribution is unimodal, the staff median, rounded up if necessary, is assigned as the team value. This decision-making process is depicted in Figure 12.

Figure 12. Decision rules for coding the *number of students per team* variable



Common plan time frequency and length

Because they are so closely related, the variables *number of team meetings per week* and *length of team meetings* were coded simultaneously. Figure 13 depicts the original coding of these variables together with the various categories for each variable.

Figure 13. Coding of *number of team meetings per week* and *length of team meetings* variables

Number of team meetings		Length of team meetings	
0	no common planning time (CPT)	0	No team meetings (CPT=0)
1	1 time / week	1	<20 min
2	2 times / week	2	21-30 min
3	3 times / week	3	31-40 min
4	4 times / week	4	41-50 min
5	5 times / week	5	>50 min
6	6 times / week	X	cannot determine or Type of Team=4
X	cannot determine or Type of Team=4		

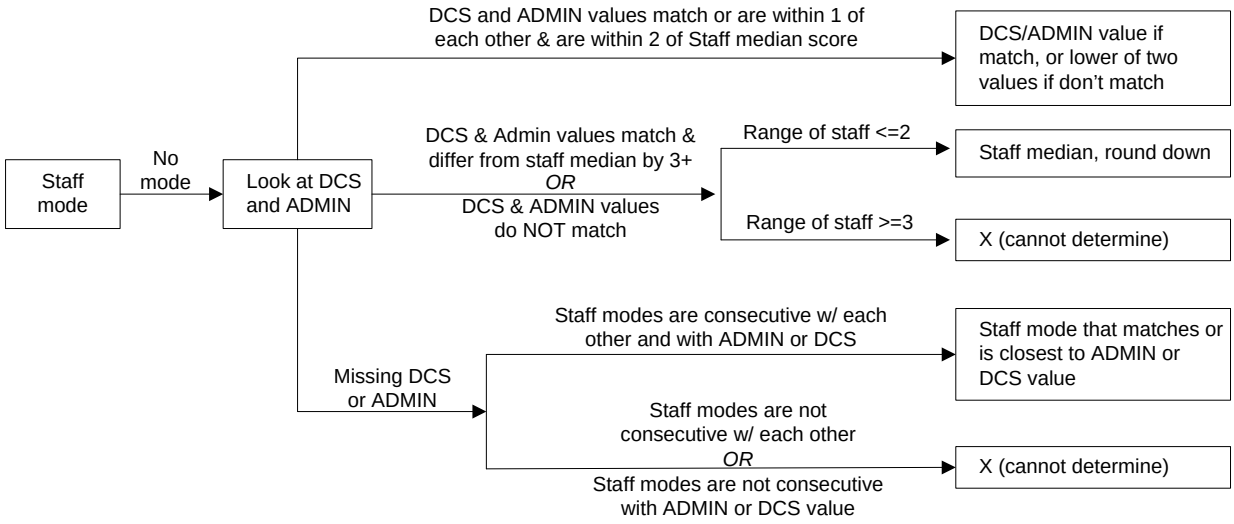
As can be seen in Figure 14, the variables inspected to recode these variables were derived from all three data sources.

Figure 14. Variables examined to code the *number of team meetings per week* and *length of team meetings* variables

Variable Description	Data Source
Number of team meetings per week for staff member's team	Staff Survey
Number of team meetings per week in each grade (5th-8th)	Administrator Survey
Number of team meetings per week (school average)	DCS
Number of minutes of team meeting (staff's team)	Staff Survey
Number of minutes of team meeting (grade level average)	Administrator Survey
Number of minutes of team meeting (school average)	DCS

The flowchart in Figure 15 depicts the decision-making processed employed by the researchers to code the *number of team meetings per week* and *length of team meetings* variables. For each team that was coded, the process shown and described below was followed first for *number of team meetings per week*. If the *number of team meetings per week* value was coded to 0 (no common planning time) or "X" (cannot determine), then *length of team meetings* was given the same value. If the value of *number of team meetings per week* was coded with a value of one through six, then the process depicted below (Fig. 15) was followed again for *length of team meetings*.

Figure 15. Final decision making process for coding teaming variables



When there is a staff mode, this modal value is chosen. If there is no mode, then the DCS and Administrator data were inspected. If the data value was missing from one of these data sources, it was determined whether the staff modes were consecutive with each other and consecutive with the DCS or Administrator value. If this was true, then the staff modal value that matched or was closest to the Administrator or DCS value was chosen. If this was not true, then the variable was coded as "X" (cannot determine). In instances when there were values for both the DCS and Administrator, the researchers determined whether they matched. If the values matched and differed from the median staff value by three or more, OR if the values did not match, an additional decision rule applied. In these cases, if the range of the staff data was two or less, then the variable was given the value of the staff median, rounded down if necessary. If the Administrator or DCS values did not match and the range of the staff data was three or greater, then a value of "X" (cannot determine) was assigned. The last scenario was that the DCS and Administrator values matched or were within one of each other and were within two of the staff median score. In this case, the DCS/Administrator value was chosen if they matched, or the lower of the two values was chosen if they did not match.

The Coding Process

Each school was coded by at least two researchers. Of the 199 schools that were coded, 13 were coded together by all three researchers as part of the process of defining and documenting the coding rules. The remaining 186 schools were split into three batches of 62 schools, and each researcher coded two batches, for a total of 124 schools. The researchers coded their schools independently. Once the coding criteria were finalized, it took the researchers approximately four weeks to complete the coding.

Results

Comparing the Researchers' Codes

Once the data were coded, the data values were entered into a spreadsheet. Once the data entry had been verified, an intricate process was employed to compare the values that two researchers had independently coded for each school (described in Appendix A). The concordance rate was determined to be approximately 97% for *grade* and *team code*; that is, 97% of the staff data records were assigned the same *grade* and *team code* values by both coders. For the remaining 6 variables, the concordance rate varied between 90% and 97%.

For all of the schools, the coded data of the two researchers who had coded the schools were printed side by side, and discrepancies between the two coders' values were highlighted. The three researchers then met to review the data coding discrepancies. During this meeting, it became apparent for two reasons that each researcher had been applying the decision rules for *number of team meetings per week* and *length of team meetings* differently:

1) Discrepancies among these two variables accounted for the vast majority of the coding discrepancies, and

2) When the coders explained why they coded the data they way the did, both explanations made sense and could be supported by the documented decision rules.

Once this ambiguity in the decision rules for *number of team meetings per week* and *length of team meetings* was identified, the researchers shifted from reviewing coding discrepancies to redefining the decision rules for these two variables to negate the ambiguity. After the decision rules were redefined and their documentation was updated, the researchers again coded the values *number of team meetings per week* and *length of team meetings* for all schools.

When these two variables had been recoded, the coded values of the data were entered into a spreadsheet and double-checked. The previous process was again used to match each school's two sets of coded data, which were then printed side by side, with the discrepancies highlighted. At this point, the concordance rates for *number of team meetings per week* and *length of team meetings* increased from 92% and 90%, respectively, to 97% and 94%.

The researchers met again to review the coding discrepancies and decide the correct coded value. These values were documented by all three researchers and the documentation was reviewed by all three researchers to make sure that the correct decision had been documented. These newly coded values were entered into a spreadsheet and verified for accuracy. The coded data were then merged back into the original SPSS data set and verified to assure that the recoded data had been matched to the correct original data records.

Reasons for Coding Inconsistencies

As noted above, before the researchers recognized that they were applying the decision rules used to code *number of team meetings per week* and *length of team meetings* in different ways, a vast majority of the coding inconsistencies were associated with the *number of team meetings per week* and *length of team meetings* variables. Once the coding rules for these

variables were redefined so that they were no longer ambiguous, and the variables were coded again based on these new criteria, few inconsistencies were found for these variables.

Not including these initial problems with *number of team meetings per week* and *length of team meetings*, there were two main reasons for coding discrepancies:

1) Failure to correctly calculate and round down the median for the *number of students per team* variable, and/or
2) Failure to accurately execute the coding rules (e.g., misreading or skipping a step in the flowchart).

For a vast majority of the discrepancies, it was very easy for the researchers to decide how the variable should be coded. In the few instances where the researchers could not easily decide on a coded value, the data were not coded, and a value of "X" (cannot determine) was assigned.

Discussion

Coding data is a time consuming and arduous, yet important process. When multiple survey respondents are asked to answer questions about an element or practice that is common to all of them, rarely does a researcher find absolute agreement between all of the respondents. Unfortunately, when statistical tests will be performed on the data, and the unit of analysis is the common element or practice, the researcher will often have to decide whether to assign a common value to all respondents based on the distribution of the data (e.g., the mean or median value) or rely on multiple data sources to deduce the value of the common element or practice. When the number of respondents in a group is rather large and/or there is little variance among the group responses, then it is often easiest to assign the group's mean or median value to each individual in the group. However, when the number of respondents is small and/or there is a large degree of variance in the group responses, the researcher may hesitate to assign the mean or

median response to each member of the group. In this case the researcher may have no option other than relying on multiple data sources when trying to assign the best common value to the members of a group.

For many reasons, these researchers found the coding process worthwhile, despite the large amount of time spent creating and documenting the coding rules, independently coding the data, reviewing the coding discrepancies, electronically compiling the data, and merging it back to its original data source. First, not only was the number of respondents in each team small, but each group's population of respondents was small; indeed, in most instances, a majority of the population of respondents completed a survey. In addition, different schools and individuals have different ideas of what it means to team teach, so it is not surprising that some teachers on a team would report teaming, while others would not. This, along with the reality that a group of teachers either is or is not teaming, as we have defined it, makes it undesirable to rely on the value of a statistic, such as the percentage of teachers who report teaming, to represent a group of teachers' teaming status. Given that two other sources of data regarding the schools' and teams' teaming practices were readily available to researchers, triangulating the data sources and coding the data seemed like an obvious choice. Finally, these researchers believe that defining and statistically supporting a model of middle grades teaming structure is extremely important, and we wanted to make sure that the data used in the model had the least error possible.

References

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Mertens, S. B., Flowers, N., Hesson-McInnis, M., & Bishop, C. (2007, April). *Development of a multivariate/multi-level model examining the impact of middle grades structures, organizations, and practices on student outcomes.* Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL.

Appendix A.

Detailed Description of Coding Process

After the coding was completed, each researcher carefully transferred the coded values documented in their hardcopy Researcher's Documentation Booklet into an electronic version of the booklet for the following six variables: *school's teaming status*, *type of team*, *number of teachers per team, number of students per team, number of team meeting per week,* and *length of team meetings*. In addition to transferring this data, each researcher also typed instructions within each record of data that required change (e.g., "change *team code* to a value of "1" and combine these two cases with the next line," or "combine with other case above where *team code* = 1"). These three data files were then split into six data files (three batches with two coders per batch), called Researcher Documentation (RD) files, which only included the records associated with the schools that the researcher had coded. These six files were named according to the batch number (1-3) and the initials of the researcher who coded the batch. The six files were printed, and copies were given to the researchers so they could double check their data entry of the six variables.

Manipulating the original data files to reflect changes made during the coding process

Recall that many changes to *grade* and *team code* values were noted in the Researcher's Documentation Booklet during the coding process, and the coding of the remaining six variables were based on these changes. As such, it was necessary to reflect these changes in all of the electronic datasets, which include not only the six newly created RD files, but also six copies of the original Staff data sets. While the six RD files were ready for data manipulation, six copies (3 batches with two coders per batch) of the original Staff dataset needed to be created: two

copies with records associated with the 64 schools in batch one, two copies with batch two school records, and two copies with data associated with batch three schools. The unique identifier *STFID* was retained, and as with the RD files, these six files, called STF (Staff) files, were named according to the batch number (1-3) and the initials of the researcher who coded the batch.

Note that the purpose of the RD files is to document the values of the six variables associated with each school/team. The purpose of the STF files is to contain the rest of the Staff survey data that will be merged with these six variable values for use in future analyses. In order for these files to be able to be connected accurately, changes to the *grade* and *team code* values need to be made in both the RD and the STF data sets, so that each of the 3,142 staff-level records in the final STF dataset can be accurately matched to the school/team-level records in the final RD dataset. Once the six RD and six STF files were completed, the same researcher went into each file and changed the *grade* and *team code* values as was specified in each coder's Researcher's Documentation Booklet.

For the RD files, this process of making the documented changes only required, in very few instances, changing the *grade* or *team code* value in records that had valid data but were missing a valid *grade* or *team code* value. For example, if neither of two Staff surveys representing the 6th grade team had a *team code*, but enough other information was provided by the staff that the rest of the variables on the team could be given values, the reviewer would assign a *team code* to the team, and document in the Researcher's Documentation Booklet that the *team code* for these two records should be changed from blank to the newly assigned *team code* value.

Changing the *grade* and *team code* values in the six STF files was more labor intensive, partly due to the fact that one row of data in an RD file often represents multiple rows of data in

the associated STF file (recall that RD files are aggregated forms of the STF files.) As such, a change to the *grade* or *team code* value noted in one record of the RD often resulted in changes to several records in the associated STF file. In addition, while few of the changes documented in the Researcher's Documentation Booklet need to be made in the RD files, all documented changes to the *grade* or *team code* values must be made in the STF data.

Matching each Coders' STF and RD data

Once the data changes were made to the RD and STF files, the accuracy of the changes were double-checked twice. Then, for each batch of data, Coder 1's RD dataset was matched with Coder 1's STF dataset, and Coder 2's RD dataset was matched with Coder 2's STF dataset. Since these RD and STF datasets now reflect the coder's changes to the values of *grade* and *team code*, each coder's RD and STF datasets can be matched by School ID, *grade* and *team code*. Matching in this fashion requires that a new text variable that contains the combined values of School ID, *grade* and *team code* be created in each dataset. In the RD files, this variable is named RDmatch, while in the STF files, this variable is named STFmatch. After these match variables are created in each of the 12 datasets, the datasets are combined, as described above, to create six new data sets. These six data sets are then further combined into two datasets, by randomly adding one of the batch one, one of the batch two and one of the batch three datasets together to create one dataset (*STFRD1*), and adding the remaining batch one, batch two and batch three datasets together to create the other dataset (*STFRD2*).

Now two datasets exist that each contains 3,142 staff records. Because each dataset was matched by School ID, *grade* and *team code*, each dataset indicates the coder's decisions about which Staff records are associated with which team. Furthermore, each dataset specifies the coder's coded value for each variable.

Combining the two final datasets in preparation for cross-coder comparison

In order to determine whether each of the 3,142 staff data records was coded identically by the researchers who coded the data, the two remaining datasets (*STFRD1* and *STFRD2*) must be matched. To accomplish this, the two datasets are matched by *STFID*, the unique identifier associated with each of the original 3,142 data records, to create one final dataset. Matching by *STFID* allows the researchers to be sure that, despite all of the data file manipulation, the 3,142 records were correctly matched back to each other.

This final dataset contains the following variables:

1) All of the variables from the Staff Survey Data Booklet, reflecting Coder 1's changes to *grade* and *team code*.
2) All of the variables from the Researcher's Documentation Booklet, including Coder 1's coded values for the final six variables.
3) All of the variables from the Staff Survey Data Booklet, reflecting Coder 2's changes to *grade* and *team code*.
4) All of the variables from the Researcher's Documentation Booklet, including Coder 2's coded values for the final six variables.
5) *STFID* and each coder's value of *STFmatch*.

Locating and interpreting coding inconsistencies

The final dataset now holds all the information necessary to determine if both coders:

1) Assigned each staff record to the same *grade* and *team code*, and
2) Assigned each team the same values for the remaining six variables.

Because it is possible for both, one, or neither of the above conditions to be true, multiple comparisons must take place in order to locate and document inconsistencies in the values for the coded data. To determine whether both coders assigned each staff to the same team, an additional variable (*STFdif*) is created to indicate whether the two coders' values of STFmatch are the same (*STFdif*=1) or different (*STFdif*=0). The values of *STFmatch* will be identical if both coders assigned the staff record to the same *team code* AND *grade*. If the coders assigned the record to a different *grade* or a different *team code* or both, then the *STFmatch* values will differ. Similarly, if one coder decided that a staff record is associated with a coded team, but the other coder decided that the staff record is *not* associated with a coded team, then the *STFmatch* values would differ.

To determine whether the values of the final six variables are the same, six additional variables are created, each reflecting the numeric difference between Coder 1 and Coder 2's values on each variable. A non-zero difference indicates that the two coders assigned different values to the variable. Non-zero differences in the values of any of the six variables are associated with one of the following:

1) A difference in *STFmatch*, where one coder assigned the staff record to a team, and the other coder either assigned the same record to a different team or did not assign the record to a team
2) No difference in *STFmatch* exists (i.e., the records were either both assigned to the same team, or neither record was assigned to a team) but the researchers assigned different values due to: an error in calculation, an error applying the decision rules, or different interpretations of the decision rules.

Documenting coding inconsistencies

In preparation for the three researchers to meet to discuss and eventually eliminate differences in coded variable values, a large Excel document was prepared. This document included all of the variables in the final dataset, in the order listed above with the exception that *STFID* and each coder's value of *STFmatch* were moved to the beginning of the document. The document also included the six variables that indicated the difference between the two coders' values of the remaining six variables.

The document was formatted for ease of review. Boxes were drawn around records belonging to the same school and records that contained different values of *STFmatch* were highlighted. The data records were split across two landscaped sheets of 11"' x 17" paper such that *STFID*, both values of *STFmatch*, and Coder 1's STF and RD variables were on the first page, and *STFID*, both values of STFmatch, and Coder 2's STF and RD variables were on the second page. Also on the second page were the six variables indicating the difference between the two coders' values of the remaining six variables. Non-zero values of these six variables were highlighted using conditional formatting. Sixty-seven data records were printed on each sheet of paper, resulting in two 45-page bundles. *STFID*, the leftmost variable on each bundle, could be used to match records across bundles.

Meeting to discuss coding inconsistencies

All three researchers met together to discuss the differences in codes. Each researcher received a hard copy of the Excel document described above. The researchers began the review process by examining the highlighted records, in which the coders had either disagreed about the team and/or grade the record should be associated with, or disagreed about whether the record should belong to a team. The two researchers who had coded the record each explained why they had coded the record the way they did. In the few instances where the two researchers

could not reach an agreement about the team or grade to which the record should be assigned, or whether the record should be coded at all, the decision was made to not code the record. The decisions were documented, and entered by the same researcher into the electronic version of the Researcher's Documentation Booklet. The data manipulation processes described above were repeated one final time, resulting in a final version of the Excel file used to document discrepancies. No discrepancies existed, meaning that the three researchers had reached a consensus about how all eight of the variables in each of the original 3,142 staff survey records should be coded.

Merging the coded data into the original staff data file

The eight coded variables were merged into the original Staff dataset using *STFID* as the matching variable. So that the researchers could double-check the final dataset to make sure the coded variables were matched to the correct records, the original values of *grade, team code, number of teachers per team, number of students per team, number of team meetings per week,* and *length of team meetings* were also merged into the original Staff dataset, along with the eight coded variables. The values of the *grade, team code, number of teachers per team, number of students per team, number of team meetings per week,* and *length of team meetings* variables that had remained in the original dataset were compared with the values of the *grade, team code, number of teachers per team, number of students per team, number of team meetings per week,* and *length of team meetings* variables that had been merged back in to the original dataset. For every record, the values of these six variables were identical indicating that the eight coded variables had been matched to the correct records.