Reflective Practice Equals Crafting for Understanding and Commitment to Interactive Assessment ($RP=C^2$)

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Reflective Practice (RP) is a method that encourages students to evaluate their own learning experience and gain insight about their level of knowledge in a particular subject. This insight helps teachers craft (C) lessons that enhance student understanding, which is particularly valuable in a classroom setting. In this study, RP has been applied to a seventh grade Algebra I Honors class in a private all-boys school by the author using a five-point rubric to rate the assessments. The assessments were conducted during one-on-one sessions with each student respondent (SR) and were guided by a structured questionnaire. Results indicated that the majority of students responded favorably to the RP intervention (8 of 14; 57.2%). Interestingly, the results generated findings that suggest the commitment (C) to adapt evaluation methods to accommodate RP (comments with grades vs. Scantron output). Additionally, the importance of measuring RP was reinforced by the favorable respondents, who asked questions that lead to a deeper understanding. Furthermore, the results indicated improvement in teacher-student interactions in the vast majority of SRs (13 of 14; 92.9%) because RP established a platform for teachers and students to talk about specific aspects of learning that enhanced their relationships as well as maximized student understanding. Student-student interaction was also improved because RP created a common vocabulary for them to have meaningful exchanges. This study infers that RP is a useful and practical technique for a middle school math class. Given the paucity of SRs (14), these findings will need to be replicated with a large enough group of students to generate quantitative analyses.

INTRODUCTION

For a good portion of the last century, Reflective Practice (RP) has been evaluated as a way to augment learning in the educative process (Dewey, 1933). Since that time, RP has been evaluated for all levels of education and professions, such as nursing (Ruth-Sahd, 2003). The most comprehensive analyses see RP as a means of self-examination and involve reflection about the entire learning experience that incorporates imagination and creativity to revisit the learning, think about it and evaluate it (Boud, Keough and Walker, 1985). More recently, RP has been more narrowly viewed from the perspectives of authors. Along this line, Schon's work described RP as a critical process for beginners to improve to the level of successful practitioners (http://www.ericdigests.org/2001-3/reflective,htm, 2012).

Following Schon's work, multiple frameworks have been developed to support a culture of RP in a school environment. In many cases, these frameworks have become a primary source

of professional development within schools – pushing teachers to become more reflective practitioners (Smyth, 1989). Despite success in various educational settings, RP has seldom moved from its professional applications. The complexity of some theories supports this mentality, offering structures for RP that are too complex or ambiguous for a student to grasp. Additionally, other prominent theories supporting RP lend themselves to being adapted for classroom use. References of theories that depict what the focus of these student reflections would follow in the next paragraph.

Assessments have provided insight into a student's content skills and proficiencies for the last several hundred years (Jacobs, 2009). This insight has enabled teachers to develop lessons that fill gaps in student understanding and drive daily instruction (Bernhardt, 2004). Assessment has also been used as learning, emphasizing students' self-assessment (Earl, 2003). Specific feedback provided by assessments could lead to RP within a classroom setting – enabling students to make meaning of mistakes and obtain a greater sense of self. Understanding that teachers assume active roles as change agents in the educative process explores the relationship between assessment and RP in a classroom setting with the help of dedicated educators (Evans, 1996). The focus of this study highlights my interest and experience as a middle school math teacher; seeking to answer the following research questions and ultimately enhance student learning.

RESEARCH QUESTIONS

How can assessment create a culture of reflective practice in the middle school math class?

- What type assessment leads to RP in the middle school math class?
- How do you measure RP within the middle school math class?
- How does assessment enable effective teacher-student and student-student interaction?

REVIEW OF THE LITERATURE

An integral part of reviewing the literature was not only discerning the aspects of RP but also determining which can be applied to the middle school math classroom.

The Aspects of Reflective Practice

Creating a culture of RP in the middle school math class is addressed primarily for teachers and administrators and not the individual classroom. For example, Smyth introduced a four-step framework (describe, inform, confront, reconstruct) to enable teachers to implement RP for their professional development (Smyth, 1989). However, if enhancing student learning is the goal, then this suggests that RP should move beyond professional settings and into the

classroom. An influential theory about RP that can be adapted from community-based learning into the classroom is to enhance student learning where learning is defined as capacities to think, motivations to learn and their effectiveness to engage constructively with others and the world around them (York-Barr, Sommers, Ghere and Montie, 2006).

Another theory that can be adapted into the classroom is the Critical Friends process. Based in cooperative adult learning, this process seeks to provide opportunities for participants to both provide feedback and engage in dialogue in a way that promotes reflective learning (Bambino, 2002). Originally developed by the Annenberg Institute for School Reform at Brown University, Critical Friends groups ideally create a trusted community of learners that listen and analyze work before offering critique (Costa & Kallick, 1993). While authors, such as Peggy Silva in *At the Heart of Teaching: A Guide to Reflective Process,* have contemplated how to link student learning to teacher practice through Critical Friends groups, it is reasonable to think that teachers can enable students to engage in the Critical Friends process themselves (McEntee, G.H., 2003).

Assigning roles, a foundational strategy in the "consultancy" process within Critical Friends groups, is commonplace in the middle school classroom. Group work offers a framework for students to build social and interpersonal skills while working toward completion of a learning task. Assigned student roles help specify the relationship between group members, while allowing students to play a significant part in the learning process (Nunan, 1989). Richards and Rogers (1986) dedicated copious research efforts about learners' roles within group settings. Although their work centered on the language classroom, the analysis reveals a vast array of possible learner roles in the classroom, including the ability for students to develop an awareness of themselves as learners (Ibid, 1986). This conscious reflection about the learning process provides a portal for RP through assessment.

Not All Theories Can Be Adapted to the Middle School Math Classroom

Other theories do not particularly lend themselves to adaptation for the middle school math classroom. An example is the Langer-Colton cyclical process for developing a framework for teacher reflection in part because the steps are too ambiguous for middle school to grasp (Langer and Colton, 1994). Another example is Linda Valli's typology for reflection in teacher preparation. Valli presents the ideas of technical reflection, reflection-in and on-action, deliberative reflection, personalistic reflection and critical reflection, to give teachers a structure for RP as well as a tool for analyzing reflective journals (Valli, 2007). As is, Valli's typologies are too complex for the middle school student to process, triggering a need for a modified version if a teacher were to utilize them for classroom purposes.

Adapting Aspects of Reflective Practice to the Middle School Math Classroom

Peter Senge (1990) offers a series of building blocks that enable learning organizations to be built and excel in the future. While these concepts are broad in scope, many of them could be adapted to encourage RP within a classroom setting. Senge discusses assessments' ability to identify an organization's learning deficiencies and discover slow, gradual processes that lead to lasting change (Senge, 1990). Assessments also enable symptomatic intervention, removing factors that limit growth (Ibid., 1990). If teachers were able to utilize assessment as feedback, then students could engage in learning disciplines previously reserved for professional organizations.

Personal mastery allows individuals to seek out the truth and continually broaden their awareness (Senge, 1990). Organizationally, personal mastery generates reflection and, after time, the ability to continually clarify what is important to an individual (Ibid., 1990). Educationally, personal mastery would allow students to achieve a clear vision of themselves as learners and develop genuine goals towards a desired outcome. Personal mastery is also the foundation for creating a shared vision (Ibid, 1990). Vision is an inquiry into the picture we wish to create (Ibid, 1990). By connecting students to a vision centered on RP, schools can create a spark that leads to clarity, enthusiasm and commitment from all stakeholders.
-Creating a spark for risk taking and experimenting within students –

What is Assessment and What Are the Different Types of Assessment?

Heidi Jacobs defines assessment as what a student produces to show knowledge and insight into content skills and proficiencies (Jacobs, 2009). Since testing was first implemented in China in 210 B.C.E., administers of testing have sought to sample performance from a domain in one of four ways illustrated below (Madaus and O'Dwyer, 1999):

1. Ask the person to supply an answer to a series of questions (e.g., short answer questions, essay questions).
2. Ask the person to produce a product (e.g., portfolio, research paper).
3. Require a person to perform an act and be evaluated against certain criteria (e.g., conduct an experiment, read aloud from a book).
4. Have a person select an answer to a question or posed problem from several options. This is historically the most recent, e.g., multiple-choice or true/false.

While these assessments have become standards for student evaluation in today's classroom, educators as far back as the 16th century have utilized one or all of these forms of assessment to determine what is taught and learned in the classroom. Philip Melancton, a

German teacher and influential designer of educational systems, wrote "No academical exercise can be more useful than that of examination. It whets the desire for learning; it enhances the solicitude of study while it animates the attention to whatever is taught" (Jackson, 1992). Melancton's description illustrates assessment's importance while also revealing assessment's influence in schooling. As such, using assessment to enhance students' thoughtfulness towards learning processes is reasonable application.

Implementing Assessment in the Classroom

Because it is desirable for assessments to produce a culture of RP in the middle school classroom, focus must be on performance-based assessments. Performance assessments require examinees to construct/supply, perform, or produce something for evaluation (Madaus and O'Dwyer, 1999). Provided coaching student responses is not part of teacher pedagogy, performance-based assessments allow teachers to evaluate higher-order thinking skills and engage in authentic learning tasks. Ultimately, performance assessments measure student outcomes in more authentic contexts (Kubiszyn and Borich, 2003). This suggests that the fourth way of assessing described by Madaus and O'Dwyer, having a person select an answer to a question or posed problem from several options, should be excluded while the first three (ask the person to supply an answer to a series of questions, ask the person to produce a product, e.g., research paper, and require a person to perform an act that is evaluated against certain criteria) should be pursued.

In the mid-1980s, investigatory learning emerged, supporting Lev Vygotsky's socio-cultural approach to cognitive development. Social development theory stresses the role social interactions play in the development of cognition (Vygotsky, 1978). Vygotsky strongly believed that community played a central role in the process of "making meaning." Classrooms are communities of learners and assessment and can be used to maximize the learning that takes place within them. Lorna Earl with help from Thomas Guskey and Robert Marzano as editors, relate that assessment has been at the forefront of every modern educational reform effort. Recognizing the importance of assessment, Earl used the phrase "Assessment as learning" and argues for correspondence of assessment and learning with emphasis on student self-assessment (Earl, 2003). Earl further described the need to move from our traditional system of rewards and punishments (grades) toward an assessment model that is more motivating because it is relevant, imaginative and scaffolded (Ibid., 2003). Relevant assessment helps students make connections among instruction, assessment and students' learning (Ibid., 2003). It challenges as well as reinforces what students learned. Imaginative or open-ended assessment allows for a range of responses and solutions and can tap into students' individual interests (Ibid., 2003). Lastly, scaffolding allows for appropriate challenges that nurture growth without discouragement and builds confidence by being ongoing and timely (Ibid., 2003).

To ensure successful implementation, Wiggins asserted the need to provide feedback early and often (Science Digest, 2012). Constructive feedback must meet four criteria to best serve student learning, which are that it must be timely, specific, understandable to the receiver and formed to allow for self-assessment on the student's part (Wiggins, 1998)
Consistent with providing feedback is social learning that encourages peer review and feedback and facilitates student/student interaction. Assessment can be the focus on these interactions, leading to more accountable talk amongst students and ultimately a student's better understanding of self.

Collecting Data in the Classroom

When data are appropriately collected and analyzed, assessments yield data that can drive comprehensive and continuous school-wide improvement (Bernhardt, 2004). Data analysis allows schools to replace hunches and hypotheses with evidence of what their students are and are not able to do (Ibid, 2004). Teachers can use this understanding to fill gaps in student understanding, while modifying daily instruction. The systems approach provides all stakeholders the opportunity to understand the interrelationships of concepts and processes (Ibid, 2004). Thus, data analysis, if executed correctly, allows students to be proactive in the learning process – achieving desired results more often (Ibid, 2004).

Data gathering is also the keystone for RP (Osterman & Kottkamp, 2004). Examining the dimensions of a practitioner's work provides insight and understandings previously ignored (Ibid, 2004). Osterman and Kottkamp (2004) provide a summary of ways that direct observation can be used to collect valuable data, including videotaping, audiotaping, structured observation, content analysis and observation and role playing and simulations (Osterman and Kottkamp, 2004). Journaling may also be used as a powerful way to gain insight into practice. Barnett and Brill (1989) offer a structured approach to constructing a critical incident journal in which practitioners summarize events and identify ways their actions may alter future responses. This process embodies RP, facilitating reflection while improving practice.

RESEARCH METHODOLOGY

How can assessment help implement RP in the middle school math class?

- How can RP be implemented in the middle school math class?
- How do you measure RP within the middle school math class?
- How does assessment enable effective teacher-student and student-student interaction?

An effectively implemented system of RP within the middle school math classroom could potentially improve student's ability to engage in metacognition – better understanding gaps in

their own learning. At a minimum, the relationship between RP and assessment should be equitably measured for all participants of this study. To do so, one middle school math class at Malvern Preparatory School will be administered two assessments and provided structures to engage in RP throughout March, 2013.

Malvern Preparatory School is a Catholic, independent, day school for boys located 30 miles west of Philadelphia, Pennsylvania. Founded in 1842, Malvern is a direct continuation of the academy program established by the Augustinians as a preparatory school for what is now Villanova University. Malvern services 624 students from Grades 6 – 12, and is committed to the Augustinian values of truth, unity and love as they prepare young men for college, leadership and life. The middle school division currently enrolls 125 students with class sizes ranging from 13-18 students. The seventh grade mathematics class that will be the focus of this study contains 15 students pursuing an Honors Algebra I curriculum (different ways to display data, e.g., central tendencies-mean, median).

Both assessments, which will be administered throughout the study, will follow five to seven days of content instruction. Lessons leading to each assessment align with current curriculum guidelines as well as mathematical process strands defined by New York state to establish basis for reflective practice. These mathematical strands include Problem Solving, Reasoning and Proof, Communication, Connections and Representation. Cumulatively, they should be viewed as a way to help students see mathematics as a discipline, rather than a set of isolated skills. For the purposes of this study, these mathematical strands enable reflective practice by providing opportunity for observation of students, analysis of student performance and feedback from interviews with students surrounding assessment.

Student Observation

Students will be observed during a classroom session to assess how they are assimilating the mathematical process strands. During daily, small-group breakout sessions, student interactions will be watched to detect evidence of the mathematical process strands. For example, a pair of students when engaging in a curriculum task designed to improve student understanding will solve the problem by writing the individual steps and discussing the solution using relevant vocabulary. It is anticipated that there will be varying degrees of proficiency among the students.

Analysis of Student Performance

Tests will be constructed and graded through the lens of the mathematical process strands. This means that graded tests returned to the students will not contain a letter grade. However, the returned tests will contain critical comments that identify proficiencies within

those strands using pre-defined abbreviations for each strand. These abbreviations are depicted in the rubric in the Table 1 below.

Table 1 – Pre-Defined Critical Comment Abbreviations

MATH RUBRIC	**4** 	**3** 	**2** 	**1** 
PROBLEM SOLVING P/S (math)	Gets correct answer using most efficient strategy	Gets answer right using correct mathematical steps	Gets answer partially right or has minor mistakes in steps	Answer is mostly or completely incorrect
CONNECTIONS CON (vocabulary)	Uses vocabulary words relevant to solving problem and defines them	Uses vocabulary words relevant to solving problem	Uses vocabulary related to topic but not specific to solution	Uses little or no vocabulary related to problem
REPRESENTATION REP (translation)	Shows multiple representations and understanding of both and how they relate	Translates problem into equation / table / graph / diagram with correct symbols & labels	Translate problem but minor mistakes are made (symbols & labels)	Does not translate problem correctly, has multiple errors
COMMUNICATION COM (explanation)	Explains what was done and gives mathematically reasons why	Explains what was done to solve the problem with details	Explains solution with few details or does not fully answer question asked	Does not explain solution or answer the question asked
REASONING & PROOF R/P (ideas & check)	Justifies answer or strategy using mathematical ideas & checks answer	Justifies answer or strategy with mathematical ideas or check answer	Some mathematical ideas are used to, or check is made but answer is still incorrect	Response is not reasonable and no check is made

Analysis of student performance continues with a five-minute written reflection followed by student groups discussing what they did well and identifying what their deficiencies were along ith considering how to improve their deficiencies.

Student Interviews

To understand how these different approaches affect RP, a structured interview instrument was developed around the five math process strands discussed earlier. The Reflective Practice Structured Questionnaire asks the following questions:

1. How does getting feedback make you feel? (Positive, Neutral or Negative)
2. Depending on the response, one of three questions was asked:
    - If positive, What made it more helpful?
    - If neutral, Why wasn't it any different?
    - If negative, Why was it difficult?
3. How do you think you did on the test?
4. Is there anything else you, the student, or I, the teacher, can do?

Each interview will be conducted one-on-one after an assessment is returned. Students will respond to four questions centered on the five process strands. Given the heightened sensitivity of respondents, each interview will be conducted by the author with each of the student respondents (SR) and last about 10 minutes, keeping the identity of all students anonymous. Background information about students included age, race, number of years studying at Malvern Prep, participation in extracurricular activities, religion and commuting distance.

Upon completion, each student respondent's answer will be summarized in a table. Additionally, relationships with the parents of all SRs were leveraged to establish the basis of the SR interview. Individually, all parents were contacted via phone and enthusiastic about their son's participation. Furthermore, of the 14 sets of parents, more than half wanted to know how the discussions went.

RESULTS

Each student was interviewed using the Reflective Practice Structured Questionnaire and was conducted one-on-one after an assessment was returned. Interviews with SRs lasted about 10 minutes.

Applying the study methodology yielded favorable results. Overall, the 14 SR reacted positively to the structured questionnaire discussion. Of the 14 students, eight (8) were positive (57.2%), five (5) were neutral (35.7%) and one (1) was negative (7.1%). Positive responses ranged from liking the feedback and wanting more in other classes (SR1) to appreciating being able to identify an area needing emphasis (SR7) and better understanding of the concepts (SR11). The neutral responses indicated focus on the grade (SR4 and SR13) as well as identifying areas where student is challenged (SR12). The one negative response revealed frustration with the fact that doing poorly on one part of the test decreased overall performance and focus on grade (SR14). The results are summarized in Table 2 below and on the next page.

Table 2 – Summary of Structured Interviews by Student Respondent

Student Respondent (SR)	Question #1-Response/Feedback How does getting feedback make you feel? Check one; positive, neutral or negative	Question #2 Response/Feedback Positive-What made it more helpful? Neutral-Why wasn't it any different? Negative-Why was it difficult?	Question #3 Response/Feedback How do you think you did on the test?	Question #4 Response/Feedback Is there anything else you (student) can do? Is there anything else I (teacher) can do?
SR1	Positive	Liked feedback, more classes need to do it.	Good. Felt a bit behind because of absences leading up to test.	N/A
SR2	Neutral	Similar to other stuff in math. Same time, able to identify needs.	Alright. Messed up on the graph	Would like to do more frequent follow-ups with teacher based on assessment feedback.
SR3	Positive	Lets you know about construction of the assessment; how much a teacher "cares".	Did well. Answers were correct, need to improve explanation.	Realizes importance of explanation, but would like to just put answers for a test.
SR4	Positive	Better understand concepts through feedback.	Pretty well – felt confident in test; understood concept.	Highlight more positives from test performance.
SR5	Neutral	Categories identify where you are struggling. They are specific.	Identified that writing in math is a weak point.	N/A
SR6	Neutral	Strong desire to translate into grade. Spent all	Could have done better, explaining solving process	Like process (teacher/student conversation) to

		time doing this.	more thoroughly.	continue.
SR7	Negative	Doing bad on one part affects overall average. Just likes to get answer.	Average. Poor essay, but strong Representation.	More in-depth analysis on all future assessments.
SR8	Neutral	Harder to process grade. Sought out percent.	OK. Needed to use more vocabulary in explaining answer.	Do this more often.
SR9	Positive	Thought it helped self-esteem. Could see where you did well on one section vs. another.	OK. Made 'silly' mistakes, looking through the test helped identify.	N/A
SR10	Positive	Liked that needs immediately identified.	Did pretty well – somewhere in the 'A' range.	N/A
SR11	Positive	Could better understand what he didn't "get".	Low 90s.	A conversion chart to percentages. What is a '4' equal to?
SR12	Neutral	Expected it. Really liked opportunity to discuss performance.	Good. Really knew and understood concept of linear relationships.	Really likes opportunity to discuss performance, hoping it continues.
SR13	Positive	Immediately identified right/wrong parts of assessment.	Good.	Likes different strands. Focused on positives and negatives of performance, not score.
SR14	Positive	Easily identify weaknesses.	Low to mid 90s; matching pattern of my other math grades.	Attach percentage conversion. Rather it be included to share with parents.

Background information about SR was attained and summarized in Table 3 below and on the next page.

Table 3 – Student Respondent Demographics

Student Respondent	Race	Age	Years at MP	Extracurricular Activities	Religion	Commuting Distance
SR1	Caucasian	12	2	Baseball, Football, Chorus	Catholic	0 – 1 mi.
SR2	Caucasian	12	2	Basketball, Lacrosse	Catholic	1 – 5 mi.
SR3	Asian Indian	12	2	Basketball, Track, Math Team, Band	Buddhist	10 – 15 mi.
SR4	Caucasian	13	2	Cross Country, Swimming, Chess, Photography	Catholic	5 – 10 mi.
SR5	Caucasian	12	2	Swimming, Chess Club, Band	Catholic	10 – 15 mi.
SR6	Caucasian	13	2	Basketball, Baseball (6), Lacrosse (7)	Catholic	5 – 10 mi.
SR7	Caucasian	13	1	Lacrosse, Math Team, Yearbook	Catholic	10 – 15 mi.
SR8	Caucasian	12	2	Track, X Country, Swimming, Math Team	Catholic	10 – 15 mi.
SR9	Caucasian	13	1	Lacrosse, Squash	Catholic	5 – 10 mi.
SR10	Caucasian	12	2	Lacrosse, Yearbook, Chorus	Catholic	1 – 5 mi.
SR11	Caucasian	12	2	Basketball, Lacrosse	Catholic	1 – 5 mi.
SR12	Caucasian	12	2	Squash, Track, Chorus	Catholic	20 – 25 mi.

SR13	Caucasian	13	2	Baseball, Football, Photography	Catholic	5 – 10 mi.
SR14	Caucasian	13	2	Squash, Tennis, Chorus	Catholic	5 – 10 mi.

DISCUSSION

These initial results suggest that students (SRs) responded favorably to the RP exercise implemented in my middle school math class. From these findings, several discussion points emerge. Initially, assessment was addressed and is illustrated by the excerpts highlighted later in this and forthcoming paragraphs. As an example, SR5, without the assessment in front of him, described his performance in a post-interview by stating that he was able to get the answer through creating an equation to describe each phone company. He realized that once he did he was able to substitute the number of minutes for each person and see which option was best for each person. The graph only confirmed his answers. Additionally, he struggled to use appropriate wording for slope and y-intercept to describe the process. He would change that if he could do it again as well as be more specific about those ideas and how they connected to the problem. Learning environments of the 21st Century are vastly different from those of the past. T

echnology's ubiquitous presence has dramatically changed the way teachers teach, and the way students learn. It has also made answering the question of "why are we learning this" more difficult than ever before. The accessibility of information has forced teachers and school leaders to rethink their responses to this question, and attempt to provide more than just weak answers – creating a learning environment that engages in big understandings and big ideas. Assessments need to change to reflect this shift, providing actionable feedback to students. In contrast to low-level decoding skills typically measured on Scantron assessments or pre-made textbook assessments, this study used one application question to determine student's understanding of linear relationships – asking students to evaluate and analyze the information before creating a response (Bloom's Taxonomy). Doing so allowed students to engage in learning that really matters while demonstrating various levels of proficiency in five unique categories: Problem Solving, Representation, Communication, Connection, and Reasoning and Proof.

These categories not only gave me a better sense of how students were processing the concept of linear applications but also gave students a basis to assess their own performance. Of the 14 students in the class, 12 were able to identify clearly areas of strength and weakness. Often times, students noted specific areas of improvement similar to SR5. Another student, SR2, walked me through things he would do differently on his graphical representation of the three cell phone companies. "I felt the graph made sense when I finished it on the assessment. When I

got it back, I realized I left off important stuff. Labeling the axes and lines would have made it clearer for me and you to tell which company was best for each person."

The assessment allowed this type of feedback to be commonplace during student interviews. While the assessments were not directly in front of students, all 14 students surveyed elaborated on areas of improvement. That said, a few students identified a need for positive feedback. SR4 mentioned multiple times throughout his interview that he wished there was more positive feedback. He thought he did well, but felt the structure was set up to clearly indicate negatives while ignoring the positives from the assessment. Perhaps this positive reinforcement was neglected in trying to provide actionable feedback to a group of seventh grade honors math students.

Measuring RP

A second area that emerged from the results is measuring RP and is illustrated by the case of SR2. From my conversation with SR2, he stated, "I like this conversation. We should talk more after we receive assessments back. I can ask you questions about the things I missed. It would be helpful. It wouldn't have to be on everything, just the stuff I missed".

All students seemed to enjoy the post-reflection conversations. "This is cool because in other classes, we go over the whole test, even when it seems like nobody got the question wrong," stated SR7. The individualized nature of the interview allowed students to explore specific skill sets while not "wasting time" on concepts they felt they had acquired. As their teacher, I felt I was able to engage in meaningful conversations around their specific concerns, allowing me to avoid the typical approach as described by SR5. This approach, however, did not come without its detractors. For example, SR6 described that he had used the majority of his 10-minute reflection time trying to convert his holistic score into a percentage grade. "It's frustrating. I know what I did wrong, but I am not sure how I did. What am I supposed to tell my parents when they ask?".

SR6's stance was echoed by three others. SR4 wondered what he would tell his parents, after all, they are the ones who helped him study. He was convinced that anything but a percentage or letter grade would be unacceptable. I reminded these students that their parents had been notified, and would be expecting such feedback. This did not seem to calm all fears as two students still worried what their category numbers meant percentage-wise. These concerns were genuine. While I guided all students towards the focus of feedback, it was difficult to move beyond a percentage grade with a few such as SR9 when he stated, "I know my dad. He may have said this is ok, but it will not be ok. He will want to know if this is an A or a B. It is really all he cares about".

In contrast, many students felt liberated by the holistic scoring rubric. Two students noted that the absence of a percentage or letter grade on top of the exam allowed them to focus on the feedback instead of sharing and comparing grades with friends. This focus led to a deeper

understanding of feedback provided and more thoughtful questioning during our one-on-one interviews. “Why did I get this wrong?” was replaced with “How can I be more specific when writing my explanation?” Perhaps a why questions vs. how questions is too simple, but I found it revealing that how questions outnumbered why questions by a count of 28 to 4 in the 14 coded interviews.

While this measure is over-simplifying a complex process, it does provide insight into how we might be able to capture RP through assessments in the math classroom. Student’s ability to verbalize my coded feedback was impressive, but their ability to ask questions that led to deeper understanding was exceptional. Is there a way to effectively capture these questions and work through them with our students – creating a learning environment in which teachers and students are co-learners?

Teacher/Student Interactions

“I hope it continues. This way is cool – being graded on different sections. You’re able to instantly see what you need to work on because everything is really clear. More teachers should do this”. When pushed to elaborate on this comment – more teachers should do this – SR10 revealed that process strands armed him with entry points in our discussion.

SR14 expressed similar feelings towards our interview. “I feel like there are specific things for us to talk about, things that make more sense than just looking at the answer to Question #2”. Both students not only correctly identified strengths and weaknesses revealed in the assessment, but also asked excellent questions, utilizing language from the rubric to illustrate their points throughout. In turn, our discussion was able to get at the heart of the mathematical understanding that each student was struggling with. These successes – identifying and discussing a specific knowledge gap – were not limited to these two students.

Throughout the interview process, multiple interviewees commented on their desire to continue one-on-one conversations, citing their increased ability to understand mathematical mistakes and increased connection with me as their teacher. Like many educators, I take great pride in connecting with the students in and out of the classroom. Coaching multiple sports within the school community has enabled me to establish outstanding relationships with students and families. But these connections have not always increased student achievement.

“Grading our test in this manner let us know you care”. SR3, along with five others from the focus class, were members of the 2011-2012 MS Basketball that I coached. While I had established a great rapport with these individuals, it was not until the development and implementation of the rubric that SR3 felt the same level of connection in the academic classroom. On the basketball court, you are always giving us constant feedback, providing ways to improve our offense or defense, this conversation is similar to that. The assessment and grading rubric allowed me to establish explicit learning goals, and engage in meaningful, reflective discussions, similar to those on the basketball court.

How often do we, as teachers, attempt to facilitate rich discussions that enable our students to engage in, reflect on and contribute to big understandings? This is no easy task, and for many educators, one that has become more elusive in an increasingly digital age. Sarah Michaels (2008) has given it the term Accountable Talk – when teachers establish a classroom culture that encompasses a student's accountability to his learning community, accepted standards of reasoning, and knowledge. In essence, the ability to establish norms within a classroom setting will allow our students to better understand their own strengths and weaknesses, but also equips them with a common language to engage in robust dialogue. Peter Johnston (2012) has more recently referred to this as 'leveraging teacher and student talk,' noting that words can single-handedly change the life of the classroom. This study revealed the power of using intentional words to describe student performance. Moving beyond percentages, these words allowed my students and me to interact on a more intimate level, uncovering the source of misunderstandings and engage in meaningful discussion about performance. While many parents, and some students, still desire a 'grade' to indicate a level of mastery, holistic scores enabled me to facilitate incredibly revealing discussions – ultimately making me a more informed educator in the pursuit of maximizing student understanding.

Student/Student Interactions

A silence had taken over the room upon the return of the linear assessment from the day before. Students feverishly flipped through their assessments, seeking to decode the holistic feedback they had just received. After a 10-minute silent reflection, students were encouraged to talk with one another about the test.

Initially, it appeared that students were gathering together to determine percentage conversions. However, upon closer examination, it was revealed that the absence of traditional grades steered the student conversation towards understanding the provided feedback and the assessment content. The following vignette describes two of these observed interactions: "Did anyone get a '4' on the graphing section?" SR13 sought out high performers in this section to better understand why his graph did not accurately represent the different cell phone companies. When he located a volunteer, his questions were thoughtful and strategic. "It says my scale is inappropriate, what kind of scale did you use?" SR4 replied, "I used 50s across the x-axis, and 10s along the y-axis. Doing this let me show the total cost for all plans and all people given in the problem." After taking some time to digest this comment, SR13 then turned to his own graph, and reflected on its scale, "I guess counting by 1s doesn't really show enough information, it doesn't tell the whole story."

Another group had formed to discuss the Communication section. "Can I read yours?" was a common question amongst the group of four students. As students started to read other responses, follow-up questions sought to understand the process student went through in constructing a response. During their six minute conversation, the group discussed transition

words, appropriate vocabulary and outlines as ways to improve their future responses. “Someone should be able to do what you did after they read it,” said SR7 (Fieldnotes, April 2013).
These stories highlight a major take-way from this study. In creating a common language via the assessment rubric, students were able to discuss their own assessment performance in a more sophisticated and informative manner. While grade calculation was still present in many conversation circles, it was only a minor component to an otherwise reflective discussion. These reflective experiences were supported by an assessment rooted in revealing a holistic understanding of the content, and reinforced during subsequent interviews.
There were few efforts made earlier in the year to provide similar feedback to students. And while ‘turn and talk’ is a common strategy in many math classrooms across America, providing a topic of discussion that will sustain middle school students can be daunting. Assessment done in this manner could offer an opportunity for educators to create dialogue amongst their students that is authentic, sustainable and reflective.

Student Demographics

By and large, this seventh Grade, Honors Mathematics class is a microcosm of Malvern’s overall student body – drawing most of its students from Chester and Delaware counties. Eighty-five percent of Malvern’s student body was baptized Catholic, and are a part of families that are very active in their respective parishes. This breakdown held true for the focus class of this study, as 13 of the 14 participants are of the Catholic faith. These commonalities, location and faith, help to put Malvern’s Mission – Truth, Unity, Love – into action across the expansive campus.

Interestingly, this class includes two first-generation immigrants. These students represent 15.4 percent (2/13) of the total first-generation immigrants currently enrolled at Malvern Preparatory School. While both students have become active members of Malvern’s community – participating in multiple activities and creating networks of friends – language barriers remain present in the academic classroom. Multiple strategies have been devised and implemented to varying degrees of success with the help of our on-site Learning Specialist.

The implementation of RP in the middle school math classroom had a profound effect on these two young men. Both were incredibly vocal during our one-on-one interviews and requested the desire to continue assessment review in this manner. The common language and accompanying visuals helped them understand complex feedback – a task previously reserved for Parent/Teacher Conferences, in which native speaking parents communicated in-depth feedback. Furthermore, the constructed assessment and rubric allowed these students to better communicate with their peers, seeking to understand how to better construct a written response in English.

It is important to note that both of these students have a very high aptitude in mathematics. However, as their teacher, it was difficult to provide feedback that would

communicate areas of strength and weakness, ultimately furthering their understanding. While holistic scoring and RP may not be the solution to helping English Language Learners (ELLs) succeed in the math classroom, it may offer a possible strategy in this pursuit.

CONCLUSIONS/IMPLICATIONS

The results indicate that Reflective Practice (RP) enabled SRs to evaluate their own learning experience and gain insight about their level of knowledge in a seventh grade Algebra I Honors class in a private all-boys school. Using a five-point rubric to rate the assessments, one-on-one interviews with SRs, which were guided by a structured questionnaire, yielded results that indicated the majority of SRs reacted favorably to RP (8 of 14 positive; 57.2%). Additionally, the vast majority (13 of 14; 92.9%) asked questions that lead to better understanding of the subject matter. These results indicate improvement in teacher-student interactions because RP establishes a platform for teachers and students to talk about specific things to enhance relationships and to maximize student understanding.

Importantly, this insight helps teachers craft lessons that enhance student understanding, which is particularly valuable in a classroom setting. For example, it emphasized the need to adopt evaluation methods that accommodate RP, such as constructive commentary with grades instead of just Scantron output. Furthermore, the results indicated improvement in teacher-student interactions because RP established a platform for teachers and students to talk about specific things that enhanced relationships as well as maximize student understanding. Student-student interaction was also improved because RP created a common vocabulary for them to have meaningful exchanges. This study infers that RP is a useful and practical technique for a middle school math class.

Given the paucity of SRs (14), these findings will need to be replicated with a large enough group of students to generate quantitative analyses. When expanding the study population in future studies, gender mix should also be considered to assess the response by female SRs. Additionally, other types of middle schools should be included, e.g., public schools, to understand the impact of RP on students and teachers, who are likely to be interacting with larger class sizes. Another interesting consideration is evaluating RP for other academic levels, such as high school or college. Because the study population will be significantly increased, consideration to transition data collection from one-on-one interviews to using a social media based collection method, e.g., Google Plus, which is readily available to all respondents.

IMPLICATIONS

To assess how the culture of RP would look, consideration must be given to the challenges of the 21st Century learning environments. Academic rigor demands that students be more agile and that teachers have greater involvement in the dynamics of the learning process. For this to be effective, it suggests the need for consistency with the mission of an academic institution, moving beyond prescribed assessments constructed by various third parties. To this end, schools must consider what really matters in a student's learning experience. Conversations built around informative feedback can lead to exemplary understanding. This accountability can also lead to greater participation in whole class discussions as well as establish a relationship between teacher and student as co-learners throughout the academic year. Understandably, this represents a shift in school settings – demanding educational leaders to create and support cohesive vision around RP.

This movement will take time and trust. Results will have to be experienced and documented across all academic disciplines, connecting each member of a school environment to a shared purpose. While positive results from this study were isolated to one honors math class at one school, there is reason to believe that this strategy, Assessment as RP, could enhance educative assessment – resulting in shifts in pedagogy and curriculum.

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