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The Impact of Self-Assessments Used with Formative Assessments on Student Achievement

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The Impact of Self-Assessments Used with Formative Assessments on Student Achievement

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An Action Research Project Presented
in Partial Fulfillment of the Requirements
For the Degree of Master of Education

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April 19, 2020

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Abstract

Educators strive to create engaging and impactful strategies that not only improve student achievement but also instill 21st-century career readiness skills. Research has implied that through self-assessments, both student achievement and 21st-century skills are impacted in a positive way. Self-assessments can be used within the classroom as a form of formative assessments or feedback. The objective of self-assessments involves students analyzing their own work, identifying errors, and reflecting on their thinking. Student achievement, grit, and overall learning has been shown to improve through the implementation of self-assessments. For self-assessments to be successful, specific criteria needs to be implemented. The criteria includes time to understand the process, student involvement in creating rubrics, direct instruction when using the rubrics, and purposeful learning. This action research project was conducted to determine if student achievement is impacted in the 7th- and 8th-gradmathematics classroom when self-assessments are paired with formative assessments.

The Impact of Self-Assessments Used with Formative Assessments on Student Achievement

Consistent and effective feedback has been a strategy that has been proven to facilitate student achievement and learning. However, time to provide this type of feedback is not always available (Andrade & Valcheva, 2009). To combat the lack of time, self-assessments have become a strategy that teachers have implemented in their classrooms. According to Andrade and Valcheva, self-assessments are a form of formative assessment that allow students to evaluate their own work based on a rubric. When students are able to assess their own work, they are provided with immediate feedback that will potentially increase their achievement. According to Larry Ainsworth (2010), formative assessments have been shown to improve student achievement, especially when feedback from teachers or students are provided.

Within the middle school mathematics classroom, students work with concepts that require efficient and timely feedback. Through the PowerTeaching Curriculum (2015), many of the mathematic concepts build the foundation for more rigorous and relevant content both inside and outside of the mathematics classroom. Without the basic understanding of these concepts, students will potentially struggle throughout their mathematics career. To provide the feedback that is essential for student achievement, self-assessments can be an effective tool to help increase student achievement in the middle school mathematics classroom. Boston (2002) explains that when students are able to identify and explain their errors through self-assessments, they have an increased opportunity to close any gaps that were created based on their misunderstandings.

Ainsworth (2010), Boston (2002), and Andrade and Valcheva (2009) all found that feedback when used with formative assessments has positively impacted student achievement. Therefore, the use of self-assessments on formative assessments should increase student

achievement in the Mathematics Classroom. This action research project will answer the following question, “How is 7th and 8th grade student achievement in the mathematics classroom impacted by the use of self-assessments on the PowerTeaching Math Quick Checks and Cycle Checks, and Edulastic Assessments?”. For nine weeks, 7th and 8th grade mathematics students completed self-assessments on various types of PowerTeaching and Edulastic formative assessments. The self-assessments provided students with information pertaining to their areas of strength and weakness, which were used as a guide for studying for their Summative Unit Test. Through the engagement of self-assessments, 7th and 8th grade mathematics students took part in their own academic success. As an educator, this action research project provided me with another tool to improve student achievement in the mathematics classroom. Furthermore, self-assessments are a cross-curricular tool. The data provided in the action research project may potentially assist other educators in various domains with a strategy that can improve student achievement.

Review of the Literature

Educators recognize the impact formative assessments provide on student achievement in all areas of education. Formative assessments are an assessment method that educators use to gather information on student understanding throughout a unit and provide feedback based on the results (Cauley & McMillan, 2010). Formative assessments are most impactful when effective and meaningful feedback is provided in a timely manner. Cauley and McMillan’s Formative Assessment Cycle provides a clear picture about the importance of feedback when implementing formative assessments. The cycle involves a six-component process that is continuous. The process is as follows: on-going assessments, on-going feedback, instructional corrections, student motivation, on-going student engagement, work and achievement. The six

components work together to foster student achievement and understanding, feedback being one of those components. Feedback can be provided in a variety of different ways; however, self-assessments have been found to better provide students with the autonomy to more successfully master the learning goals.

The inclusion of self-assessments has impacted many aspects in student success. In a study with college level students, Hanrahan and Isaacs (2001) found that self-assessments allowed the students to think more critically about their work. Furthermore, the students felt more confident in their work when they were aware of what was going to be assessed (Hanrahan & Isaacs). Armstrong (2016) believed that through critical thinking, students would begin to further understand their own metacognition. A deeper understanding of how your brain functions allows students to better assess their tasks as well as understand how to achieve their goals (Armstrong). As students engage in more self-assessments, they are continuously thinking more critically about their own work, thus positively impacting their achievement in a variety of ways.

Although formative assessments have been found to impact student achievement, the inclusion of self-assessments has amplified its impact. Boston (2002) found that the most impactful feedback involves suggestions for improvement, as well as descriptions of errors made on the task. When feedback is used with formative assessments, students have a better opportunity to “close any gaps between the desired goal and a student’s current understanding; furthermore, it can guide them to their desired goal” (Boston). In addition to closing gaps, formative assessments, when used with self-assessments, have also proven to have more impact on low-achieving students and students with disabilities. When students are given clear criteria

of what they are expected to learn and have opportunities to reflect and revise their work, they show more academic improvement than those who do not.

Self-assessments as a form of feedback have impacted student achievement in a variety of ways. According to Andrade and Valtcheva (2009), providing feedback on formative assessments can promote learning and achievement. In a mathematical study on high school and college level students, Andrade and Valtcheva found that using self-assessments on their formative assessments had positive effects on students' achievement. The study found an increase in students' mathematical vocabulary, communication, and response details. Furthermore, increased exposure to self-assessments had an impact on students' mathematical perception and grit. Within the same study, students reported feeling more confident as they attempted challenging problems. Students also reported that through self-assessments, they were able to focus more on key elements that impacted their success, identify their strengths and weaknesses, decrease anxiety, and feel more confident (2009).

Ainsworths (2010) found that the use of formative assessments or "assessment as learning" has also been shown to improve student achievement. Ozan and Kincal (2017) found that formative assessments had both a positive impact and no impact on student achievement. However, when used with some form of feedback technique, formative assessments had a higher chance of increasing student achievement. In the same study, students' self-regulation skills were positively increased when self-assessments were used as a form of feedback. Self-regulation skills are described as "skills that require students to actively use their cognitive skills, make efforts to reach their learning goals, get help from friends or parents when necessary, and most importantly, take responsibility for their own learning" (Ozan & Kincal, pg. 109).

As student motivation and grit are increased through self-assessments, student achievement is also positively impacted (Stalling & Tascione, 1996). The researchers found that self-assessments increase students' mathematical independence and confidence. As students identified the different types of errors they made on their formative assessments, students were able to find effective ways of communicating and learning from their mistakes. Furthermore, students independently carried the process of self-assessments into other classroom tasks. Stiggins (2009) found that self-efficacy was also positively impacted using self-assessments in students in the upper elementary grades. Self-assessments, when used as assessments for learning, gave students a better understanding of their educational abilities.

The impact of self-assessments did not cease when the task at hand ended. Ross (2006) found in a study involving 7th grade students that self-assessments increased positive interactions, as well as decreased off-task behaviors. The study also found that the use of self-assessments increase self-efficacy beliefs, the ability to accomplish challenging tasks. Lehmann and Chase (2015) also found that self-assessments provide students with an opportunity to complete complex work. Through the complex work of self-assessments, students become exposed to constructive criticism. Receiving constructive criticism can be viewed as a 21st-century skill (Furman, 2017). The use of constructive criticism through self-assessments provides students with more opportunities to practice skills that will be used in the future.

Concerns of Self-assessments

Although the impact of self-assessments can be beneficial, there are some components in the process that raise some concerns. Hanrahan and Isaacs (2001) reported that college level students had a difficult time staying objective when assessing their own work; furthermore, some

students felt that their work met all the criteria and could not be assessed further. Lastly, students had a difficult time accurately completing the self-assessment when the criteria that was being assessed was not specifically taught.

In the beginning implementation of self-assessments in the mathematics classroom, Stallings and Tascione (1996) reported similar challenges. Students found self-assessments challenging and had a difficult time defining the types errors. Teachers also found it difficult to share control of assessing their work with the fear that certain students will assign lower standards when completing the self-assessments (Ross, 2006). Students also believe that it is the “teacher’s job” to assess their quizzes and the process was “boring.” Lastly, teachers feared the response they would receive from parents.

Criteria for self-assessments

Implementation of self-assessments is not a simple task. In order to effectively implement self-assessments, educators must provide certain criteria to avoid the challenges that were discussed above. Cauley and McMillian (2010) described a three-step process they [word more academically appropriate than believe? Search synonyms of believe and you should find something to substitute] provides the building blocks for successful self-assessment implementation. The process consists of the following steps: “students judge their own work, identify discrepancies between current and desired performance, and identify areas of improvement” (2010). This three-step process aligns with other argued criteria needed for successful implementation.

Other researchers have found that the implementation process for self-assessments is an essential part of its success. Andrade and Valcheva (2009) hypothesized that self-assessments

will be the most successful when the following criteria are met: students understand the value of self-assessment, have been given opportunities to self-assess, have been taught directly the process of self-assessments, use rubrics throughout the self-assessments, and are able to revise their tasks. [Good revision here.] In addition to these criteria, another important component included the students' involvement when creating the rubric. Andrade and Valtcheva included high school and college level mathematical students in creating the rubric that students used to self-assess their tasks. Dean (2012), Andrade, and Valtcheva all emphasize the importance of clear criteria when creating a rubric to be used for any self-assessment. Furthermore, student input when creating rubrics may help reduce the challenges that can occur during the self-assessment process.

Ross (2006) shared similar beliefs when implementing self-assessments. He emphasized the importance of student and teacher collaboration when creating criteria for self-assessments and shared the need for feedback on self-assessments. To maintain the reliability of self-assessments, Ross discusses the importance of staying consistent when implementing self-assessments; following the implementation process will help create positive reliability. Although reliability can be maintained with self-assessments, Ross found that the validity of self-assessments is mixed. The mixed results on the validity of self-assessments can be connected to the various judgements of students and teachers. The judgments of both teachers and students may vary in the quality with which the assessment was completed.

The literature supports my hypothesis that self-assessments have a positive impact on student achievement. Formative assessments contribute to this success; however, when complemented with feedback, formative assessments have a great impact on student achievement. To reduce the challenges that occur when implementing self-assessments, it is

essential to follow the research-based criteria described above. As self-assessments are used more regularly, the benefits they provide will hopefully impact more than just student achievement. Research has shown that self-assessments create opportunities for students to think critically, increase their metacognition and grit, and lastly understand the value of their learning.

Methods

Participants

The participants that took part in this action research project attend the River Valley Junior-Senior High School located in Correctionville, IA. This district encompasses four different communities: Quimby, Washta, Correctionville, and Cushing. River Valley Junior Senior High School (2018) has a total enrollment of 224 students, ranging from sixth grade to twelfth grade. Within this building, 95.1% of the students are white, 3.1% are Hispanic, 0.4% are Native American, 0.4% are Asian, and 0.9% are multiracial. Furthermore, 12.5% of the students in this building are on an Individualized Educational Plan (IEP), 0.4% are English Language Learners, and 46.4% of the students in this building have a low socio-economic status (qualify for free or reduced lunch).

The school day begins at 8:20 AM and ends at 3:25PM. Between those times students attend eight different courses, each lasting 43 minutes. The junior high's schedule consists of Mathematics, Reading, Social Studies, Science, Physical Education, Music/Band (optional), Study Hall (if applicable), and Exploratory. The high school schedule varies based on the credits needed for graduation. The teachers in this building teach a variety of courses, some teaching both junior high and high school courses.

There was a total of 49 participants in this study: 27 seventh graders and 22 eighth graders. In regard to the seventh graders in this study, 7% are on an IEP and 29.6% of the students participate in some form of intervention program. Of the eighth graders, 13% are on an IEP and 22.7% participate in some form of intervention program. The study was conducted during the 3rd, 4th, 6th, and 7th periods of the day during middle school math periods. Seventh graders attended mathematics class during the 3rd and 6th periods of the day, whereas eighth graders attended mathematics class during the 4th and 7th periods of the day.

Measures

Throughout this action research project, two types of quantitative data were collected and one type of qualitative data was collected. The two types of quantitative measures that were used were formative and summative assessments. The data was gathered to help answer the research question, *do self-assessments on formative assessments impact student math achievement in 7th and 8th grade students?* The data was collected over a series of eight weeks, starting on January 20th and ending on March 6th. In addition to the data collected during the action research project time period, other quantitative data were used as a comparison. Common summative and formative assessments documented prior to the action research project were included as part of the quantitative data measures.

The common formative and summative assessments used during this study were built into our current curriculum, PowerTeaching Math. The formative assessments ranged from three to seven questions, each relating to a specific standard being taught. The point value of each formative assessment varied based on the number and type of errors made based on the self-assessment rubric. The summative assessments encompassed the previously assessed standards on the formative assessments and had ten to fifteen questions. The mean score of each

assessment was collected and used to help determine impact. The mean score from the formative assessments taken prior to the study was compared to the mean score on the summative assessments taken prior to the study to determine the impact of formative assessments without the use of self-assessments. The mean score from the formative assessments taken during the study was compared to the mean score from the summative assessments taken during the study to determine if there was an impact on student achievement when self-assessments were implemented with the formative assessments.

The self-assessments were gathered as a form of qualitative data collection. The self-assessments that were used during the action research project were implemented to help identify common errors made on the formative assessments. The self-assessment rubric was created using four common Math errors and a combination of all errors. The four common errors include Carelessness, Precision, Computation, and Problem Solving. The criteria for each type of error differed slightly based on the students' contribution when creating the self-assessment rubric.

Procedures

The implementation of this action research project was to determine if self-assessments on formative assessments had an impact on student mathematics achievement in the 7th and 8th grade students. The comparison for this action research project included the common summative and formative assessments that were documented prior to the study, as well as a comparison of the mean, median, and mode of the common formative and summative assessments completed during this study. The two grade levels were chosen based on their size and familiarity with the instructional routine of PowerTeaching Math. The instructional routine of PowerTeaching Math

is taught in sixth grade and may have impacted the results due to students still learning the processes.

The study began on January 20th; however, the first piece of data collected during the study was January 29th. Prior to the first formative assessment in this study, the researcher and 8th grade students created the criteria that were going to be used for the self-assessment rubric. The students determined what types of mistakes would qualify for the four different types of errors. In compliance with the research, this process was completed prior to each formative assessment given in the study. After creating the criteria, the students then completed the formative assessment. The researcher and the students then used the self-assessment rubric to assess the students' formative assessments. Throughout the whole-group instruction, the researcher demonstrated what mistakes would qualify for the different types of errors. This was a very collaborative process with both teacher and student input. Within the 7th grade Mathematics Class, the whole group self-assessment process was implemented during all three self-assessments that were given. Within the 8th grade Mathematics Class, the whole-group self-assessment process was implemented during all three self-assessments that were completed. Due to lack of time, both classes were not able to complete the self-assessments without teacher guidance.

After the self-assessments were completed, the students then identified their most common errors and completed a self-reflection on the errors. Self-assessments were only implemented on formative assessments. To determine the impact of the self-assessments, summative assessments were implemented after the completion of the unit. The summative assessments were assessed using the same rubric as the self-assessments; however, the value of the summative assessments increased based on the number of questions and standards assessed.

The results of the summative assessments would help determine the impact of self-assessments when compared to the previously gathered quantitative and qualitative data.

Findings

The variables analyzed in this study included the mean scores on the PowerTeaching Summative Assessments. The use of the self-assessment on formative assessments were the independent variable and the impact the self-assessment had on the summative assessments was the dependent variable. The 7th Grade and 8th Grade mean scores from PowerTeaching Summative Assessments taken during the study were compared to the PowerTeaching Summative Assessment mean scores taken prior to the study using paired sample T-tests. The p-value on the T-tests, $\alpha = .05$, was used to determine any statistical significance in the mean scores. In addition to the p-value on the T-tests, a bar graph was created to show any major differences in the mean values of individual participants between the PowerTeaching Summative Assessments. The four pieces of data provided below were analyzed to determine the impact of self-assessments on formative assessments had on student achievement on summative assessments.

Figure 1 and Figure 2 represent the individual mean scores from the PowerTeaching Summative Assessments taken prior to the study and the individual PowerTeaching Summative Assessment mean scores collected during the study for the 7th Grade and 8th Grade. When interpreting the graphs, there is a slight difference in mean scores for the majority of the 7th and 8th Grade students. The majority of both 7th and 8th Grade students have a decrease in their mean scores from the Summative Assessments taken prior to the study when compared to the Summative Assessments taken during the study.

Figure 1

Individual 8th Grade Mean Scores (2020)

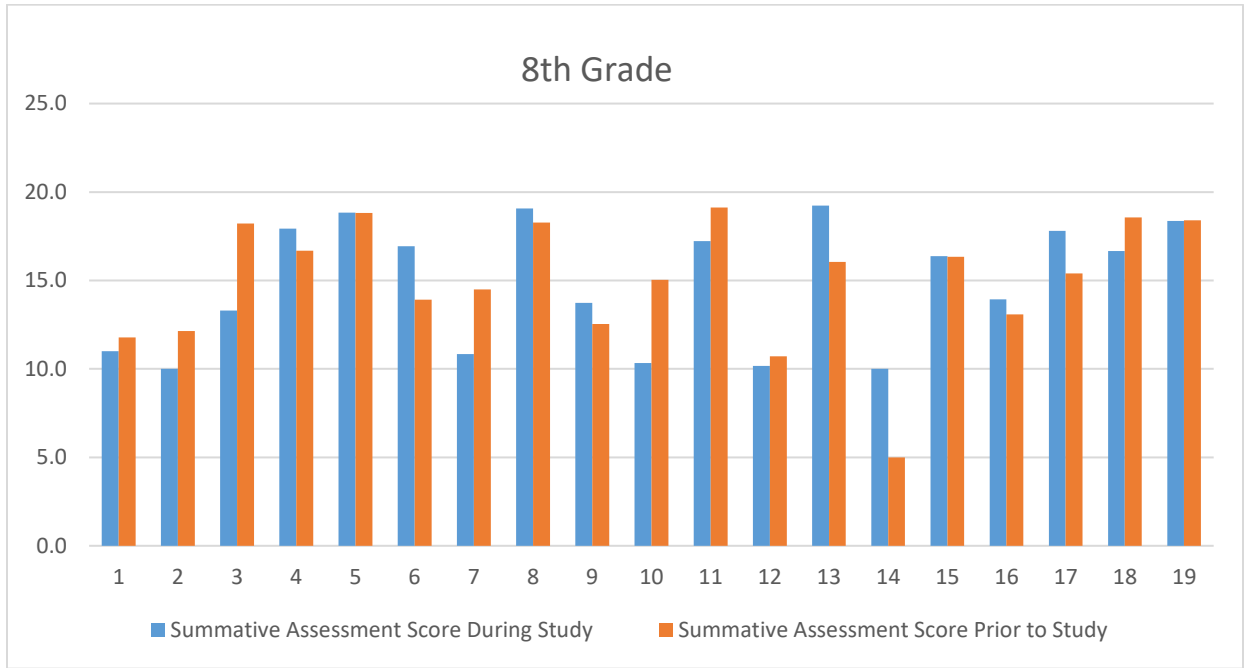
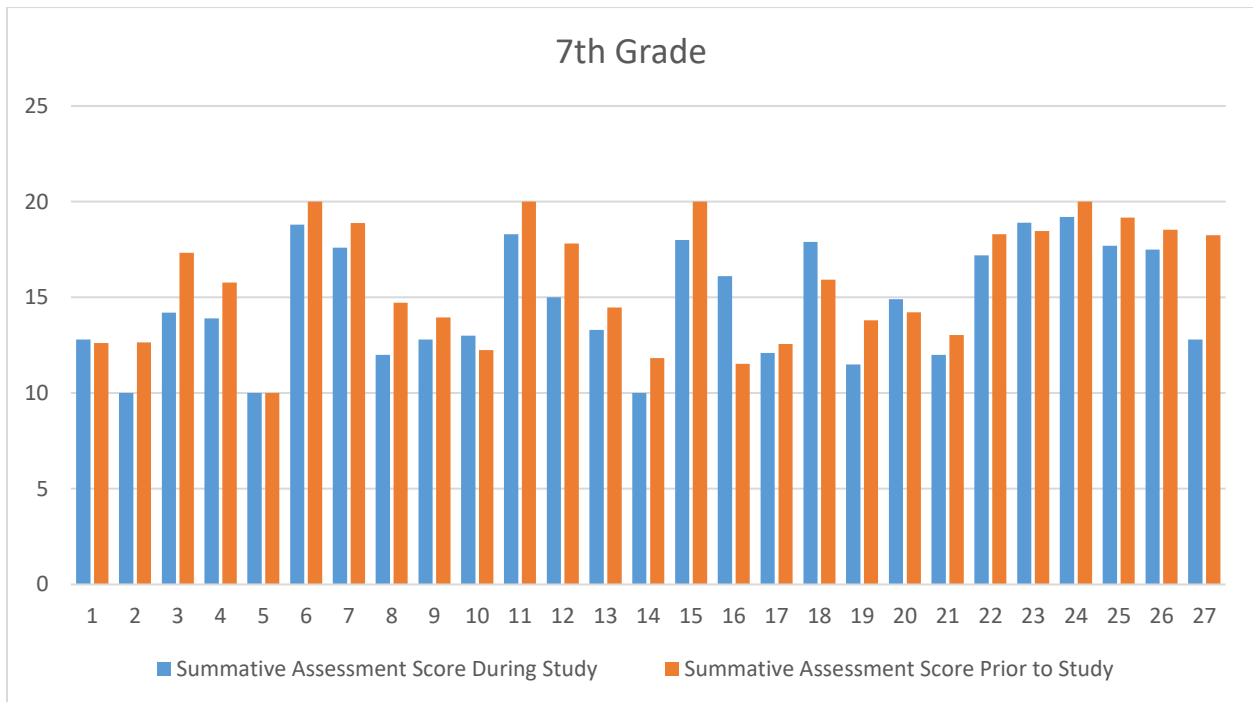


Figure 2

Individual 7th Grade Mean Scores (2020)



The data provided in Table 1 includes the number of participants in each group and the mean from the PowerTeaching Summative Assessments. When comparing strictly the mean scores from the summative assessments, there is a slight decrease from the mean scores on the summative assessments gathered during the study from the mean scores taken on the summative assessments prior to the study. The 8th Grade mean score decreased by 0.2 point and the 7th Grade mean scored decreased by 1.1 points. When analyzing the mean scores as a collected group, the mean scores showed a slight decrease of 0.6 point from the summative assessments taken prior to the summative assessments taken during the study.

Table 1*Group Mean Scores (2020)***Descriptives**

	N	Mean
8 th Grade Mean Scores Prior to the Study	19	15.0
8 th Grade Mean Scores During the Study	19	14.8
7 th Grade Mean Scores Prior to the Study	27	15.8
7 th Grade Mean Scores During the Study	27	14.7
7 th and 8 th Grade Mean Scores Prior to the Study	46	15.4
7 th and 8 th Grade Mean Scores During the Study	46	14.8

Although there is a slight decrease in the mean scores in all three categories from Table 1, the p-value from the sample T-tests was analyzed to determine any statistical significance. The p-value provides researchers a better understanding of how statistically significant their

study was when analyzing their data. If the p-value is <0.05 , there is a statistical significance between the data being analyzed; however, if the p-value is 0.05 or greater, there is no statistical significance.

Analyzing the data from Table 2, the p-value for each category varies in its statistical significance. The p-value from the 8th Grade shows no statistical significance since the p-value is above 0.05. The 7th Grade and whole group data both show statistical significance. The 7th Grade p-value is notably less than 0.05, whereas the whole group p-value is slightly below 0.05. Although both the 7th Grade and Whole Group Data showed they were statistically significant, the impact of self-assessments had the opposite impact that the researcher hypothesized.

Table 2

Paired Samples T-Test

			statistic	df	p
8 th Grade Prior	8 th Grade Study	Student's t	0.252	18.0	0.804
7 th Grade Prior	7 th Grade Study	Student's t	2.962	26.0	0.006
Whole Group Prior	Whole Group Study Data	Student's t	2.077	45.0	0.044

Discussion

Major Findings

The findings from this study indicated that self-assessments had some impact on student achievement on 7th Grade Mathematics Students; however, the impact on 8th Grade Mathematics Students was not statistically significant. Although there was an impact on student achievement

for 7th Grade Mathematics Students, the study showed a negative impact. Analyzing both the p-value and the comparisons of PowerTeaching Summative Assessments mean scores, the majority of the students did not improve their mean scores after using self-assessments on the formative assessments. When the 7th and 8th Grade Mathematics Groups were combined, the data showed that student achievement was also negatively impacted through the use of self-assessments on formative assessments.

Limitations to the Study

The study was limited in the following ways: the number of PowerTeaching Summative and Formative Assessments implemented, the length of the study, familiarity with self-assessments, and the difficulty of the content being taught. Researchers who have implemented self-assessments suggest that students participate in the creation of the self-assessment rubric; however, some students were inexperienced when using rubrics to assess their work. Having to teach this new skill required more time than previously anticipated.

The data gathered from the PowerTeaching Summative Assessments prior to the study assessed content that many of the students grasped quickly due to their ability to connect to their knowledge from the previous year. The data collected during the study assessed content that was relatively new to the students. 8th Grade Mathematics Students were assessed on Functions, a completely new unit that is introduced in 8th Grade. 7th Grade Mathematics Students were assessed on Scale Factor and Geometric Formulas, concepts that were not taught as in-depth during the previous year. The unfamiliarity of the concepts from the units assessed during the study prolonged the length of each unit to ensure students were prepared to take the assessments.

The prolonged length of each unit also limited the amount of formative assessments and summative assessments that were implemented during the study.

Conclusion

The data collected during this study did not show a statistical significance for 8th grade mathematic students but did show a negative impact for 7th grade mathematic students. However, to increase the reliability and validity of the impact of self-assessments, the time of the study needs to be increased. As students gain more familiarity with the process and expectations, the results may change to approve the researcher's hypothesis. Self-assessments have been shown to positively impact student achievement. Stallings & Tascione (1996), Ross (2006), and Ozan, C., & Kincal (2017) have all found that self-assessments have some form of positive impact on students. Therefore, this intial study does not fully disprove my hypothesis due to the previously discovered impact of self-assessment and the limitations to this study.

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