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About the Journal

Founded in 2013, the Journal of Teacher Action Research (ISSN: 2332-2233) is a peer-reviewed online journal indexed with EBSCO that seeks practical research that can be implemented in Pre-Kindergarten through Post-Secondary classrooms. The primary function of this journal is to provide classroom teachers and researchers a means for sharing classroom practices.

The journal accepts articles for peer-review that describe classroom practice which positively impacts student learning. We define teacher action research as teachers (at all levels) studying their practice and/or their students' learning in a methodical way in order to inform classroom practice. Articles submitted to the journal should demonstrate an action research focus with intent to improve the author's practice.

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DEVELOPING 7TH GRADE STUDENTS' MATHEMATICAL CONFIDENCE THROUGH THE PROCESS OF SELF-REFLECTION

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Abstract Much of the current research focuses primarily on ways in which reflections and self-efficacy individually lead to improvement in grades. However, research literature addressing the connections between reflections and academic confidence, particularly, mathematical confidence is largely missing. The aim of this action research study was to examine how students' awareness of their strengths and areas of growth regarding geometry standards in 7th grade impacted their mathematical confidence. Researchers found that while students' participation in self-reflections resulted in an increase in students' mathematical confidence for the 3-dimensional geometry unit, such activities need to become commonplace in mathematics classrooms to impact students' overall mathematical confidence.

Keywords: teacher action research, student reflections, mathematical confidence, middle school geometry

Introduction

As students entered class on the day of the test, several exclaimed "I am going to fail this test!". They hadn't even seen the test yet, and this was the first test of the year. These students were in a 7th grade advanced class, the majority of them had done all their homework and were active participants in class. As such, it was rather surprising that many of these students exclaimed such strong sentiments. During instruction and class activities, it seemed like they were understanding the material, so it was concerning that they did not feel confident for the test.

When asked how or what they studied, the most common responses included "I did not know what to study", "I did not know how to study" or "I gave up". It became apparent that they did not know what to study so they either focused on studying the wrong material or were very overwhelmed and gave up on studying. Through their demonstrated work ethic during class, the evidence suggested that the majority of these students are motivated to do well, so it was concerning that they felt so unprepared for the assessment.

The scenario described sets the stage for the action research study described in this article, in which the course instructor examined whether engaging in self-reflection following learning of material of three geometry content standards had an impact on student's mathematical confidence. The following question guided the research: In what ways does student awareness of their strengths and areas of growth regarding geometry standards in 7th grade impact their mathematical confidence?

Research has shown that it is important that students develop self-reflection skills as it relates to an improvement in their understanding of the content (Schunk, 1996; Zimmerman, Moylan, Hudesman, White, and Flugman, 2011). Much of the current research focuses primarily on ways in which reflections and self-efficacy individually lead to improvement in grades. However, there are gaps in the research literature addressing the connections between reflections and academic confidence, particularly, mathematical confidence. Belief in self is measured by two interrelated constructs: academic self-confidence, and self-efficacy (Vogt, n.d). Vogt's research has shown that "people with positive self-views are more likely to strive overcome obstacles to achieve success than people with lower levels of confidence" (p. 1). While much of the existing research focuses on ways in which self-reflection can improve students' performance, the focus of this study was to help students become familiar with the process of self-reflection to increase their mathematical confidence. Previous research acknowledges that an increase in confidence leads to an increase in performance, however the first step is generally to help students feel more confident. If students are able to determine their strengths and areas of growth before they take an assessment, it may help them better focus on specific topics while they are studying. As 7th grade students begin to advance in their studies, the instructor felt it was important for them to gain academic confidence, especially in regards to mathematics.

This study was developed to examine how engaging students in opportunities to self-reflect to become more aware of their strengths and areas of growth regarding geometry standards in 7th grade potentially impacts their mathematical confidence. Once students finished learning a standard in the 3-Dimensional Geometry Unit, they filled out a pre-reflection form to describe how confident they felt about that particular standard. They also made a checklist for themselves in which they described up to three steps that they would take to ensure they felt prepared for the assessment. A post-reflection was administered at the end of the unit following the unit test.

Literature Review

Through reading and examining the available literature, it is perceived that continuous practice of self-reflections, and setting and working towards achievable goals will result in an increase in of students' mathematical confidence (Schunk, 1996; May and Etkina, 2002; Zimmerman et al., 2011). When students are taught the process of self-reflection, they are able to determine for themselves their areas of strength and growth. "Students are often given various study skills advice but very few actually follow the advice given to them" (Gibbs & Northedge, 1979). The authors further claim that pieces of advice given to students do not seem to involve excitement, personal exploration, and unpredictability, all of which tend to result in making studying seem like a chore. This article, provides a new studentcentered alternative – where instead of requiring passive acceptance of given advice, students become active participants in this aspect of their learning. This requires more time as students need to experiment with various frameworks, and often one way may not always produce desired results. These types of interventions tend not to consistently bring about immediate changes. It is important to note that *learning to learn* is a continuous life process. Through this study, informed and adapted by the work of Frondeville, students will become familiar with one framework of doing reflections.

There is a need for additional research related to mathematical confidence, therefore the bulk of the literature review relates to the reflection process, self-efficacy, and performance in mathematics; connections are made to how these relate to mathematical confidence. As many different types of studies have been done on these topics, the following literature review is organized by the major subjects, namely learning to self-reflect, connections between self-efficacy and performance; and lastly connections between academic confidence, self-reflections and performance.

Learning to Self-Reflect. As teachers we often assume that reflection is occurring and overlook the importance of it in an educational setting. After attending a conference with the theme "Reflection: A Neglected Area in Learning", Boud, Keogh, & Walker (1985) became convinced that reflections are a vital element in any form of learning, and teachers need to consider how to incorporate them in their classrooms. In their book *Reflection: Turning Experience into Learning*, the authors point out three points about the reflective process to keep in mind: only learners themselves can learn and only they can reflect on their own experiences; reflection should be pursued with intent; and the reflective process is a complex one in which both feelings and cognition as closely interrelated and interactive. The authors share their findings on the importance of reflections as a learning tool in professional education and that the skills required for reflection need to be developed in professional courses. They further suggest that through engaging in this reflection cycle, we start seeing the intended outcomes.

Much research has shown that it is important that students develop self-reflection skills as it relates to an improvement in their understanding of the content (Boud et al., 1985; May & Etkina, 2002). In a study by May and Etkina (2002), the researchers explored how students' self-reflections on how they learned content in an introductory physics class impacted the epistemological beliefs they exhibited. While the previous piece of literature described the process of reflection, this was a study involved college physics majors to see whether engaging in the reflection process resulted in an improved understanding of the content. The students were asked to reflect on four open ended questions: "What did you learn in lab this week? How did you learn it?, What did you learn in lecture and recitation this week? How did you learn it?, What questions remained unclear?, and If you were the professor, what questions would you ask to determine if your students understood the material?" (May & Etkina, 2002).

The authors found that these reflections helped the professor in guiding their lessons, and as a result some conceptual gains were measured. This study supports much of the other research literature in education that suggests that students' self-reflection on their own learning, and then acting upon those reflections contributes to higher performance.

Connections Between Self-Efficacy and Performance. There are several variables that play an important role in students' academic achievement, namely, academic motivation (especially self-efficacy beliefs). "High self-efficacy helps to create feelings of serenity in approaching difficult tasks and activities. As a result of these influences, self-efficacy beliefs are strong determinants and predictors of the level of accomplishment that individuals finally attain" (Pajares, 1996, p. 545). The author refers to two areas of self-efficacy and academic performance and found a link between efficacy beliefs and college major/ career choices; relationships among efficacy beliefs, related psychological constructs, and academic motivation and achievement. In this literature syntheses, the author refers to many other major studies done one similar topic including Bourffard-Bouchard, Parent, Larivee (1991) who shared that students with high self-efficacy engaged in more effective self-regulatory strategies. Pajares further shares a table of items used to measure various self-efficacy constructs as shared by various researchers. In relation to my study, Bandura's (1993) work on collective efficacy helps in measuring students' confidence levels.

Bandura (1997), shares his theory stating that those with higher self-efficacy expectancies—the belief that one can achieve what one sets out to do—are healthier, more effective, and generally more successful than those with low self-efficacy expectancies. "Perceived self-efficacy is defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. Self-efficacy beliefs determine how people feel, think, motivate themselves and behave" (Bandura, 1997). A strong sense of efficacy has been found to result in higher performance. People with high assurance are not afraid to approach and fail at difficult situations.

Self-efficacy is developed over a lifetime and occurs in developmental stages: Personal → Familial → Peer influence → School → Transitional experiences of adolescence → Concerns of adulthood → Advancing age. Focusing on school as it relates to this study, the "cooperative learning structures, in which students work together and help one another also tend to promote more positive self-evaluations of capability and higher academic attainments than do individualistic or competitive ones" (Bandura, 1997).

Connections Between Academic Confidence, Self-Reflections and Performance. According to recent reports, full time students in K-12 virtual schools have shown lower performance in mathematics than their counterparts in traditional schools. The purpose of Choi, Walters, & Hoge (2017) study included analyzing assessment data from virtual schools to explore the association between self-reflection and mathematics performance; comparing the patterns found in student self-reflection across elementary, middle, and high school levels; and examining whether providing opportunities for self-reflection had positive impact on mathematics performance in an online learning environment. The researchers found that participation in self-reflection varied by grade, unit test performance level, and course/topic difficulty; more frequent participation in self-reflection and higher self-confidence level were associated with higher final course performance; and self-reflection, as was implemented here, showed limited impact for more difficult topics, higher grade courses, and higher performing students.

Schunk (1996) conducted two studies in which students worked under the condition involving either a goal of learning how to solve problems (learning goal), or a goal of merely solving them. Students who pursue a learning goal experienced a sense of self-efficacy for attaining it and were motivated to engage in task-appropriate activities. Children given the performance goal and high ability feedback persisted at the task but avoided challenging tasks that they may have made errors in. Children given the performance who received low-ability feedback selected easier tasks, did not persist to overcome mistakes, and displayed negative affect. Through the study he found that emphasizing to students that their goal is to learn to solve problems can raise their self-efficacy for learning and motivate them to regulate their task performance and work diligently.

Schunk's finding are similar to that of Zimmerman et al. (2011) who conducted a classroom-based intervention study to help struggling learners respond to their academic grades in mathematics as sources of self-regulated learning (SRL) rather than as indices of personal limitation. The study was done at a technical college in developmental (remedial) mathematics or introductory college-level mathematics courses. SRL instruction was hypothesized to improve students' mathematics achievement by showing them how to self-reflect more effectively. Mathematics exam self-efficacy, and self-evaluation scales were used to measure how confident students felt about a specific question on the exam, and how confident they felt about the accuracy of their solution. The researchers found that students in this group out performed their peers on the exams. The self-reflections resulted in higher self-efficacy beliefs when solving problems. Participation in the study also helped students view academic grades as learning opportunities to further learning, rather than as an end-point to learning.

Methodology

Participants and Setting. The research took place at a middle school located in the southeastern region of United States. The majority of the students came from families classified as middle-class/ upper middle class in terms of socioeconomic levels. The study took place in one 7th grade advanced mathematics class for which the researcher is the instructor. While the class in which the study occurred has 30 students, four of the students' (N=26) scores were not analyzed due to missing/ partial data. This study took place for the duration of the geometry unit (approximately 1 month). The students are already enrolled in the researchers' class, and all activities in this study will be a part of their regular coursework.

From prior experience with teaching this same course last year, the instructor has witnessed students feeling nervous and anxious before exams as they do not know what they should spend their time focusing on. As a result, they often focus their time studying what they are already comfortable with, leaving behind the content they actually need to focus their time on. Especially with the geometry unit, since it covers several dense topics such as: deriving surface area and volume formulas, and understanding the relationship between volume of prisms and pyramids, the instructor felt it would be beneficial for them to be aware of their own strengths and areas of growth regarding the content in the standards. One limitation that impacted this study included the fact that this was the students' first time learning this reflection process. For this reason, some students had trouble reflecting about themselves.

Research Design. Current literature focuses on how self-reflection leads to higher performance, this study specifically focused on whether this reflection process lead to higher mathematical confidence. As suggested by Atkins and Murphy (1993) there are three stages of in this reflective process: (a) becoming aware of perplexing feelings and thoughts, (b) analyzing and examining the situation, feelings, and knowledge, and (c) developing a new perspective on the situation. This study further developed this research on various self-reflection processes. While performance is an important measure, in order for us to develop life-long learners, it is important that our students develop a growth mindset. In this study, immediately after learning and practicing a specific mathematics standard in the 7th Grade geometry unit, students reflected on their confidence level and then thought about steps they could take to work on the aspects of the standard which they listed as their areas of growth (see Appendix A). Through the remainder of the unit, students acted upon these steps, and then re-reflected after their unit test (see Appendix C). The idea of self-reflection and confidence is directly tied with self-efficacy. As supported by cognitive learning theory, much research has shown that that self-efficacy is correlated to students' learning (Gibson & Dembo, 1984; Woolfolk & Hoy, 1990). As described by Bandura (1997), "Confidence is a nondescript term that refers to strength of belief but does not necessarily specify what the certainty is about… Perceived self-efficacy refers to belief in one's agentive capabilities, that one can produce given levels of attainment" (p. 382). While self-efficacy and self-confidence are related, there is a distinction, and this study solely focused on students' mathematical confidence. As this was the student's first time formally experiencing this process, it becomes important to note that increasing mathematical confidence can be a long process, and drastic results were not expected in the duration of such a short study.

Data Analysis Methods. Both quantitative and qualitative measures were used to see whether there was any change in students' confidence. Quantitative analysis was based on the data received from the pre-reflection (Appendix A) and post-reflection (Appendix C), and was analyzed using the scale shown in Table 1. To determine whether there was a significant change in the confidence level for individual students, a paired two tailed t-test was performed at $\alpha = 0.05$

H_0: There is no significant difference in student's mathematical confidence after participating in self-reflections.
H_a: Participating in self-reflections impacts students' mathematical confidence.

Table 1: Pre-Reflection Data Scoring

Confidence Level	**Score**
Not Confident	1

Somewhat Confident	2
Confident	3

Note: A score of 1.5 or 2.5 was given if the chosen selection was in the area of intersection of the two confidence levels.

Qualitative analysis was based on the data received from the open-ended questions in both the pre- and post- reflections. Researcher looked for prominent strategies and themes from the collected data. The reason for combining both quantitative and qualitative data was to better understand the research problem by converging both quantitative (broad numeric trends) and qualitative (detailed views) data.

Results and Discussion

Students' results were analyzed using both quantitative and qualitative methods and supported that engaging in this reflective process led to an increase in students' mathematical confidence. Students responses to the Venn-diagrams were examined using quantitative methods while their responses to the open-ended prompts were examined qualitatively (see Appendix A and C).

Quantitative Analysis. Students were given a Pre-Reflection (see Appendix A) right after they finished learning the content for a particular standard. Similar Venn-diagrams (see Appendix C) were given to students after they had completed the Unit Exam- students assessed how confident they were about the content in each standard. The table below describes the mean mathematical confidence score for each standard.

Table 2: Mean Confidence Score

Standard and Description	Pre-Reflection Score	Post-Reflection Score
7.G.1.3: Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.	2.12	2.52
7.G.2.6: Solve real-world and mathematical problems involving area, volume and surface area of two- and three- dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.	2.17	2.42

8.G.3.9: Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.	2.37	2.35

As seen by a relatively high mean score, students were pretty confident with the 8.G.3.9 standard. Throughout the unit they engaged in various activities such as exploring how the volume of cylinders is similar to the volume of prisms, and volume of cones is similar to volume of pyramid, as well as exploring how the volumes of both solids are related to each other. Part of the high confidence for this standard can also be attributed to students understanding of the previous relationships established in 7.G.2.6.

For 7.G.1.3, students' average confidence level shows that were the least confident with 7.G.1.3. While students did a hands-on activity where they made parallel and perpendicular slices to determine the cross sections of various solids, it was difficult for them to visualize the cross sections determined by other types of slices. More about this is described in the qualitative analysis section.

For the majority of the standards, students said they felt more confident about the content during the unit test. For 7.G.1.3 there was a 19% increase in the confidence level, whereas for 7.G.2.6 there was a 12% increase. The exception to this was for standard 8.G.3.9 for which there was has a slight decrease (1%) in the average confidence level.
The results of the paired two-tailed t-test show a *p-value* of 0.03 meaning the null hypothesis was rejected and the data produced significant difference showing that self-reflections increased students' confidence.

Qualitative Analysis. Also included on each of the reflections sheet were open-ended questions. While we discussed what each of the numerical confidence levels meant, for many students it was still hard to numerically describe how confident they felt. The open-ended responses on the pre-reflection served as a tool to gain insights on the specific skills students learned, and skills they found to be a challenge. The third question helped students set up a specific and feasible to-do list for themselves. This self-reflection helped in engaging learners with various types of learning styles, as each student was able to come up with their own list that matched their individual requirements.

To analyze such questions, responses were categorized using two different methods. In the first method, the responses to questions 1 and 2 were analyzed using students prior and new knowledge. For the second method, student responses were sorted by whether their checklist was school or home based.

Method 1 - Standard 7.G.1.3. The majority of students had not heard about cross-sections prior to this lesson. Their responses to what they learned varied from learning about what cross sections were to naming the cross sections given a specific 3D solid. "A new concept I learned is the concept of slicing" was a common student response. Students engaged in hands-on Play-Doh activity for which they built a given 3D solid and made various slices to determine the 2D cross sections. Students were also shown online videos to help them in visualizing the non-parallel and perpendicular cross sections which can be a little difficult to visualize. One student stated that he learned "that slicing a figure a certain way can create a different shape".

While many students were able to understand how to make perpendicular and parallel cross sections, at the end of learning this standard, they were still challenged by how to visualize the various 2D cross sections. Students responses such as "how to draw the slicing to make the shape" and "finding the correct angle to make the slice" were frequently seen.

Method 1 - Standard 7.G.2.6. For this standard, students came in with a little more prior knowledge than they did with the previous standard. Students had previously been exposed to surface area and volume in different contexts such as when buying wall paint or in other content areas such as science. For this standard, the student responses were more focused on how to find these two, and in understanding the formulas. "I already knew what volume was from an experiment in science class. In this class I learned how to find it given any shape [3D solid]".

While students understood that finding the surface area meant finding the sum of the areas of each side, they often had trouble visualizing the hidden sides, and/or forgot to include that side in their calculations. One of the other concepts many students found challenging was remembering the formulas for 2D shapes. For this they said, "I just need to practice and remember the formulas, like the triangle one has 1/2". Students also had a lot of trouble finding surface area and volume of composite figures. The other area of challenge was given surface area or volume, finding the side length. For these later two concepts, it is essential for students to have a good grasp of the basic concepts which as many students shared, they needed more practice with.

Method 1 - Standard 8.G.3.9. This standard was the one that students had the most prior knowledge with. They had just learned volume of prisms and pyramids so once we explored how the volume of cylinder was similar to a prism, and volume of cone is similar to pyramid, they had a much easier time understanding and remembering it. While not frequently mentioned, a few students stated that finding the area of the base was easier this time because it was always a circle. The volume for a sphere was a little more abstract. While students were shown how the formula was derived and how it related to the other formulas, they still found that this one was different from the others.

The challenges with this standard were similar to that in the previous one. Students stated that finding volume of composite figures challenging with this one as well.
While students were able to determine what they individually learned and areas of challenge for them, an important part of the reflective process is then working on those areas of growth. For this reason, students were asked for three steps they planned on taking to prepare for the assessment.

Post-Reflection Score. While some students still found some of what was mentioned in the individual section to be a challenge, they listed many more areas of strengths compared to areas of growth. For the areas of strengths, students shared that completing items on their checklists such as reviewing notes regularly and coming in for extra help increased their confidence. For the areas of growth, the majority of students shared they needed more practice with some specific types of questions. One particular question that many students referred to asked students to find the surface area of a side of a cube given volume of the cube. While students understood the individual concepts, they had little practice with a multi-layer problem just like this one.

Method 2 - Pre-Reflection Score. For the third question, students were grouped by whether the steps they were planning on taking before the assessment were going to primarily be in class or at home. The responses to this question were pretty similar for all three standards. The majority of students said they were going to do things both at home and school. In general, students' responses were along the lines of:

At Home:

- Complete all homework assignments
- Use Khan Academy to practice concepts they were still struggling with.
- Review notes regularly using various methods including flashcards, and making a "cheat sheet"
- Work on practice problems from notes, textbook, etc.
- Using models to simulate the problems (primarily for the cross-section standard)
- Get help from tutor or family member
- Practice/ review formulas (primarily for the surface area and volume standards)
- At school:
- Pay attention in class
- Participate in group/class discussions
- Ask more questions during class
- Come for extra help

Method 2 - Post-Reflection Score. The majority of students completed about 90% of the checklist they had made for themselves. While the accountability for all the at home portion of student to-do list cannot be reliably measured (with the exception of homework), it was noticed that the majority of students who put doing homework on their checklist were ones who generally tended to complete it, so there was not a significant change. However, some changes could be noticed in students' behavior in class. Many more students were focused on taking the notes and participating in class. At times I did have to remind students of what they had put on their checklist, and this often helped some students in refocusing themselves.

From an overall analysis of both the quantitative and qualitative data, it can be concluded that engaging in this reflective process led to an increase in students' mathematical confidence. The t-test for the quantitative data shows that there is a significant difference, and from the qualitative data, from a qualitative analysis, it can be assumed that students' mathematical confidence increased after engaging in this self-reflection process.

Conclusion

As mentioned previously, there is a dearth of research on the connections between self-reflection and self-efficacy. While there is a distinction between the two, they are closely related in that both measure student's perception of themselves. As found by many of the research studies described in this literature review, there seems to be a positive relationship between students' engaging in the reflection process and their self-efficacy level and performance, and this is similar to what was found in this study. In this particular study, the process of engaging in self-reflections, did in fact result in an increase in students' mathematical confidence.

Not all students have previously engaged in this process, so as mentioned by Schunk (1996), Boud et al. (1985), for them to conduct a true and meaningful self-evaluation, it was important to first teach them the importance and the process. As mentioned by Bandura (1997), and Boud et al. (1985), reflections are a developmental and cyclical process, this is not something that can be taught or perfected overnight. Yet, as Zimmerman et al. (2011) found, which was also found in this study, this process is important in getting our students to become self-regulated learners. It is the instructors hope that through consistently engaging in reflective practices in this course, students are able to determine a reflection framework that works for themselves and they will continue to engage in that process for this course and beyond.

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Appendix A: Pre-Reflection Instrument

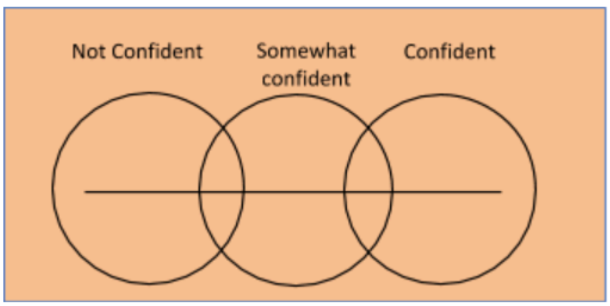
Below is a version of the researcher created pre-reflection instrument used for this study. Students were given three of these forms (one for each standard). As indicated in the findings and analysis section, the Venn-diagram was used for quantitative analysis, and questions 1 and 2 below were used for Method 1 for qualitative data analysis, and question 3 was used for Method 2 for qualitative data analysis.

Reflection

Standard:

Brief description of standard:

Place an x on the line in the venn diagram below to describe how confident you feel about the content learned in this standard. Then answer the questions below.



1. Describe one new concept or strategy you learned.

2. Explain what challenged you.

3. Describe up to 3 steps you plan to take to make sure you feel prepared to be assessed on this standard.

Appendix B: Unit Test

Below is a version of the researcher created unit test. As indicated in the findings and analysis section, the test was grouped by standards. Students' post-reflection (Appendix C) was based on their confidence on the items assessed on this test.

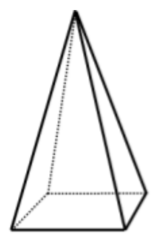
Name ______________________________________ Date ____________________ Period _______

UNIT 3 TEST: Three-Dimensional Geometry (Day 1)

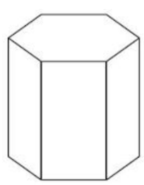
7.G.1.3: Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids. (Questions 1-3)

1. Which of the listed cross sections can be formed by the intersection of a plane and the shape below?

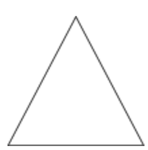
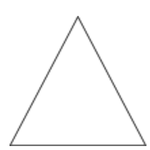
   - ☐ Square
   - ☐ Trapezoid
   - ☐ Circle
   - ☐ Triangle
   - ☐ Rhombus
   - ☐ Rectangle



2. For the solid below, sketch two cross sections. One cross section should be parallel to the base, and the other perpendicular to the base. Identify each of the cross sections and describe how the dimensions of the cross sections are related to the dimensions of the solid.

Original Solid	Parallel Cross Section	Perpendicular Cross Section
		

3. Describe a solid that has both of the following cross sections.

Parallel to the base:	Perpendicular to the base:	Original Solid
		

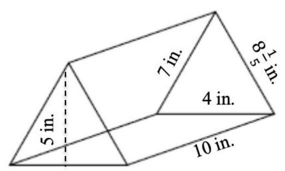
Name ______________________________________ Date ____________________ Period _______

7.G.2.6: Solve real-world and mathematical problems involving area, volume and surface area of two and three dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. (Questions 4-8)

4. What is the surface area of a rectangular box that is 12 inches × 8 inches × 10 inches?

    a. 960 in^2
    b. 592 in^2
    c. 296 in^2
    d. 200 in^2

5. Find the surface area for the figure below.



6. You have a cube that is 64 cubic feet in volume. What is the surface area of <u>one</u> of its faces?

    a. 6 square feet
    b. 64 square feet
    c. 16 square feet
    d. 36 square feet

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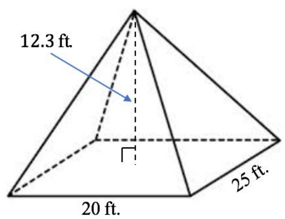
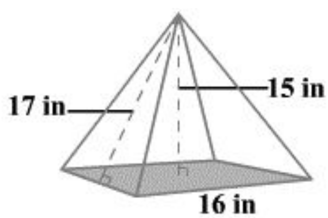
UNIT 3 TEST: Three-Dimensional Geometry (Day 2)

7. Find the volume of the pyramid shown below.



8. Find the surface area of the square pyramid shown below.



8.G.3.9: Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems. (Questions 9-12)

9. Mrs. Hartka is packaging soup in cylindrical cans. She calculated the volume of soup to be 325 cubic centimeters per can. The area of the base of each can is 25 square centimeters. What is the height to which Mrs. Hartka fills each can with soup?

    a. 13 centimeters
    b. 25 centimeters
    c. 300 centimeters
    d. 8,125 centimeters

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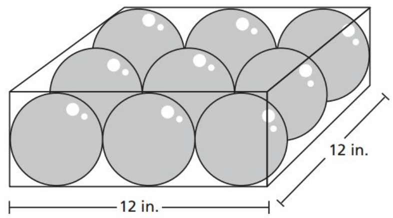
10. A box contains 9 identical glass spheres that are used to make snow globes. The spheres are tightly packed, as shown below.



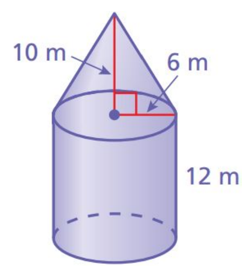
What is the total volume, in cubic inches, of all 9 spheres? Round your answer to the nearest tenth.

Volume of a sphere = $\frac{4}{3}\pi r^3$

11. The volume of a cone is 15π cubic meters. What is the volume of a cylinder with the same base and height? Explain your reasoning.

12. Find the volume of the composite solid below. Round your answer to the nearest tenth.

a. 1,733.3 m^2
b. 2,486.9 m^3
c. 1,733.3 m^3
d. 2,486.9 m^2



Appendix C: Post-Reflection Instrument

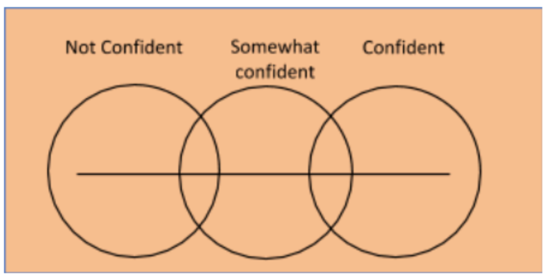
Below is a version of the researcher created post-reflection instrument used for this study. As indicated in the findings and analysis section, the Venn diagram was used for quantitative analysis, and questions 1 and 2 below were used for Method 1 for qualitative data analysis, and question 3 was used for Method 2 for qualitative data analysis.

Name: __________________________ Per: _____

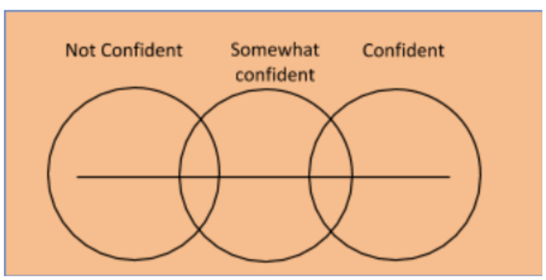
<u>Test Reflection</u>

Place an x on the line in the venn diagram below to describe how confident you feel about the questions relating to the content learned in the following standards.

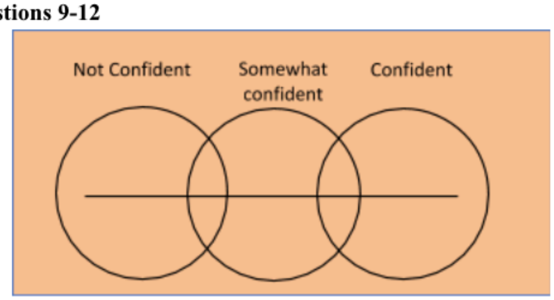
7.G.1.3: Questions 1-3



7.G.2.6: Questions 4-8



8.G.3.9: Questions 9-12



Overall Reflection: Answer the following questions about all three standards assessed on this test.

1. Looking at your responses to all three venn-diagrams, list the standard(s) you feel the most confident about?

2. Looking at your responses to the venn-diagrams, list the standard(s) that are still challenging for you?

3. Thinking back to the steps you had decided to take, describe the steps you took to make sure you felt prepared to be assessed on the standard(s) listed in question 1? What additional steps will you take to understand the standard(s) you listed in question 2?