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Does the Use of Bell Ringers as Formative Assessments Affect Student Retention of Knowledge
in a Third Grade Science Classroom?

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Table of Contents

Abstract.....	3
Introduction.....	4
Literature Review.....	5
Methods.....	16
Participants.....	17
Data Collection.....	18
Ethical Considerations.....	18
Results.....	19
Quantitative Data Analysis.....	19
Discussion.....	27
Summary of Major Findings.....	27
Limitation of the Study.....	28
Further Study.....	28
Conclusion.....	29
References.....	31

Abstract

This research study explored if the use of daily bell ringers used as formative assessments increased student achievement in science. The study analyzed the effect daily bell ringers had on student summative assessment scores in a third grade science classroom. Data collection included summative assessments from a control group taught without daily bell ringers and the test group taught with daily bell ringers. The data and analysis showed there was an increase in the average class scores and amount of student's proficient with the implementation of daily bell ringers.

Does the Use of Bell Ringers as Formative Assessments Affect Student Retention of Knowledge
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The shift from state science standards to the Next Generation Science Standards (NGSS) requires students to show more depth of knowledge and understanding of content than simple rote memorization of facts. NGSS requires students to apply their knowledge to real life situations. Puttick and Drayton (2017) describe NGSS by saying,

The Framework advocates a knowledge-in-use perspective on curriculum and instruction articulated in terms of three dimensions of science: Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas. The Science and Engineering Practices describe what scientists do to investigate the natural world and what engineers do to design and build systems (students engage in practices to build, deepen, and apply their knowledge of core ideas and crosscutting concepts), and the Crosscutting Concepts help students explore connections across the four domains of science, including Physical Science, Life Science, Earth and Space Science, and Engineering Design...Performance expectations described in the NGSS integrate the three dimensions, and represent what should be assessed at the end of a grade level or grade band. (p. 344)

With students needing to show more depth of knowledge and being able to apply what they have learned for assessments, it is important for teachers to understand where students are in their understanding of the topics being taught.

Formative assessments, or assessments for learning, can be used by educators to diagnose student learning and use that information to plan instruction (Ainsworth, 2010). Bell ringers fit this definition of formative assessment when an educator uses the student responses to guide instruction, to either review with the whole class or small groups, or continue the lesson because

students have mastered the information. Bell ringers (sometimes referred to as bell work or morning work) are warm up activities a teacher has prepared for the students to complete as they enter the room. “A bell ringer is both a classroom management tool and an educational strategy to get students on task and ready to learn from the minute they walk into the room” (Boettner, 2011, p. 8). Having students actively engaged as they enter will set the tone for the class to stay on task throughout the class period. As a teacher researcher, the hypothesis that guided this action research study is that using bell ringers, as formative assessments will increase student retention of knowledge for the assessments.

Literature Review

Formative assessments are used by teachers to gauge students’ understanding of concepts taught, allowing teachers to reteach material as necessary for student understanding. Formative assessments often do not have grades given to them. Many teachers become concerned about having enough scores in the gradebooks to justify the letter grade given to students, which can lead to less formative assessments. Teachers use the data from formative assessments to modify instruction to meet the needs of the students.

Forbes, Sabel, and Biggers (2015) explored how third, fourth, and fifth grade teachers’ knowledge in the Earth Science discipline being taught influenced their use of formative assessments. The researchers followed 26 third, fourth, and fifth grade teachers from 13 schools in three different school districts in the same state. Prior to teaching the eight week Earth Science unit to students, the teachers were given an assessment to determine their knowledge of the content. The units were taught at various times in the school year. Researchers used both quantitative and qualitative methods for data collection. Through the use of assessment data, instructional logs, interviews, and observations, researchers concluded there was no correlation

between teachers' knowledge of content material and the quality of the formative assessments used. Teachers also relied on the curriculum modules to determine students' understanding of key concepts, looking for specific terminology and representations, rather than drawing upon their knowledge. In addition, although teachers used formative assessments to determine gaps in student understanding, the follow-up instruction did not target those gaps, they simply retaught the key concept. Forbes et al. (2015) concluded that teachers need to be provided more support in using formative assessments, either in preservice or professional development settings. It is also suggested that instructional materials should provide formative assessments and discussion probes in their resources.

A study done by Antoniou and James (2013) explored the use of formative assessments in four third and fourth grade classrooms. The aim of the research was to explore what teachers do that count as formative assessments, understand teachers' rationale and attitudes towards formative assessments, and to develop a framework for analysis of formative assessments (Antoniou & James, 2013). The researchers did not give a timeframe for the study, but said 24 lessons were observed. The researchers employed different methods for collecting qualitative data, including teacher interviews, classroom observations, and analyzing written feedback on student papers. Researchers found that all four teachers believed formative assessments were crucial for student learning and performed formative assessments in their classrooms, but only one captured the spirit of formative assessment modifying her instruction as needed by her students (Antoniou & James, 2013). Three teachers seemed more concerned with getting through the required curriculum before the end of the year, regardless of how their students level of understanding. Researchers found that teachers did not provide effective, descriptive feedback on students' work, an essential component of formative assessment. Antoniou and

James (2013) concluded that teachers must be provided training opportunities and support to use formative assessments most effectively.

Hollingworth (2012) studied the importance school leadership played in the implementation of formative assessments in a high school. The high school staff consisted of 38 teachers, 15 of which were on the Formative Assessment Building Leadership Team (BLT). The 15 classroom teachers on the BLT, the building's principal and the district's superintendent were interviewed and observed in this eight month study. The researcher found the leaders in this school were very supportive of classroom teachers and ongoing instructional professional development. The principal provided common planning time for teachers to plan with their subject area department teachers. This was important for teachers to have support and the ability to collaborate as formative assessments were implemented in their classes. Another key factor found by the researcher was the role the principal and superintendent took as instructional leaders. They immersed themselves into the same professional development sessions as the faculty. Hollingworth (2012) concludes "Perhaps the most valuable lesson for administrators striving to be instructional leaders is that as pedagogical practices evolve, it is insufficient for teachers to be the only staff people engaging in new learning. The knowledge base of the teacher-leader must also grow" (p. 377).

Another study conducted by Sabel, Forbes, and Zangori (2015) looked at the connection between preservice teachers' knowledge of life sciences and their ability to evaluate formative assessments. The study followed 49 preservice elementary teachers enrolled in a fifteen week course integrating life science content with instructional methods used in elementary science classrooms. Preservice teachers were given copies of elementary students' work and required to evaluate their work, including giving feedback and follow up instruction. The elementary

students' work correlated with the content the preservice teachers were learning, giving the preservice teachers background knowledge before assessing student work. Sabel et al. (2015) concluded that having a stronger background knowledge allowed preservice teachers to engage more productively in the formative assessment process and gave them insight to their students' thinking. The stronger background knowledge allowed the preservice teachers to anticipate and correct common misconceptions students had.

Types of Formative Assessments

Formative assessments can vary depending on when and how they are given to students. Some formative assessments are not planned and occur on-the-fly, because of discussions that happen during class. Formative assessments can also be planned by the teacher, such as a check for understanding, while others are embedded into the curriculum. Formative assessments embedded into the curriculum provide guidance for teachers to look for when assessing student understanding and how to follow up instruction based on gaps in student understanding of key concepts.

Steven Turner (2014) discusses five essential elements of instruction of the PILOT assessment strategy used in an assessment-centered classroom. An assessment-centered classroom is one in which "students focus on what the quiz indicates about concepts learned or concepts yet to learn" and not just on the points or grades (Turner, 2014, p. 3). Pre-assessments give teachers a baseline for students' knowledge. Teachers then use the results of the pre-assessments to identify student strengths and needs. Teachers must link differentiated classroom experiences to learning standards. Teachers must offer multiple assessments in class (formative assessments). These formative assessments may include, but are not limited to, observation cards, entrance (bell ringer) / engage / exit slips, or students made quiz questions. After re-

teaching necessary concepts, teachers give students a summative assessment. “The five steps of the PILOT assessment strategy allow middle grades teachers to gather assessment data before, during, and after instruction” (Turner, 2014, p. 15).

Martin, Polly, Wand, Lambert, and Pugalee (2015) examined teachers’ perspectives while participating in professional development to support their use of a technology program used as a formative assessment. The researchers followed 148 elementary teachers for one year as they implemented the instructional tool Assessing Mathematics Concepts Anywhere (AMC Anywhere) which focused on students’ understanding of number sense. Professional development consisted of five summer days and three online modules to extend the summer workshop. Qualitative data was collected, including pre and post teacher practices surveys and teachers’ postings on the online discussion forum, which was part of the professional development projects. Researchers found that teachers found AMC Anywhere to aid in differentiating classroom instruction. The online formative assessment allowed teachers to be more specific with data being collected, allowing teachers to differentiate instruction for students. The use of the online formative assessment allowed teachers to become more student centered and make data based instructional decisions.

Michael Romano (2011) discusses why bell ringers are an effective way to begin a class period. Bell ringers are effective formative assessments to use while teachers are taking attendance, answering questions, and collecting homework. Using bell ringers captures students’ attention and prepares the students’ brains for class, by reviewing previously taught concepts. To effectively accomplish this, teachers may need to vary the bell ringer based on the needs of the individual class. Romano (2011) stresses it is important for teachers to establish consistent routines with bell ringers to help set the tone for the classroom.

Students know the teachers' expectations when bell ringers are consistently used. Crumrine and Demers (2007) discuss how the science teachers of a high school learned to use formative assessments effectively. The teachers at this high school have embraced their responsibility to teach for understanding, not learning for the test, using formative assessments. The teachers met every two weeks to share their experiences with formative assessments over the past two weeks. The researchers provide examples of the formative assessments the teachers use, such as bell ringers, exit tickets, whiteboards, and clickers. The researchers found that the teachers are improving their use of formative assessments, regardless of the method used, and are changing their instruction based on what students need. The teachers in the study prefer formative assessments that provide anonymity because it allows students with weaker understanding of the material to have the confidence to participate, where they may not have participated in a class discussion. "Formative assessment demands that teachers willingly redirect the plan even when it is inconvenient, because learning is not about the teacher being ready; learning is about the students being ready" (Crumrine & Demers, 2007, p. 68).

Miranda and Hermann (2015) state teachers often have questions on how to effectively use formative assessment to modify instruction in real-time. The researchers walk readers through lessons on magnetism in a third grade science classroom, showing how to incorporate formative assessments. In the article, the researchers demonstrate how to elicit misconceptions students have during formative assessments, allowing teachers to modify lessons based on students' needs. Exit tickets are also used as formative assessments, giving immediate feedback to teachers, allowing teachers to review or elaborate the lessons as needed. Miranda and Hermann (2015) conclude that although integrating formative assessments in real-time instruction requires teachers to be flexible, it often results in increased student performance.

Teacher Feedback to Students

Cotton (2017) refers to Bloom's concept of mastery, where students are not allowed to move to new concepts until mastering current concepts, as the foundation of formative assessment. Formative assessments allow teachers to gauge their students' understanding of concepts and follow up with instruction to meet the gaps. Teacher feedback to students is a key element of formative assessments. Feedback should be descriptive, guiding students to the desired outcome, but still allowing students to find their way. Cotton (2017) surveyed 57 fourth and fifth grade teachers (representing 80% of the district) and the 1,177 students (representing 80% of the district) students in their classrooms. The surveys showed the teachers had an understanding of formative assessments, but did not use them effectively to enhance student learning.

Teacher feedback on formative assessments is important for students to allow students to improve their performance and understanding. Comments such as great job or good work do not provide students with direction to further their understanding of the concept. Teachers can use feedback to lead students in the right direction to help correct misconceptions they have. When discussing teacher feedback on formative assessments, Clark (2011) states:

Feedback, therefore, becomes formative when learners: a) are engaged in a process which focuses on meta-cognitive strategies that can be generalized into similar problems of varying degrees of uniqueness; b) are supported in their efforts to think about their own thinking; c) understand the relationship between their performance, their current understanding, and clearly defined success criteria; and d) are activated as owners of their own learning. (p. 162)

Effective feedback closes the gap between the students' current understanding and mastery. In order for formative assessments and teacher feedback to be effective, teachers must also follow up with instruction that addresses the gaps in student understanding.

Sathasivam and Daniel (2016) explored the influence a school environment has on teachers' use of formative assessments. Two science teachers, teaching the same material at the same school were observed. Even with the same curriculum, administration, and technology support, their use of formative assessments was very different. Sathasivam and Daniel (2016) concluded the types of questions and feedback given to students was the key difference. One teacher asked lower order thinking, closed questions and provided answers to the students rather than guiding them in their thinking. The other used higher order thinking, open-ended which required the students to improve their level of understanding. Constructive teacher feedback lets students know their strengths and weaknesses, allowing students to know what their misconceptions are.

Yu and Li (2014) examined the effects of group-based formative assessment. In this study, two sections of an eighth-grade English class in China were given a summative exam. No significant difference was found in the average exam scores between the two classes. The first class used a group-based formative assessment method to review. The class was broken into review groups of four or five students. All groups contained at least one student at each grade level: pass, good, and excellence. Students were given their exams back, and worked cooperatively to find the correct answers. After 30 minutes, students were given the correct answers. Students in the second class were given their exams back along with the correct answers, and were told to use their notes and books to find the correct answers. They were also able to ask questions for clarification. Students in the second class were also given 30 minutes to

complete the activity. Students were then given the same exam questions one week later. It was found that the students who were in the class using group-based formative assessment method scored 10% higher on the second exam than on the first exam. The second class who reviewed independently scored only 2.4% higher. This study showed that formative feedback also is effective when it comes from peers, not just the teacher.

Furtak, Kiemer, Circi, Swanson, Leon, Morrison, and Heredia (2016) followed nine high school biology teachers at three different schools for four years to study the effects of a three year professional development program, called the Formative Assessment Design Cycle (FADC). Teachers taught the same natural selection unit to be observed each year during the study. The first year was the baseline year, with no FADC intervention. Teachers participated in FADC for the following three years, meeting monthly during common planning times, at their respective schools. After planning, teachers were videotaped doing the activity with their students. The facilitator then reviewed the videotape with the teachers to look at student response, format of formative assessment activity, and how the design and facilitation could be improved. Researchers focused on how teachers' abilities to design formative assessment tasks and teacher feedback to students changed during the FADC intervention. Researchers also studied the teachers' formative assessment abilities with student learning. Because different groups of students were observed, researchers only looked at the pretests and posttests in the baseline year and year four. Furtak, et al. (2016) found that teachers' abilities to design formative assessment tasks and give feedback to students increased significantly as a result of the FADC intervention. Although the teachers' quality of questions increased over the study, it was found to not make a positive contribution to student achievement in either year. This leads

researchers to believe that asking quality open-ended questions alone may not support student learning. Teacher feedback is vital to improve student learning and retention of knowledge.

Effects of Formative Assessments

Nora Bakula (2010) performed a study to look at how using quality formative assessments affects the results of students' summative assessments. Although Bakula (2010) taught five sections of science which were given the same formative assessments, data was only collected from one section. As a teacher researcher, Bakula (2010) gave students weekly formative assessments during a thirty-day science unit. One formative assessment was performance based, while the remaining five were traditional paper/pencil assessments. The formative assessments allowed the teacher to see student weaknesses and misconceptions. The teacher researcher collected weekly data and retaught concepts as needed indicated by the students' scores on the formative assessments. The teacher researcher found that being flexible and addressing the needs of the students improved students' understanding of concepts, meeting the goal of students understanding the material, not memorizing answers. Student scores increased from the formative assessments to the summative assessments, concluding that the time spent re-teaching the concepts missed on the formative assessments increased students' understanding.

In their research on formative assessments, Curry, Mwavita, Holter, and Harris (2014) studied the impact of formative assessment on students' summative assessments, and what supports are necessary for teachers to use formative assessments effectively. Researches used a combination of qualitative and quantitative data in this study. Qualitative data consisted of interviews with teachers and administrators and observations. Quantitative data consisted of formative assessment scores and state mandated assessment scores. The researchers followed a

group of students for three years, beginning in second grade, to understand how the use of formative data influenced student scores on state tests (Curry et al., 2014). The researchers choose these grades because this district began emphasizing formative assessment data in second grade, and state testing began in third grade. Test scores over the years showed an increase in students' scores, showing that the use of formative assessments employed by the teachers were successful. Curry et al. (2014) concluded that data use is a skill that needs to be developed; mentoring and support is essential to developing these skills.

Morrison (2005) explored a different type of formative assessment – the science notebook. In this study, 44 preservice teachers kept science notebooks during their science methods classes. The focus of the study was to see how preservice teachers view using science notebooks as formative assessments and their potential use in their own classrooms. The focus of the notebooks was to be a formative assessment based on the level of communication, organization, and degree of completeness. Throughout the course, the preservice teachers began to see the science notebooks as a way to assess students' science understanding and process skills. A strong connection to literacy skills was also found in the science notebooks. Teachers need to use open-ended questions when using notebook entries as formative assessments to allow students to demonstrate their understanding and explore scientific inquiry, rather than using notebooks to record data and definitions.

Buck and Trauth-Nare (2009) worked collaboratively with a middle school science teacher to explore teachers' perceptions and use of formative assessments, student experiences, and implications of integrating daily formative assessments. As teacher educators, Buck and Trauth-Nare (2009) were interested in understanding a teacher's growth with formative assessments and being able to use that to improve their teacher education practices. Initially, the

teacher was hesitant to implement the extra writing required for effective formative assessments. The teacher relied on close-ended questions. As a result of working collaboratively with the researchers, the teacher began to understand the importance of open ended questions and descriptive feedback required for students to close the gap between students' current level of understanding and mastery of the concept. It was found that a level of trust was necessary for the students to fully accept formative assessments. They needed to know that it was ok to show their understanding, and that the formative assessments would not affect their grades in the same way as summative assessments. Dirksen (2011) states that we need to teach students "failure is OK as long as it leads to learning. There is a reset button in education. It is called formative assessment" (p. 30).

Methods

This action research study took place in a third grade science classroom. The teacher researcher taught the unit on water and climate using the third grade NGSS Full Option Science System (FOSS) Water and Climate science kit from our Northwest AEA. The teacher researcher chose the NGSS FOSS science kit because it aligns with NGSS. The assessments provided with the NGSS FOSS kit gives students real life situations that require students to apply the knowledge they have learned. This unit is broken into five investigations. Only Investigations 1 and 2 were used in this action research study. The teacher researcher teaches three sections of third grade science. Both groups were taught with the same formative assessments periodically built into the curriculum, but the test group was given the additional daily bell ringers as formative assessments.

The teacher researcher projected questions onto an interactive whiteboard for students to record answers into their science notebooks. The teacher researcher wrote questions to review

the key objective that was taught the previous day. Students wrote their original answers with a pencil. After a few minutes, the teacher researcher would lead a discussion about the correct answers. Students did not erase their incorrect answers, but made corrections with a colored pencil. This allowed the teacher researcher to see what misconceptions students had and address the topic again in a small group, or as a future bell ringer.

Participants

This action research project was implemented in a third grade science classroom. Two groups of students participated in this study. The teacher researcher used a control group and a test group because the teacher researcher found a significant difference in the percentage of correct answers in the 2017-2018 I check 1 and I check 2 summative assessments. The teacher researcher was the same in both groups. The control group occurred in the 2017-2018 school year, and the test group occurred in the 2018-2019 school year. In both groups, three classes of third graders were observed.

In the control group, there were 37 males and 34 females. All of the students range from 8-9 years old. The students' demographics consist of 60 white students, four African American students, four Hispanic students, and three Asian students. Within the control group, 14 of the students fall below the free and reduced lunch socio-economic status. In the group of 71 students, five students are on an Instructional Education Plan (IEP) for special education services in math and reading, eight students receive Title I reading services, three are on behavior IEP, and four are English Language Learners.

In the test group, there were 36 males and 29 females. All of the students range from 8-9 years old. The students' demographics consist of 56 white students, three African American students, four Hispanic students, and two Asian students. Within the test group, 11 of the

students fall below the free and reduced lunch socio-economic status. In the group of 65 students, two students are on an IEP for special education services in math and reading, eight students receive Title I reading services, one is on a behavior IEP, and two are English Language Learners.

Data Collection

The purpose of this action research study was to look at the effects of bell ringer activities used as formative assessments in a third grade science classroom. Quantitative data for the control group was collected from averaging the percentage of correct answers on the 2017-2018 class scores for I check 1 and I check 2. The control group was taught without the use of daily bell ringers as a formative assessment. Quantitative data for the test group was collected from averaging the percentage of correct answers on the 2018-2019 class scores for I check 1 and I check 2. The teacher researcher used daily bell ringers as a formative assessment for the test group.

The independent variable was the addition of the bell ringers. The bell ringers consisted of a key point that was taught in the previous day's lesson. Higher-level thinking questions were used, rather than quick answer questions. For example, "Describe why we use a thermometer to measure temperature" versus "What tool do we use to measure temperature?" Students recorded the responses to their bell ringers in the bell ringer section of Investigation 1 and Investigation 2 in their science notebooks. The dependent variable is the student retention of information taught. Student retention of information was determined using summative assessment (I check 1 and I check 2) data at the end of each investigation.

Ethical Considerations

Very little bias was included as research was conducted. The teacher researcher was the teacher for both the control and test groups. At the completion of each investigation, the teacher researcher gave a summative assessment (I Check 1 or I Check 2) that comes with the NGSS FOSS Water and Climate kit. When looking for validity and reliability of the FOSS material, FOSS (2018) states, “Using the FOSS assessment system, you can be sure that the assessments are valid and reliable” (p. 338). FOSS did not provide a Cronbach score for reliability and there is no detailed content validity process, making their claim of validity and reliability biased. Student numbers were randomly assigned (a for control group, b for test group) to ensure participants were kept anonymous throughout the action research study.

Results

Quantitative Data Analysis

Quantitative data was collected to try and answer the question does the use of bell ringers as formative assessments affect student retention of knowledge in a third grade science classroom. The teacher researcher looked at the average class scores to compare the control and test groups. Table 1 shows the results of the control group who were taught without the addition of bell ringers.

Table 1

Control group average scores for I check 1 and I check 2

Student	I Check 1	I Check 2
1a	100%	71%
2a	89%	64%
3a	100%	93%
4a	94%	93%

5a	100%	86%
6a	78%	100%
7a	94%	100%
8a	94%	86%
9a	100%	100%
10a	94%	79%
11a	100%	100%
12a	100%	100%
13a	94%	79%
14a	100%	93%
15a	94%	100%
16a	89%	93%
17a	100%	100%
18a	94%	79%
19a	78%	71%
20a	83%	93%
21a	94%	93%
22a	100%	93%
23a	89%	100%
24a	83%	100%
25a	83%	79%
26a	100%	100%
27a	100%	93%

28a	100%	100%
29a	100%	93%
30a	94%	86%
31a	100%	100%
32a	94%	86%
33a	94%	86%
34a	94%	93%
35a	89%	79%
36a	100%	86%
37a	83%	64%
38a	83%	100%
39a	100%	93%
40a	67%	57%
41a	100%	86%
42a	100%	93%
43a	100%	100%
44a	100%	93%
45a	94%	86%
46a	67%	71%
47a	100%	100%
48a	72%	71%
49a	83%	79%
50a	100%	100%

51a	89%	71%
52a	100%	79%
53a	72%	100%
54a	100%	64%
55a	94%	86%
56a	100%	100%
57a	100%	93%
58a	100%	100%
59a	100%	93%
60a	78%	93%
61a	100%	86%
62a	100%	93%
63a	89%	93%
64a	100%	79%
65a	100%	86%
66a	78%	93%
67a	100%	86%
68a	78%	86%
69a	94%	93%
70a	100%	93%
71a	100%	93%
Average	93%	88%

When looking at the 2017-2018 average score of I check 1 and I check 2, a significant difference was found:

I check 1: 93%

I check 2: 88%

This difference may be based on the content of one investigation being more challenging than the other. This led the teacher researcher to use the 2017-2018 school year assessments as the control group for the action research study because bell ringers were not used.

In order to collect the quantitative data, the teacher researcher gave two different posttests (I checks) covering material from two different investigations. The I checks were part of the FOSS Water and Climate unit. I check 1 was given at the end of investigation 1. I check 2 was given at the end of investigation 2. I check 1 was the same assessment in both the control and test groups. I check 2 was the same assessment in both the control and test groups. Table 2 below shows each student's percentage correct and the class average score.

Table 2

Test group average scores for I check 1 and I check 2

Student	I Check 1	I Check 2
1b	94%	100%
2b	78%	100%
3b	100%	100%
4b	89%	93%
5b	89%	93%
6b	100%	100%

7b	94%	100%
8b	89%	100%
9b	94%	100%
10b	94%	100%
11b	89%	100%
12b	72%	100%
13b	94%	100%
14b	89%	100%
15b	94%	100%
16b	94%	100%
17b	100%	100%
18b	78%	86%
19b	94%	100%
20b	94%	100%
21b	94%	100%
22b	72%	93%
23b	83%	86%
24b	100%	100%
25b	100%	100%
26b	89%	93%
27b	83%	79%
28b	94%	93%
29b	94%	93%

30b	89%	100%
31b	100%	100%
32b	100%	100%
33b	94%	100%
34b	78%	100%
35b	100%	86%
36b	83%	93%
37b	83%	93%
38b	100%	100%
39b	100%	100%
40b	72%	93%
41b	94%	100%
42b	100%	100%
43b	94%	79%
44b	100%	100%
45b	100%	100%
46b	100%	100%
47b	94%	79%
48b	78%	93%
49b	89%	100%
50b	83%	86%
51b	94%	100%
52b	100%	100%

53b	83%	93%
54b	83%	93%
55b	100%	93%
56b	100%	100%
57b	83%	93%
58b	100%	100%
59b	89%	86%
60b	94%	100%
61b	94%	100%
62b	83%	93%
63b	89%	100%
64b	94%	93%
65b	94%	100%
Average	92%	95%

The data for I check 1 showed the control group (Table 1) had a class average of 93% on the test with 87% (62 out of 71 students) of the class being proficient. Proficient averages the individual's score was on or above 80%. While the test group (Table 2) had a class average of 92% on the test, 89% (58 out of 65 students) of the class was proficient. This shows 2% of the class to be more proficient on I check 1 with the use of bell ringers than without the use of bell ringers as a formative assessment.

Although individual student scores were not compared in this study, the highest score in both groups was 100% on I check 1. While the class average for the test group was 1% lower

than the control group, the lowest individual score increased from 67% for the control group to 72% for the test group.

The data for I check 2 showed the control group had a class average of 88%, with 76% (58 out of 71 students) being proficient. The test group had an average of 95%, with 95% (62 out of 65 students) being proficient on I check 2. This shows an increase of 19% of students being proficient with the daily use of bell ringers. The class average increased 7% with the use of bell ringers as a formative assessment.

When looking at individual student scores, the highest score in both groups was 100% on I check 2. The lowest score increased from 64% for the control group to 71% for the test group with the addition of daily bell ringers as formative assessments.

Discussion

Summary of Major Findings

The data of this action research study showed that using daily bell ringers as formative assessments did increase assessment scores in a third grade science class. The largest quantitative difference was seen in the number of students proficient on I check 2, which had a significantly lower class average in the control group than I check 1 control group, leading the teacher researcher to believe the content was harder for the third grade students. The test group's class average for I check 2 actually increased as compared to the I check 1 score, showing that the daily bell ringers improved their score on what was thought to be tougher content.

Both the control group and the test group were taught with the use of the same formative assessments embedded into the FOSS Water and Climate unit. The only difference was the addition of the daily bell ringers, giving the teacher researcher a daily gauge of the students'

understanding of the material being taught. This daily review / assessment allowed the teacher researcher to immediately address any misconceptions or gaps in understanding the students had.

“If you engage student’s right when the bell rings, the transition into class time is likely to happen quickly and smoothly” (Romano, 2011, p. 14). The use of daily bell ringers projected on the interactive whiteboard when students entered the room allowed the teacher researcher to engage the students as attendance was taken and supplies for activities were prepared for the class. The teacher researcher then led a discussion about the bell ringer and transitioned into the daily activity.

Limitations of the Study

Limitations of this study include that although student demographics were similar, different groups of students were used in the control and test groups. The teacher researcher was not able to use the same group of students due to a significant difference in class averages on I check 1 and I check 2 in the control group. Due to scheduling conflicts, the teacher researcher taught the control group the FOSS Water and Climate unit in December – February. The unit was taught in September – November for the test group. This could account for the 1% decrease in I check 1 results, as students were still learning procedures and routines. This could also account for the 6% increase in students proficient in I check 1 and I check 2 for the test group, as students had become familiar with the routines and procedures of the classroom.

Further Study

Implications for further research include using bell ringers as a classroom management tool. “A bell ringer is both a classroom management tool and an educational strategy to get students on task and ready to learn from the minute they walk into the room” (Boettner, 2011, p. 8). This research could include using bell ringers to decrease wait time between students entering the classroom and students being on task (answering bell ringers). Research could also

include tracking behavior issues to see if engaging students as they enter the classroom affects behavior in the class period.

Research into different types of formative assessments could also be looked at to see if there is a difference in the type of formative assessment used. Bell ringers show the students' understanding a day after the lesson has been taught, while exit tickets show the immediate understanding. Implementing a pretest before each investigation in the control and test groups would also allow for more specific data to analyze.

Future research studies could be done to look at different types of teacher feedback and the implications it has on student performance. The use of teacher feedback is a key factor in using formative assessments effectively. Research has shown that the teacher's background knowledge has an effect on the teacher being able to anticipate student misconceptions and being able to provide more thorough feedback.

Conclusion

Formative assessments are a vital tool for teachers to use to improve student learning. The use of formative assessments allow teachers to get a snapshot of where their students' understanding of material is. There are many types of formative assessments that teachers can use. The type of formative assessment used does not determine the effectiveness of the formative assessment. Teachers must use what they are comfortable with in their classroom, and availability of resources may determine what formative assessment a teacher uses. There are many factors to consider when using formative assessments, but effective teacher feedback is a key element. "Constructive feedback let students know their strength and weaknesses of their work rather than simply providing the students with the right answer" (Sathasivam & Daniel, 2016, p. 14).

Throughout this action research project, the teacher researcher explored the use of formative assessments on student retention of knowledge in a third grade science classroom. The teacher researcher used various formative assessments. The formative assessments were the same in the control and test groups, with the exception of daily bell ringers used only for the test group. The test group showed an improvement in both summative assessments. The addition of daily bell ringers proved to be an effective addition to the unit of study, supporting research stating formative assessments are effective in increasing student knowledge. Daily bell ringers allowed the teacher researcher to address any misconceptions the students had about previous lessons. The teacher researcher also found them to be an effective way to gauge the understanding of students who had been absent. The teacher researcher was immediately able to see what misconception the absent student had, or know that the student understood the concept and did not need further instruction.

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