



## **An Investigation into the Relationships among Middle School Teachers' Beliefs about Collaboration, Their Perceptions of Formative Assessment, and Selected Teacher Characteristics**

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**Abstract:** The purpose of this study was to examine the relationships among middle school teachers' beliefs about collaboration, their rationale for using common formative assessments, and teacher characteristics that can explain these relationships. Seventy-six middle school teachers from two middle schools participated in the study. Findings indicate that teachers believe collaboration benefits instruction and assessment informs instruction. The findings suggest that age might play a role in the relationship between teacher beliefs and assessment, that the degree to which teachers get along with each other influences the success of a collaborative group, and that collaboration is not limited to structured meetings.

**Keywords:** *Formative, assessment, mixed-methods, PLC, teaching, teacher beliefs, collaboration*

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### **An Investigation into the Relationships among Middle School Teachers' Beliefs about Collaboration, Their Perceptions of Formative Assessment, and Selected Teacher Characteristics**

Assessment, as defined by Popham (2013), refers to any activity designed to uncover covert abilities, skills, or knowledge using an overt action. Assessment activities can be formal measures of student learning, such as written tests, or assessments can be informal measures of student learning, such as teacher questioning of individual students and student groups or observations of individual students and student groups. The idea that formative assessment forms instruction and informs students and teachers is generally agreed upon in the literature (e.g., Ainsworth & Viegut, 2006; Bell & Cowie, 2001; Black & William, 1998; Brookhart et al., 2016; Fisher & Frey, 2007; Popham, 2013; Reeves, 2007). Formative assessment enables teachers to collect evidence of

learning, provide feedback to inform learning, and position students to have agency over their own learning (Wilam, 2018). One variation on formative assessment is common formative assessment (Ainsworth & Viegut, 2006). Common formative assessments are frequent, collaborative, moldable, and responsive assessments designed by teachers who work collaboratively to help a group of students develop agreed upon knowledge and skills.

A critical element of common formative assessment is the collaborative work in which teachers engage. The idea of collaboration is often operationalized in schools through professional learning communities (PLCs). Working in PLCs teachers can support one another with the aim to improve student outcomes by co-teaching, co-planning, and co-assessing (Owens, 2015). Professional learning communities are structured in a similar way to the communities of practice discussed by Wenger (1998). Wenger argues that learning communities encourage professional growth because members bond over common purpose and use their developed personal relationships to strengthen their professional growth (Wenger, 1998). PLCs allow for frequent interaction among colleagues across all levels of experience which allows teachers to maintain a sense of shared responsibility for the success of all students involved, not just for the ones in their own classrooms. Numerous factors can impact the efficacy of PLCs, including collaboration quality and frequency of collaborative activities (Reynolds, 2009; Ronfeldt et al., 2015; Schaap & de Bruijn, 2018). Collaboration in the context of this paper refers to working with colleagues to reach a consensus on the knowledge and skills necessary for the success of a shared group of students (DuFour et al., 2006).

This research examines common formative assessment beliefs and practices as a means for identifying enablers of effective PLCs. Collaboration beliefs and practices include the aspects of sharing, outputs, and productivity. Common formative assessment aspects include ideas such as evaluating teaching, diagnosing students' strengths and weaknesses, implementing new instructional strategies, and dividing the workload. It has been established in the literature that teachers who use formative assessment, collaboration, and common formative assessment implement instruction that results in improved student learning (Ainsworth & Viegut, 2006; Black & Wiliam, 1998; Fuchs & Fuchs, 1986; Fontana & Fernandes, 1994; Graham, 2007). Ainsworth and Viegut (2006) argue that formative assessments are most powerful when they are designed, implemented, and analyzed collaboratively, often within a PLC. Identifying beliefs and practices tied to common formative assessment will enable insights into enablers for effective collaboration and data use in PLCs.

## **Collaboration Factors and Common Formative Assessment**

### **Collaboration Factors**

Collaboration can be defined as individuals working together as a group towards common goals through the sharing of knowledge, skills, and information (DuFour et al., 2005). Professional learning communities depend on frequent interaction among colleagues across all levels of experience allowing teachers to maintain a sense of shared responsibility for the success of all students, not just for the ones in their own classrooms (Mis, 2009; Reynolds, 2009). Sharing ideas during planning can improve instruction by providing an environment to generate more ideas (Clement & Vandenberghe, 2000; Forbes, 2007) enabling multiple perspectives that provide instructional feedback to members of the collaborative group (Graham, 2007; Moston, 2008). A well-established PLC encourages collaboration because PLCs and collaboration thrive on the same aspects: agreed-upon community values and goals that emphasizes better learning and teaching

(DuFour, 2004), group accountability for the learning of all students (Moston 2008), professional development to improve teaching (Mis, 2009; Reynolds, 2009), shared leadership, teamwork, and both group learning and individual learning (Mis, 2009; Reynolds, 2009).

Research has identified many factors that can discourage teachers from collaborating, such as time constraints (Clement & Vandenberghe, 2000; Mis, 2009), teachers' and schools' holding onto tradition (DuFour, 2004; Reynolds, 2009), and school culture and colleagues' attitudes (Cizek et al., 1996).

### **Common Formative Assessment**

Common formative assessments are defined by DuFour, Eaker, DuFour, and Many (2006) as “an assessment typically created collaboratively by a team of teachers responsible for the same grade level or course.” Common formative assessments are used frequently throughout the year to identify individual student needs, effective teaching strategies, and program-wide concerns. Common formative assessments are both collaborative and formative; teachers work together to design, administer, and analyze the assessments so that they can refine their instruction using data.

### ***Benefits***

Common formative assessments provide a basis for comparison so that teachers can reflect on their teaching. Comparison of data with colleagues enables teachers to determine if students are struggling because of curriculum, instructional style, or student issues (Ainsworth & Viegut, 2006; DuFour et al, 2006;). Common formative assessments enable teachers to establish a realistic curriculum by working together on assessments clarifying the curriculum, establishing consistent priorities, establishing common pacing guides, and deciding which standards to omit from the curriculum (Ainsworth & Viegut, 2006; DuFour et al, 2006; Marzano, 2003; Reeves, 2007).

### **Methods**

The purpose of this study was to examine how Teacher Collaboration Beliefs (TCB), Teacher Collaboration Practices (TCP), Assessment Factors (AF), and Teacher Perceptions of Common Formative Assessment Practices (TPCFA) relate to each other, and if Teacher Background Characteristics (TBC) play a role in any of these relationships. Teacher Collaboration Beliefs (TCB) refer to the views held by teachers about collaborating with their teaching colleagues. TCB are the perceptions and opinions classroom teachers form over time about working with their colleagues in collaborative teams. Teacher Collaboration Practices (TCP) refer to the self-reported information that suggests if teachers are collaborating; this includes teachers directly stating their collaboration habits and also includes conclusions drawn from the survey responses that suggest collaboration occurs or does not occur. TCP are the self-reported teacher habits relating to frequency and content of collaboration meetings. Assessment Factors (AF) include teacher perceptions of assessment use and teacher self-reported assessment values as well as teacher reported rationales for using aspects of assessment. AF are the opinions teachers hold about the assessment tools and activities they use to assess their students. Teacher Perceptions of Common Formative Assessment Practices (TPCFA) refer to the self-reported teacher beliefs about their own use of common formative assessment.

### **Study Setting and Participants**

The two schools purposefully selected for this research have both been using a PLC model and common formative assessments for five years and have had the time to form an opinion on

aspects that they appreciate about the process as well as suggest improvements. The common formative assessment model adopted by both schools follows the guidelines outlined by DuFour, Eaker, DuFour, and Many (2006). Time to collaborate is built into the school day by both administrations. Both school settings provide 45 minutes twice a week for PLC members to meet. Both school sites use the same online formative assessment tool to administer assessments to students. The two schools are a part of the same school district, and the school district has a top down mandate from the superintendent requiring that all teachers participate in professional learning communities (PLC) and use common formative assessments. The target population included 76 middle school (7th and 8th grade) English, history/social studies, mathematics, and science teachers because these teachers are required to participate in professional learning communities.

At both school sites there are four PLCs in each grade level: 7th grade history, 7th grade mathematics, 7th grade English, 7th grade science, 8th grade civics, 8th grade mathematics, 8th grade English, and 8th grade science. The PLC model implemented at both of the school sites requires teachers to implement common assessments every eight weeks as mandated by the school administration.

### **Study Variables**

The primary variables this study examined were teacher collaboration beliefs (TCB), teacher collaboration practices (TCP), assessment factors (AF), teacher perceptions of common formative assessments (TPCFA), and teacher background characteristics (TBC). Collaboration beliefs and practices examined were sharing, outputs, and productivity. The term sharing includes the sharing of ideas, data, and resources among teachers in the PLC. The term outputs encompass teacher created assessments, rubrics, lesson plans, and learning activities. The term productivity includes time on task during meetings, teacher reporting of benefits, and meeting organization. Variables relating to common formative assessment include assessment factors (AF) and teachers' perceptions of common formative assessment (TPCFA). These variables include evaluating teaching, diagnosing students' strengths and weaknesses, implementing new instructional strategies, dividing the workload, and fulfilling administrative requirements. The variable, teacher background characteristics (TBC), includes the selected characteristics of gender, age, grade level taught, subject area taught, years' experience, career switcher status, and education.

### **Research Design**

A parallel mixed methods design was used to collect both quantitative data and qualitative data. The strength of the parallel mixed methods design is that it capitalizes on the strengths of both quantitative and qualitative research (Creswell, 2008; Greene, 2007). The initial quantitative data collection phase consisted of administering a researcher created informational survey to middle school teachers, Beliefs and Practices of Collaboration and Common Formative Assessment (BPCCFA). The survey provided data about teacher background characteristics (TBC), teacher collaboration beliefs, teacher collaboration practices, assessment factors (AF), and teacher perceptions of common formative assessment (TPCFA).

The qualitative phase of the research involved a semi-structured interview with ten teachers selected out of the 23 teachers who responded in the survey that they were willing to participate in the interview. Teachers were selected so that a sample across the teacher background characteristics was represented. Open ended questions were asked during the interview so that the participants could create the response unconstrained by the researcher's views (Creswell, 2008).

## Results

### Quantitative Results

The BPCCFAs survey consisted of three sections: background information, common formative assessment information, and collaboration information. Teacher background characteristics represented in the survey include gender, career switcher status, age, and teaching experience. Eight males responded to the survey and 36 females responded to the survey, yielding a 58% return rate.

The survey participants represent a varied sample of age, experience, grade level and subject area taught. The majority of the survey participants have 2-5 years and 15-25 years' experience teaching. Most participants have been career teachers, meaning they entered the profession with less than five years' experience in any other profession.

Survey responses regarding assessment factors (AF) and teacher perceptions of common formative assessment practices (TPCFA) indicated teachers frequently use common formative assessment to diagnose student strengths and weaknesses, grade students, and evaluate teaching. Additionally, teachers indicated that they frequently assess students at the beginning, middle, and end of instructional units. Survey responses indicated that teachers perceive diagnosing student strengths and weaknesses and sharing instructional strategies as the two biggest benefits of using common formative assessment. Responses suggested that most teachers do not prefer to work in isolation on assessments.

The results from the BPCCFAs survey relating to TCB and TCP suggested that teachers frequently attend and participate in PLC meetings. Teacher responses indicated that department wide policies are in place. Most teachers indicated that PLC meetings are relevant and beneficial to their teaching. Most responses suggested that teachers enjoy co-designing assessments with their PLC and enjoy sharing data with their PLC colleagues. The majority of responses indicated that teachers find collaborating with their PLC beneficial to making instructional decisions.

An exploratory factor analysis (EFA) was used to summarize correlations among data. The research questions sought to understand AF, TPCFA, TCB, and TCP. The EFA identifies correlations among survey items so that it can be determined if the items measure AF, TPCFA, TCB, and TCP. Each question from the survey is viewed as a single component and the factor analysis showed if components grouped together (Mertler & Vannatta, 2009). The components will group with other components that tended to have the same variances in responses. To ensure the accuracy of the exploratory factor analysis, two tests were performed. The Mahalanobis distance test, was used to determine if outliers existed. Bartlett's test of sphericity and KMO were used to ensure that components were sufficiently intercorrelated to conduct an exploratory factor analysis (Mertler & Vannatta, 2009). Following the exploratory factor analysis (EFA) an analysis of variance (ANOVA) was used to compare the means between the teacher background characteristics (TBC). The TBC of gender was compared using an independent samples t-test because only two populations exist for that TBC.

The exploratory factor analysis (EFA) consisted of three mandatory tests and one optional test. The three mandatory tests include: (a) Kaiser's Rule, (b) Scree Plot, and (c) Principles Component Analysis. The fourth test, Residuals Test, was not required for this data because Kaiser's Rule and the Principles Component Test both showed more than 1 component. Factors were restricted to two. The data was also rotated to produce a rotated component matrix. The survey contained 43 items, which translated into 43 variables. All 43 items were analyzed using descriptives. To increase the accuracies of the exploratory factor analysis the number of variables

analyzed should be no more than 10 because the sample size is 44, allowing four samples per variable (Mertler & Vannatta, 2009).

Exploratory factor analysis was conducted to evaluate any underlying common components for the measures on the following 10 survey variables: *We design and implement CA, Used to diagnose student strengths and weaknesses, Implement strategies my colleagues share, Jointly creates CFA, Participate (PLC) meetings, PLC meeting time is related to my teaching, PLC meetings benefit my teaching, Co-designing assists, Sharing assists with decisions, and Comfort sharing data.* Factors were restricted to two to force loadings and limit components being retained. Three criteria were used to determine the appropriate number of components to retain: eigenvalue, scree plot, and variance. The results of the eigenvalue show that 4 components are valued greater than 1, and therefore should be retained (Table 1). However, the first two components seem more stable than the second two components. The first two components have eigenvalues of 3.82 and 1.53.

Table 1  
*Initial Eigenvalues*

<b>Component</b>	<b>Total</b>	<b>% of Variance</b>	<b>Cumulative %</b>
1	3.818	38.178	38.178
2	1.525	15.249	53.427
3	1.160	11.601	65.028
4	1.066	10.658	75.686
5	.755	7.546	83.232
6	.635	6.355	89.587
7	.407	4.067	93.654
8	.309	3.089	96.743
9	.206	2.065	98.807
10	.119	1.193	100.000

The scree plot suggests that two components are shown before the graph levels off, and therefore should be retained. The principles component analysis suggests that the first component accounts for more than 38% of the variance and the second component accounts for 15% of the variance, therefore, combined these two components account for 53% of the variance (Table 1). Because the factors were restricted to two the Eigenvalues, Scree Plot, and Principles Component Analysis essentially confirm the forced loadings, and two components were retained.

The rotated component correlation matrix (Table 2) was used to identify which variables shared common components, two common components were identified. Two underlying factors were identified, and the variables were sorted into two groups based on the loading of the identified underlying components. Component 1, also factor 1, was named Sharing Benefits Instruction and Component 2, also factor 2, was named Assessment Informs Instruction.

Table 2  
*The rotated component correlation matrix*

Variables	Component	
	1	2
Sharing assessment data with my PLC assists me with making instructional decisions	.875	.132
I feel comfortable sharing assessment data with my PLC	.863	.012
Co-designing assessment with my PLC assists me with my teaching	.751	-.155
PLC meeting time is often devoted to conversations related to my teaching	.708	.320
I implement instructional strategies my colleagues share	.562	.432
PLC meetings benefit my teaching	.489	.255
we design and implement CA that are used to evaluate teaching	.134	.801
used to diagnose student strengths and weaknesses	.323	.734
jointly creates Common Formative Assessments that I use	.154	.521
I participate in Professional Learning Community (PLC) meetings	-.159	.440

Component 1, Sharing Benefits Instruction, includes the variable relating to sharing through collaboration and the resulting benefits to instruction. Component 2, Assessment Informs Instruction, includes variables relating to uses of assessments to inform instruction. Essentially, Component 1 addresses the benefits of sharing and Component 2 addresses the benefits of assessments. Factor scores were then computed for each participant. Bartlett's approach was used because only the shared factors affect the factor score (DiStefano, Zhu, and Mîndrilă, 2009).

### ***Independent Samples T-Test***

The resulting factors scores' means on the two identified components, (a) Sharing Improves Instruction and (b) Assessment Informs Instruction, were compared based on selected teacher background characteristics (TBC). In both components for males and females the differences were considered to be not statistically significant ( $t(41) = 0.42, p = .680$  and  $t(41) = 0.50, p = .620$ ). Both components for career switchers and non-career switchers were not statistically significant ( $t(41) = 0.82, p = 0.418$  and  $t(41) = 1.88, p = 0.067$ ).

### ***Analysis of Variance***

The analysis of variance (ANOVA) compares the means between more than two groups on a single variable. A one-way ANOVA was used to compare TBC as they relate to Component 1 and Component 2. The TBC of age group, grade level taught, subject area taught, and teaching experience were evaluated with each of the two components, Sharing Improves Instruction and Assessment Informs Instruction. Views on Component 1 did not differ significantly across age group,  $F(4, 38) = .54, p = .706$ , grade level taught,  $F(2, 40) = 0.11, p = .893$ , subject area taught,  $F(4, 38) = 1.41, p = .250$ , and teaching experience,  $F(5, 37) = 0.58, p = .717$ . Views on Component 2 did not differ significantly across grade level taught,  $F(2, 40) = 2.04, p = .144$ , subject area taught,  $F(4, 38) = 0.42, p = .794$ , and teaching experience,  $F(5, 37) = 1.15, p = .350$ . Views on Component 2, Assessment Informs Instruction, did differ significantly across age groups,  $F(4, 38) = 2.67, p = .047$  (Table 3).

Table 3  
*Descriptives by Age Group for Assessment Informs Instruction*

Age group	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval	
					Lower Bound	Upper Bound
<b>20-29</b>	14	51.0293	7.69693	2.05709	46.5852	55.4734
<b>30-39</b>	11	49.8559	11.92970	3.59694	41.8414	57.8704
<b>40-49</b>	11	52.1285	5.03869	1.51922	48.7434	55.5135
<b>50-59</b>	4	53.2951	7.14197	3.57098	41.9306	64.6596
<b>over 59</b>	3	33.5271	18.40332	10.62516	-12.1893	79.2435
<b>Total</b>	43	50.0000	10.00000	1.52499	46.9225	53.0775

Tukey post-hoc comparisons (Table 4) of the five age groups indicate that the over 59 group ( $M = 33.53$ , 95% CI [-12.19, 79.25]) gave significantly lower value ratings than the 20-29 group ( $M = 51.03$ , 95% CI [46.59, 55.47]),  $p = .040$ , and the 40-49 group ( $M = 52.13$ , 95% CI [48.74, 55.51]),  $p = .030$ . Comparisons between the over 59 group and the remaining two groups, 50-59 group and the 30-39 group, were not statistically significant at  $p < .05$ .

Table 4  
*Multiple Comparisons Assessment Informs Instruction*

(I) Age group	(J) Age group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
<b>20-29</b>	30-39	1.17344	3.74193	.998	-9.5399	11.8868
	40-49	-1.09916	3.74193	.998	-11.8125	9.6142
	50-59	-2.26577	5.26537	.993	-17.3408	12.8093
	over 59	17.50223*	5.90862	.040	.5855	34.4190
<b>30-39</b>	20-29	-1.17344	3.74193	.998	-11.8868	9.5399
	40-49	-2.27260	3.96009	.978	-13.6106	9.0654
	50-59	-3.43922	5.42258	.968	-18.9644	12.0860
	over 59	16.32879	6.04914	.073	-.9903	33.6478
<b>40-49</b>	20-29	1.09916	3.74193	.998	-9.6142	11.8125
	30-39	2.27260	3.96009	.978	-9.0654	13.6106
	50-59	-1.16661	5.42258	1.000	-16.6918	14.3586
	over 59	18.60139*	6.04914	.030	1.2823	35.9204
<b>50-59</b>	20-29	2.26577	5.26537	.993	-12.8093	17.3408
	30-39	3.43922	5.42258	.968	-12.0860	18.9644
	40-49	1.16661	5.42258	1.000	-14.3586	16.6918
	over 59	19.76800	7.09324	.060	-.5404	40.0764



Table 4 cont.

*Multiple Comparisons Assessment Informs Instruction*

(I) Age group	(J) Age group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
<b>Over 59</b>	20-29	-17.50223*	5.90862	.040	-34.4190	-.5855
	30-39	-16.32879	6.04914	.073	-33.6478	.9903
	40-49	-18.60139*	6.04914	.030	-35.9204	-1.2823
	50-59	-19.76800	7.09324	.060	-40.0764	.5404

**Factor scores.** The two identified factors, Sharing Benefits Instruction and Assessment Informs Instruction, from the rotated component matrix were transformed in SPSS to create factor scores for each participant. Factor score 1, Sharing Benefits Instruction, is a score for each participant on their view of the five combined variables that all correlate because of the same underlying component. Factor score 2, Assessment Informs Instruction, is a score for each participant on their view of the four variables all correlated because of the same underlying component. The factor scores represent each individual's responses on the identified factor. The only significant findings,  $p=.047$ , on the factors scores were among the over 59 age group (Table 5) on the Assessment Informs Instruction factor scores ( $M=33.53$ ,  $SD=18.40$ ). The variance among all other TBC (gender, career switcher, teaching experience, and subject area) was not significant.

Table 5

*Means for Age Group on Factor Scores*

Age group		T_SharingBenefits	T_AssessmentInforms
20-29	Mean	50.4357	51.0293
	Std. Deviation	11.34468	7.69693
30-39	Mean	48.4044	49.8559
	Std. Deviation	7.67592	11.92970
40-49	Mean	48.4216	52.1285
	Std. Deviation	11.43231	5.03869
50-59	Mean	51.8039	53.2951
	Std. Deviation	8.48254	7.14197
over 59	Mean	57.1995	33.5271
	Std. Deviation	9.70206	18.40332

**Qualitative Results**

Six female teachers and four male teachers were purposefully selected. Table 6 shows the TBC represented in the interviews.

Table 6  
*Teacher Background Characteristics Represented in Interviews*

Name	Gender	Age	Grade	Content	Years Teaching	Career Switcher	Undergraduate Degree
Ellen	female	40-49	7th	science	5-9 years	yes	minored in content I teach
Lena	female	20-29	7th	English	2-4 years	no	major in content I teach
Bob	male	30-39	8th	science	5-9 years	yes	major in content I teach
Mary	female	over 59	7th	math	over 25 years	no	majored in education
Annie	female	40-49	8th	math	5-9 years	yes	other
Randy	male	20-29	7th	math	2-4 years	no	major in content I teach
Maria	female	20-29	7th	social studies	2-4 years	no	minored in education
Molly	female	over 59	7th	science	15-25 years	no	major in content I teach
Juan	male	40-49	7th	math	15-25 years	no	other
Ethan	male	30-39	7th	English	5-9 years	no	majored in education

Grounded theory design informed the qualitative data analysis. Grounded theory is used to generate a theory based on current data to explain the action of a population (Strauss & Corbin, 1998). A systematic procedure for coding qualitative data was adopted for this study. The systematic procedure involved three cycles of coding: open coding, axial coding, and selective coding. The open codes this study identified are show in Table 7.

Table 7  
*Open Codes Identified*

Codes		
<b>1 PLC Meeting Time</b>	<b>7 Influence</b>	<b>12 Data Discussions</b>
a) Punctual	a) Student Learning	a) Test
b) Focused	b) Administration	b) None
c) Email	c) Professional Development/Readings	c) Strengths/Weaknesses
d) Multiple Preps	d) Consistency	d) Re-teaching/Teaching
e) Want More Big Idea Planning	e) County/District/State	e) Anxious
f) Want More Meetings	f) Student Ability	f) Off-Task
g) All Have Equal Say	g) Parental	<b>13 Grading</b>
h) Don't Meet Just to Meet	h) Enjoy Collaborating	<b>14 Concerns</b>
<b>2 Get along on a personal level</b>	i) Previous Work/Previous Teaching	<b>15 Sharing Students</b>
<b>3 Struggling Students</b>	j) Previous Negative PLC	
<b>4 Online Tests</b>	k) Improves Teaching	
<b>5 Change Assessments</b>	l) Share Workload	
a) Better Assessment Type	<b>8 Culture</b>	
b) Multiple Choice	<b>9 Designated roles</b>	
c) Motivation	<b>10 Personal Teaching Style</b>	
<b>6 Time</b>	<b>11 Big Picture</b>	

Results from the qualitative coding that are of interest include 29 mentions of the *get along on a personal level* code, 12 mentions of the *better assessment type* code, 16 mentions of *administration influence* code, five mentions of the *parental influence* code, nine mentions of the

*personal teaching style* code, and 13 mentions of the *concerns* code (see Table 7). The *get along on a personal level* code was identified in all 10 interviews. Each participant spoke to how well the PLC “meshed” (Ethan) or explained, “we all get along really well” (Juan). The *better assessment type* code was identified in 8 of the interviews. Participants expressed an interest in changing the current assessment type used in their PLC, wanting “more smaller quantitative assessments more frequently” (Lena) or “in an ideal world I would have a portfolio assessment, that would accumulate work throughout the unit and then a final activity that is less traditional tests and more analytical” (Ellen). The 16 mentions of the *administration influence* code were distributed across seven interviews. The *administration influence* code most often addressed the school improvement plan and the opening faculty meeting discussion about teacher test scores. The five mentions of the parental influence code addressed the perception parents have of classroom practices, “that way you don’t have the whole stereotype of students, ‘oh he is the harder grader’ you don’t have parents complaining” (Randy). The nine mentions of the *personal teaching style* code refer to individualized teaching styles as exemplified by Maria, “the reality is we are all different teachers and we do teach some things differently. I might emphasize one part of history, and that is just how history is; you kind of connect to different things based on your background.” With the majority of the codes reflecting positive statements regarding PLCs it is important to note the 13 responses identified by the *concerns* code. Concerns ranged from schools being too reliant on numbers (Bob and Molly), to meetings being dominated by one individual (Ethan), to the time-consuming format of online tests (Ellen). The major codes identified were collapsed into four themes. The themes and the collapsed codes they include are shown in Table 8.

Table 8  
*Themes identified in the interviews*

Theme	Open Codes and Axial Codes (A, B, C, etc.)
Procedural	<ul style="list-style-type: none"> <li>• PLC Meeting Time: A) Punctual, B) Focused, C) Email, D) Multiple Preps, F) Want More Meetings</li> <li>• Online Tests</li> <li>• Time</li> <li>• Influence: B) Administration, E) County/District/State, H) Parental, J) Share Workload</li> <li>• Designated roles</li> <li>• Data Discussions: B) None, F) Off Task</li> <li>• Grading</li> </ul>
People	<ul style="list-style-type: none"> <li>• Get along on a personal level</li> <li>• Culture</li> <li>• Data Discussions: E) Anxious</li> </ul>
Conceptual	<ul style="list-style-type: none"> <li>• PLC Meeting Time: E) Want More Big Idea Planning, G) All Have Equal Say, H) Don’t Meet Just to Meet</li> <li>• Change Assessments: A) Better Assessment Type, B) Multiple Choice, C) Motivation</li> <li>• Influence: C) Professional Development/Readings, D) Other Teachers Are Doing, G) Consistency/Same Page, I) Enjoy Collaborating, J) Previous Teaching, K) Previous Work</li> <li>• Big Picture</li> <li>• Concerns</li> </ul>
Inside the Classroom	<ul style="list-style-type: none"> <li>• Struggling Students</li> <li>• Influence: A) Student Learning, B) Student Ability, I) Improves Teaching</li> <li>• Personal Teaching Style</li> <li>• Data Discussions: A) Test, C) Strengths/Weaknesses, D) Teaching/Re-Teaching</li> <li>• Sharing Students</li> </ul>

### Mixed Methods Parallel Analysis of the Quantitative and Qualitative Findings

The parallel examination of the quantitative and qualitative findings suggests that the quantitative components are supported by the qualitative codes. The frequency, by participant, of the axial code occurrences as they relate to the two components is shown in Table 9. The axial codes are organized under each of the two components. The *struggling students* code, *concerns* code, *personal teaching style* code and *time* code were not useful in explaining why teachers' responses grouped into either Component 1 or Component 2 and were therefore not organized under either component.

**Table 9**  
*Frequency of the axial code occurrences*

	Ellen	Lena	Bob	Mary	Annie	Randy	Maria	Molly	Juan	Ethan
<b>Sharing improves</b>										
Sharing Students				X	X	X	X			
Influence PLC Meeting Time	X	X	X	X	X	X	X	X	X	X
Culture	X				X		X	X	X	X
Get along on personal level	X	X				X	X	X	X	X
Roles	X		X			X		X	X	
<b>Assessment Informs</b>										
Data Discussions	X	X	X	X	X	X	X	X	X	X
Change Assessment	X	X	X	X			X	X	X	X
Grading		X				X		X		
Online Tests	X		X	X	X	X	X	X	X	X
Big Picture			X						X	X

The axial codes included under Component 1, Sharing Improves Instruction, include codes related to the sharing of ideas, resources, and workload: *sharing students*, *influence*, *PLC meeting time*, *culture*, *get along on a personal level*, *designated roles*. The axial codes included under Component 2, Assessment Informs Instruction, include codes related to the beneficial instructional outcomes of using assessment. The codes included in Component 2 are *data discussions*, *change assessment*, *grading*, and *big picture*.

### Discussion

The quantitative results from the factor analysis suggest that components group together based on an underlying structure. The two components that were found to be responsible for the underlying correlation between variables were Component 1, Sharing Benefits Instruction, and

Component 2, Assessment Informs Instruction. Teachers across the TBC indicate they view sharing as a means for improving instruction and assessment as a means for informing instruction.

The qualitative results suggest that the degree to which teachers get along on a personal level was a key idea in each of the interviews, with 29 mentions of *get along on a personal level*. Interview data also suggest that better assessment type, administration influence, parental influence, personal teaching style, and concerns were key ideas across the interview data. Teachers report that sharing and assessment benefits occur outside structured PLC meetings.

A parallel mixed methods examination of the quantitative and qualitative results suggests that eleven of the fifteen identified codes can be organized under Component 1 and Component 2. This suggests that the quantitative findings from the BPCCFAs survey are supported by the semi-structured interview responses. The codes and the BPCCFAs survey responses support the identification of Component 1, Sharing Improves Instruction, and Component 2, Assessment Informs Instruction. Teachers indicate that the practices of collaboration and assessment benefit instruction.

Due to the factors of the survey new research questions were devised to describe the results more effectively. Both qualitative and quantitative responses were analyzed to address the four revised research questions, (a) What is the nature of the relationship between Sharing Improves Instruction and Teacher Background Characteristics (age, gender, teaching experience, work experience, and education)? (b) What is the nature of the relationship between Assessment Informs Instruction and do Teacher Background Characteristics (age, gender, teaching experience, work experience, and education) play any role in these relationships? (c) What do teachers value about sharing? (d) What do teachers value about assessment?

### **Discussion of Quantitative Results**

The quantitative analysis of the survey items suggests that teachers value sharing and assessment but are unclear about items relating to PLC meeting participation and jointly creating assessments. The anti-image matrix shows a weakness with the items regarding PLC meeting participation and jointly creating common formative assessments. It is suspected that those items on the survey represent the administration's requirement of attending weekly meetings and of creating joint assessments. The remaining survey items suggest that teachers value the practice of collaborating and value assessment data. Therefore, the weaknesses in these two items combined with the strengths in the other items suggest that teachers enjoy collaborating, but do not enjoy attending required meetings or creating required assessments. The interviews show that many of the PLC accomplishments occur over email and are not a part of the structured meeting, such as sharing students and resources, therefore the requirement to attend weekly meetings is an unnecessary nuisance because teachers can accomplish their favorite aspects of collaboration without meeting. Essentially, the benefits of sharing and assessments can occur outside of meetings, so the item asking about meetings could be interpreted in different ways, depending on the understanding of how sharing occurs and how assessments are created. Because of the weakness with the PLC meeting item and a lack of research available on PLCs in middle schools, an empirical argument can be made to support the factors, but this variable should be investigated further to determine the relationship with the Sharing Improves Instruction component or the Assessment Informs Instruction component.

### ***TBC as They Relate to Each Component***

Analysis of TBC and the two components showed that little variance across TBC existed. The findings from the ANOVA showed that the only statistically significant findings relate to age group on Component 2, Assessment Informs Instruction. The findings from the qualitative interviews show that the majority of common formative assessments are carried out in the classroom using an online assessment tool. The ANOVA showing that the older age group of teachers believes less that assessment informs instruction is corroborated by research from Marc Prensky (2007) which shows that teachers in the older age group are often less familiar with technology and younger teachers have an easier time with technology. The Tukey post hoc comparisons show that the only significant difference between age groups is the over 59 compared to the 20-29 and 40-49 age groups, even though the over 59 group has a lower mean score, ( $M=33$ ,  $SD=18.40$ ), on Component 2 than all the groups. The sample size was not large enough to determine if the other differences between means were truly significant. Further examination between age groups with a larger sample size could explain these differences more. Technology can be a barrier to effective implementation. If an online assessment system is the primary tool for assessing students, then teachers not familiar with the technology, such as the over 59 age group identified in the analysis, are going to be more resistant to using assessment, even if they believe it to be beneficial.

### **Discussion of Qualitative Results**

Teachers at the two school sites all indicated they belong to a PLC and benefit from participation in their PLC, but do not necessarily view meetings as the best method for collaborating. Teachers identify many beneficial outcomes of PLCs, especially improvements to instruction through sharing and assessments. Teachers reported enjoying the benefits from refining their teaching through data discussions, sharing students, collaborating on unified communications with parents, and the feeling of collegial support from getting along well with PLC members. Participants indicated that they feel their individualized approaches are merged well with the group needs and that they are able to maintain their individuality while still collaborating as a group. This is important because teachers are highly educated and informed decision makers who still want the power to use their expertise and experience to make classroom decisions. The data suggested that teachers at the two school sites participate in PLCs because of an administrative requirement to attend PLC meetings but would choose to participate regardless of the requirement. By letting teachers determine their method for collaborating both their time and their professional expertise are valued, thus encouraging a positive view of collaboration.

### **Implications for Practice**

The findings from the BPCCFAs survey and semi-structured interviews suggested that teachers value sharing because it improves instruction and also value assessment because it informs instruction. It is essential for effective implementation that 1) teachers get along on a personal level with their PLC members, 2) PLC meetings should be formatted in a manner convenient for the members, 3) PLCs need time to become comfortable sharing data, and 4) PLCs still need to allow for instructional approaches individualized to each teacher.

It is important to recognize that these teacher participants indicated a strong preference for participating in PLCs; however, they also indicated overwhelmingly that getting along with their PLC members was critical to the enjoyment of participating. A PLC is much more than a weekly

meeting. It is a group of teachers that get along well and support each other to accomplish common purposes with their students.

Participation is not necessarily measured by meeting attendance, as participation occurs in many ways not related to attending a meeting, such as exchanging ideas over email or in the hallway between classes. The administrative requirements should therefore not focus on a meeting requirement, but rather recognize that collaboration occurs in many ways. Teachers enjoyed the flexibility of structuring meetings in their own way, only meeting in person when necessary and sharing resources and information via email. This would allow teachers to continue to respect each other's time. As explained in previous research (Clement & Vandenberghe, 2000; Mis, 2009) and supported by the semi-structured interview responses, limited time can be a roadblock to collaborating. As described by Randy, "We send out an email to everyone . . ." on this quiz I got this correct, this is what I saw wrong." Then teachers are able to find methods for sharing information and work around times that are convenient for them. Essentially, it should be recognized that a PLC functions very well when the PLC members get along and this can play out in ways beyond the administrative meeting requirement.

Those who want teachers to work in PLCs that focus on sharing instructional practices and common assessments should encourage PLC members to form relationships built on mutual trust and respect and allow each PLC to develop their own measures for successful collaboration. Administrators should recognize that the model of collaboration that works for one group might not work for a different group. Administrators should be flexible and not mandate a specific structure for meetings nor frequency requirements because PLC members find methods and time for collaborating that meet the needs of their students and their curriculum outside of attending meetings. PLC members should be given ownership over the process and they should be able to determine the group norms, expectations, and requirements. School leaders need to do more than simply assign teachers to groups. Leaders need to be aware of existing relationships between teachers and work to improve bad relationships or place teachers that do not get along well into different PLCs. Allowing PLC members' time to form personal relationships and the freedom to determine their own expectations will ensure that a culture of collaboration is established and maintained.

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