

Student Perception of the Effects on Student Learning of Homework, Warm-Ups,  
Class Discussions, and Quizzes as Formative Assessments

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A Special Project

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Dr. Gretta Merwin

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FACULTY APPROVAL

Student Perception of the Effects on Student Learning of Homework, Warm-Ups,  
Class Discussions, and Quizzes as Formative Assessments

Approved for the Faculty

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## ABSTRACT

This research focused on student perception of the effectiveness of four formative assessments. The purpose was to determine if formative assessments should be altered or replaced to increase student learning. The researcher examined both the impact on student learning, and how the teacher used the results of formative assessments to adjust future instruction. Participants for this study were students in the researcher's Honors Algebra/Trigonometry 3-4 classes who responded through a questionnaire. The data showed that students believed homework, quizzes and class discussions were the most effective, and warm-ups were effective but to a lesser extent. Additionally, the data showed that students believed the teacher adjusted instruction as necessary but only to a moderate extent.

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## CHAPTER 1

### Introduction

#### Background for the Project

In the teaching and learning world, there were three kinds of assessments: pre-assessments, formative assessments and summative assessments. These tools measured what students knew before, during and after a learning experience. The focus of this research was on formative assessments. Formative assessments not only measured knowledge through the learning process but were an integral part of it. They were a learning tool themselves and were designed to promote learning and make students better at the skill/concept/objective being learned.

Formative assessments also served an instructional purpose for the teacher. Teachers used the results of such assessments to inform their practice. These assessments allowed teachers a window into their students' understanding during the learning process so that interventions and extensions could be implemented as necessary before the summative assessment.

#### Statement of the Problem

An effective formative assessment fulfilled two key components. First, it acted as a learning tool for the students, enhancing their knowledge and increasing their performance on the summative assessment. Also, it informed the teacher's instructional decisions.

However, in order for formative assessments to have these characteristics, they needed to be well-designed and implemented properly. If misused or designed poorly, formative assessments could be viewed as busy work, hoop jumping, or points to be earned. In order to maximize students' potential, it was necessary to examine the effectiveness of formative assessments to ensure students' time was not wasted with busy work when it could be filled with learning.

#### Purpose of the Project

This project examined student perception of homework, warm-ups, quizzes, and class discussions as formative assessments, and the effect they had on each student's learning. The goal was to determine the perceived effectiveness of each type of formative assessment so that effective formative assessments could be continued and ineffective formative assessments could be altered or removed.

#### Delimitations

This research took place in the spring of 2011 at a high school in southeastern Washington State. The school had 1428 students as of May 2010, of which 71.2% were white, 21.3% Hispanic, 4.4% Asian/Pacific Islander, 1.4% black, and 0.7% Native American. Free or reduced meals were provided to 33.9% of students (Office of Superintendent of Public Instruction, 2010).

Within this school, the subjects of this research consisted of 82 volunteer students from four sections of the researcher's Honors Algebra/ Trigonometry 3-4 classes. The formative assessments used were designed by the researcher.

### Assumptions

The research was based on several assumptions. Based on training through course work, professional learning communities and research of literature, the researcher created adequate formative assessments. The researcher assumed homework, quizzes, warm-ups and class discussions were used regularly in the classroom and every student in the study participated in each of those assessments. Research data was collected from student responses to a questionnaire; it was assumed that all responses were honest and forthright.

### Research Question

According to student perception, what formative assessments (homework, quizzes, warm-ups and class discussions) most effectively led to student learning in Honors Algebra/ Trigonometry 3-4?

### Significance of the Project

The results of this project were pertinent to the researcher, the students and the school at large. From this project the researcher determined the efficacy of each of the formative assessments used. This project was conducted to promote effective forms of formative assessment and eliminate or modify less effective forms of assessment. The results of the research could be used by participants to

reflect on their learning and determine what effect each assessment had for them. The school at large potentially could benefit from this research through new knowledge that could easily be shared with other teachers to improve formative assessments and ultimately student learning.

### Procedure

The researcher started with the idea of formative assessment in mathematics, and began a literature review on the topic. The literature review was influential in narrowing the topic and defining a significant research question.

The researcher used the research question to determine what methodology would be most useful. The researcher believed the best way to answer the question was through an experimental design. Each assessment could have been isolated and tested. However, in isolating the assessments, other forms of assessment would be left out, depriving students of educational opportunities and creating an ethical dilemma. This led the researcher to conclude that using a survey would be the best method.

With the methodology decided, the next step was to design how the research would be carried out. This included writing a letter of introduction/permission to participants and writing the survey from which data on formative assessments would be collected.

The research was then conducted, surveys were completed and data collected. The final step was to analyze the data and draw conclusions and recommendations from it.

### Definition of Terms

class discussions. Class discussions were open question and answer time during class. Questions were typically from the previous day's homework or notes.

distributive property. The distributive property stated the product of a number and a sum equaled the sum of the products, for example

$$a \cdot (b + c) = a \cdot b + a \cdot c.$$

formative assessment. Formative assessment was assessment during learning and provided feedback to students and teachers.

homework. Homework was daily assignments composed of problems chosen by the researcher from the course text book, *Holt Algebra 2*, to be started in class and completed by each student at home.

Likert scale. A Likert scale was a scale to indicate the level of agreement with a particular statement that included strongly agrees, agrees, is undecided, disagrees, or strongly disagrees.

pre-assessment. Pre-assessment was assessment that took place before learning and determined prior knowledge of the students.

professional learning community. A professional learning community was a group of educators working collaboratively to improve student learning.

quiz. Each quiz assessed students on all objectives from half of a chapter. The problems on each quiz had a similar problem on the test.

score replacement. Score replacement was a grading method that required multiple assessments on the same topic. If a student achieved a higher score on a subsequent assessment that score replaced the former score.

summative assessment. Summative assessment was assessment of student learning after the learning process was complete.

teacher effect. The teacher effect explained the difference in student outcomes in two groups of students with the exact same learning activities, the only difference being the teacher.

warm-ups. Warm-ups were problems either from the text or created by the researcher; all warm-up problems were either a review of the previous day's topic or a review of needed skills for that day's topic and completed at the start of each class.

## CHAPTER 2

### Review of Selected Literature

#### Introduction

The world of education has been continually pushed in the direction of research-based methods and data-driven decisions. Formative assessments have provided educators with tools that were research-based and provided data from which to make informed decisions (Heritage, Kim, Vendlinski, & Herman, 2009).

This research focused on the relationship between formative assessments and student learning. Through the research, four themes appeared: what were formative assessments, how have they influenced learning outcomes, could formative assessments impact motivation, and how have teachers responded to formative assessments.

#### Formative Assessment

Current literature on the topic of formative assessments provided several different perspectives on what the term formative assessment really means. The literature also had an abundance of ideas to make formative assessments most effective. When used freely, there was vast disparity in the meanings of the term formative assessment (Black & Wiliam, 1998). When used strictly as guided by a stated definition, to have been considered a formative assessment two components had to be met. First, formative assessments informed students of their own learning, meaning they were assessments for the learners, and second, they guided

the teacher's future instruction (Heritage et al., 2009; Nichols, Meyers, & Burling, 2009; Stiggins & DuFour, 2009).

The definitions given according to some authors required formative assessment to conform to stricter standards. According to Nichols, Meyers, and Burling (2009), evidence collected as formative assessment not only must have identified a gap in learning, but suggested actions that would be successful in closing it. Another author proposed that formative assessment was “a systematic process to continuously gather evidence and provide feedback about learning while instruction is underway” (Heritage et al., 2009, p. 1).

Despite the minor differences, most authors agreed that formative assessments could come in many various forms. They could be quantitative or qualitative, formal or informal. Some of the same instruments could be viewed as either or not even as a formative assessment based on how they were used. For example, a homework assignment that did not inform the teacher's practice would not be considered a formative assessment. However, if it informed his/her practice, it could be quantitative if it was graded for correctness, or qualitative if it was to gain insight into the level of students' understanding. An example of an informal formative assessment was evidence gathered on a moment by moment basis, such as during a class discussion, provided that the teacher used that information to make instructional decisions.



This led to the question, if formative assessment could take so many faces, what made a quality formative assessment? First, clear learning targets were established. Second, there was a commitment to standards-based instruction. This type of instruction was based on the idea that all students have multiple opportunities to learn. Third, assessments were high quality, and this was a heavy task. Some characteristics of high quality formative assessments included an assessment method that was appropriate for the learning target, fair grading techniques with a scoring guide or rubric, enough sample items to represent learning, and anticipation and elimination of potential sources of bias. The fourth characteristic of quality formative assessment was effective communication. This meant that the results of the assessment were delivered in a timely manner to the recipient, which could be student, teacher, or administrator, and that the communication was clear so that action could be taken by the recipient (Stiggins & DuFour, 2009).

To achieve this, educators needed to be proactive in all aspects of their teaching. Instruction was well laid out and assessments made to measure learning outcomes in such a way that action was implied from the assessment results. Students needed to understand the appropriate interventions to ensure the mechanisms for action were in place before they were needed. This allowed the function of formative assessment use of information to inform decisions and improve student achievement (Nichols et al., 2009).

## Learning Outcomes

Formative assessments proved to be powerful tools for teachers to promote student achievement (Stiggins & DuFour, 2009; Black & Wiliam, 2010). This led to several questions about formative assessments and their use.

If formative assessments increased achievement, then did more formative assessments increase achievement more? According to the research, the answer was yes, but there were some limitations. Increased frequency of formative assessments did increase student achievement. However, there came a point when the gains started to level out, and then actually dropped. In a study conducted by Peterson and Siadat (2009), the researchers tested increased formative assessments in the form of quizzes with immediate direct feedback in a community college math class that met twice a week. They divided students into three groups: no quizzes, a quiz once a week, and a quiz twice a week. They found that students with one quiz and immediate feedback performed higher than the other two groups, and the twice per week group performed in the middle. This outcome was consistent with other similar studies (Black & Wiliam, 2010).

Did formative assessments help all student groups equally? Formative assessments did help all students. However, Black and Wiliam (2010) provided evidence that improving formative assessments helped low achievers more than other student groups. This meant that formative assessment not only raised student achievement but also helped to close the learning gap.

## Motivation

While research had shown that motivating students was difficult to do, several researchers linked motivation and formative assessment. The most proven effectiveness of motivation was shown by increasing resources in the form of increased individual attention, additional preparation, or redesigning curricula, and by the teacher effect (Vaden-Goad, 2009).

Two means to motivate students were identified that required neither the teacher effect nor an increase in resources. Rather, they used formative assessments in different ways. The method of motivation outlined by Vaden-Goad (2009) required only one prerequisite for implementing this assessment strategy. The course must have used multiple assessments on the same topic. The method was called score replacement, and provided motivation for students to learn. For example, if a course had a quiz and then a test on the same learning targets, a higher score on the test replaced the quiz grade. The idea was that having a second chance provided students the motivation to keep trying. Vaden-Goad (2009) found score replacement was an effective learning tool because it improved student motivation, retention, and performance. However, for some students who already had negative views of mathematics, this process only prolonged their agony before they gave up and increased their disdain for mathematics. The goal then of the teacher was to take advantage of this prolonged period before the student gave up and intervene.

Another method for using formative assessments as motivational tools was self assessment. Stiggins and DuFour (2009) suggested creating partnerships with students in their own assessment. This was done through a variety of means. Teachers enlisted the help of students in monitoring their own growth toward mastery of the learning targets. This helped students take ownership of their learning. Students wrote practice assessments which helped them better understand what the learning targets were, so they were more able to set clear learning goals and it was easier for students to attain them. Also, students were involved in the record keeping process, helping them feel more connected and personally responsible for their learning. Overall, these partnerships with students not only increased motivation, but had a significant positive impact on learning.

### Teacher Response

The way in which the teacher responded to formative assessment had great potential to increase student learning. However, acting on the result of an assessment was the most difficult phase of formative assessment (Heritage et al., 2009).

In a report written by Heritage and others (2009), the evidence collected from teacher evaluations suggested teachers were more effective in determining a student's level of understanding than they were of determining what to do with that information. For example, one concept teachers were evaluated on was the distributive property. The average score for teachers to identify the concept was

2.06, from a 4 point rubric. The average score for ability to determine student's understanding was 2.16, while the score for a teacher's ability to plan further instruction was only 1.21. The researchers provided evidence that scores in different categories could be transferred equivalently. Based on this evidence, the researchers also concluded that teachers needed knowledge of how understanding of a concept progressed as the concept grew in complexity, for example, as the distributive property progressed from real numbers to variables, and not just knowledge of a student's understanding. Using assessment data to inform teaching practices was a responsibility of all teachers and teachers were not as proficient at this as they needed to be. Furthermore, the researchers indicated a remedy for this problem; they suggested that teachers needed better understanding of concept progression.

When teachers were trained well and acted on formative assessments, great things happened. While the state average was 71%, at Snow Creek Elementary School in 2004, as discussed in Stiggins and DuFour's research (2009), 40% of students passed the state's reading exam. The principal reacted by organizing the staff into collaborative teams using a professional learning community model, and assigned each team to develop common, frequent formative assessments. Then, they were instructed to monitor student progress and intervene when students struggled. This school used a complicated system of interventions that involved multiple regroupings of students based on their needs.

On a particular standard, high achieving students received an enrichment activity, while lower students received additional practice and remediation. In just two years, the passing rate for the reading exam at Snow Creek Elementary School jumped to 96%, and math jumped from 70% to 100% (Stiggins & DuFour, 2009).

Furthermore, the success of Snow Creek could be explained because the teachers used assessment information as a component of a coordinated system of assessment and instruction (Nichols et al., 2009). Teachers were proactive in planning and had a plan in place before the need was evident to react to any assessment outcome for each learning target.

The most powerful tool from formative assessment, which, according to the research, was easily overlooked, was that action had to be taken based on the results of an assessment. For students, that meant they needed to study harder or they found a study strategy that worked for them. Teachers needed to intervene, revisit topics, or perhaps find that they could speed up instruction. The key to unlocking the power of assessment was action.

### Summary

Formative assessments had been essential to proper teaching and learning (Peterson & Siadat, 2009). Formative assessments served the purpose of providing data for, not of, student learning and they incorporated actions (Nichols et al., 2009). Formative assessments also provided students with motivation (Vaden-Goad, 2009). These tools allowed teachers a window into their students'

understanding, so further instruction was enhanced. The problem with formative assessments had been implementing them effectively. Many teachers were proficient at using them to see where students' understandings were, but had difficulty using that information to inform instruction (Heritage et al., 2009).

Using assessment data to inform teaching practices had been a responsibility of all teachers. Research suggested that teachers needed a better understanding of concept progression, and more generally needed to have appropriate training (Heritage et al., 2009). One way to ensure quality assessments and their implementation was through Professional Learning Communities as described by Stiggins and DuFour (2009), where teachers supported and worked with one another and agreed on standards and methods that improved student learning. Teachers needed a plan in place when students showed they did not understand, or had partial understanding. Teachers also needed to act when a student met an objective.

Research on formative assessments had shown that they raised student achievement. There were three keys to making formative assessments effective. First, high quality assessments needed to be created. Stiggins and DuFour (2009) suggested one way to do that was through collaborative teams. Second, the assessments must have provided data that clearly showed student comprehension, or lack thereof. Finally, and most importantly, the data must have led to

instructional action to increase student learning (Heritage et al., 2009; Nichols et al., 2009; Peterson & Siadat, 2009; Stiggins & DuFour, 2009).



## CHAPTER 3

### Methodology and Treatment of Data

#### Introduction

To answer the research question, according to student perception, what formative assessments (homework, quizzes, warm-ups and class discussions) most effectively led to student learning in Honors Algebra/ Trigonometry 3-4, a qualitative method was necessary. The researcher chose to utilize a questionnaire to collect both numeric data, in the form of responses to statements, and verbal data in the form of written comments. The numeric data was treated statistically, and the comments were organized and analyzed.

#### Methodology

The researcher believed an experimental method would have been the best choice to determine the effectiveness of each formative assessment because each could be isolated to determine its effect. However, this was not possible because the researcher also believed, and the literature supported, that all formative assessments worked together for the good of student learning. This would have made an experimental method unethical, as it could cause harm to the subjects by depriving them of learning opportunities.

Instead, the researcher focused on student perception and chose a qualitative methodology to allow the classroom to function normally. The research required students' opinions and feedback. Therefore, the researcher

composed a questionnaire, based on the Likert scale, which addressed the effectiveness of the four types of formative assessments being utilized. In addition, as noted in the literature review, one key to effective formative assessment was using assessment results to inform future instruction. For that reason, the questionnaire asked students to reply on items that focused on how the teacher adjusted instruction based on each formative assessment. The questionnaire also included a section for comments to elicit an indication of why students believed the way they did.

### Participants

Participants for this research were volunteers from the researcher's Honors Algebra/Trigonometry 3-4 classes. The participants ranged from freshmen to juniors in high school, with the majority being sophomores. Among the four classes the researcher taught, there were a total of 91 potential participants. Of that, there were 82 students who completed surveys for research, making a 90% return rate. The reasons that some students did not participate included choosing to not participate, absence on the day the survey was taken, and failure to return the survey. The participants' identities were kept confidential.

### Instruments

Data was gathered through a student questionnaire which addressed the four types of formative assessments being utilized in the classroom. The questionnaire requested students to reply with their level of agreement to eight

statements about formative assessments. They responded by choosing a level of agreement according to a Likert Scale. Also, the questionnaire included a section for students to write comments as to why they responded the way that they did. The survey was included in the appendix of this paper.

Issues of validity and reliability of the survey were addressed. The survey was given at the end of the year, and the students and teacher had built a good rapport and a safe environment to allow students to respond honestly. Therefore, the researcher believed the survey was descriptively valid, meaning that the survey accurately measured how students perceived formative assessments. However, the interpretive validity may have been more questionable. The students were asked to respond to statements regarding how the instructor adjusted instruction based on the outcomes of formative assessments. Students may not have been fully aware of the teacher's adjustments and teaching strategies because they were not pedagogically trained, and some adjustments happened outside of the classroom and out of the presence of students. So while the data may have shown the true opinions of the students, the students may not have been completely informed to provide truth in their opinions.

The reliability of the questionnaire was difficult to establish as the survey was only given once. Regardless, the questionnaire followed recommendations for reliability, such as, it was well laid out, written in easy to understand language and very straight forward (Gay, Mills, & Airasian, 2009), so the researcher

expected that the results would remain consistent if the questionnaire were repeated.

### Design

Specifically, the researcher chose to investigate the research question using a qualitative questionnaire. This was chosen because it allowed the researcher to collect a large amount of data, and from nearly every student, in a very short period of time. This avoided large disruptions in class time, and did not limit the research to students able to meet outside of class.

The researcher was careful to follow recommendations for developing and presenting questionnaires, including: make an attractive document, carefully proofread, avoid a lengthy questionnaire, use structured items with a variety of possible responses, and allow for comments (Gay et al., 2009).

### Procedure

The first step to conduct this research was to implement and use formative assessments in the classroom for an extended period of time. For this research, the formative assessments were used consistently for an entire school year before data was collected. This was achieved in the following ways.

Homework was assigned every day and checked for completeness the day after it was assigned. Homework assignments reflected each lesson's objectives and prepared students for quiz and test items. Homework assignments aided the

teacher in making decisions about pacing, re-teaching, and motivational methods, and parents were contacted if the student's effort was insufficient.

Each day, when students entered the classroom, they were presented with a warm-up. The warm-up consisted of a selection of problems on the whiteboard that typically satisfied one of two conditions. First, the warm-up may have included problems that were similar to problems from the previous day's homework assignment to check for understanding. Or, the warm-up may have included questions from much earlier learning, such as from a previous chapter of study or even a previous course, which represented prerequisite skills for the current day's topic. The purpose of the warm-up was to get students in the math mindset, allow the teacher time to circulate the classroom and check each student's homework, and to assess students' knowledge. Students were chosen at random to present their solutions to warm-up problems to the class, and discussion of the problems followed. Information gathered from the warm-ups allowed the teacher to adjust instruction, fill in apparent knowledge gaps, and correct mistakes in students' thinking.

Each day in class, following the warm-up, students were able to ask questions and engage in a class discussion about the warm-up problems and the homework. This time was usually limited to about five to ten minutes, but was extended based on the need, and sometimes filled the majority of a class period. The teacher used the class discussions to adjust class time and pacing, clarify

concepts, adapt the lesson for subsequent class periods, and adjust teaching strategies and explanations.

The final formative assessment, quizzes, were implemented in the following manner. Each quiz represented the objectives from one half of a chapter. There were two quizzes per chapter. Quizzes were typically ten to fifteen questions in length, and open response. The items on each quiz also directly correlated to the items on the chapter test, meaning they were the same types of problems, only with changes in the numbers and/or scenarios. Quizzes were always graded for correctness and returned to the student before the test to allow them the opportunity to learn from the quiz. Quizzes were graded using a variety of methods throughout the year. The quizzes may have been graded by the teacher, the student, or a classmate, depending on time constraints and stylistic choice. The teacher used the quiz data to aid students in reviewing for the test, fill in knowledge gaps, and clarify understandings. In at least one instance, quiz data led the teacher to postpone a test to allow time to re-teach topics.

After nearly an entire school year, students were given a questionnaire to determine how they perceived the effectiveness of each formative assessment and how they perceived the teacher adjusted instruction based on the outcomes. Students were encouraged to write comments to provide clarity as to why they responded in the manner they did.

### Treatment of the Data

The questionnaires were each given an index number 1-82. Data collected from the questionnaire was in two forms, numeric and verbal. Each was treated differently.

The numeric data represented the level of agreement of the student with each statement. The raw numeric data was entered into a spreadsheet on Microsoft Excel. For each of the eight statements, the frequency of each possible response was counted, and a graph created to visually represent all of the responses for each statement. Also, the mean value of responses was calculated for comparison.

Each survey was then indexed based on comments concerning each of the statements. The researcher organized the surveys by comments to analyze them by reviewing comments on each statement one at a time. The researcher took notes while reviewing comments to track common ideas and themes. Then, the researcher re-read the comments to verify the accuracy of ideas and themes gathered from the surveys before drawing conclusions.

### Summary

This research was conducted qualitatively using a questionnaire to determine students' perceptions of the effectiveness of four types of formative assessments utilized in the researcher's classroom. The questionnaire gathered both numeric and narrative data to determine students' opinions, and a sense of

why students held the opinions they did. The keys to reproducing this research would be to implement the formative assessments in a similar manner for a sufficient period of time and with a similar group of students at a similar level of mathematics. The data was treated statistically, and narratives were organized and analyzed in order to draw conclusions from them.



## CHAPTER 4

### Analysis of the data

#### Introduction

This research set out to determine the effectiveness of four formative assessments, homework, warm-ups, quizzes, and class discussions, as perceived by students in the researcher's Honors Algebra/Trigonometry 3-4 classes. The basis for the project was to determine if formative assessments were effective or ineffective so that ineffective formative assessments could be altered or removed. The research also explored how well the teacher used formative assessment data to make educational decisions and adjust teaching as needed, because this was a key component in effective formative assessments

#### Description of the Environment

This research took place in the spring of 2011 at a high school in southeastern Washington. Participants were volunteers from the researcher's Honors Algebra/Trigonometry 3-4 classes. There were 82 volunteers that participated in the study. The materials used in the study included the course text book, *Holt: Algebra 2*, and materials created by the teacher.

#### Research Question

According to student perception, what formative assessments (homework, quizzes, warm-ups and class discussions) most effectively led to student learning in Honors Algebra/ Trigonometry 3-4?

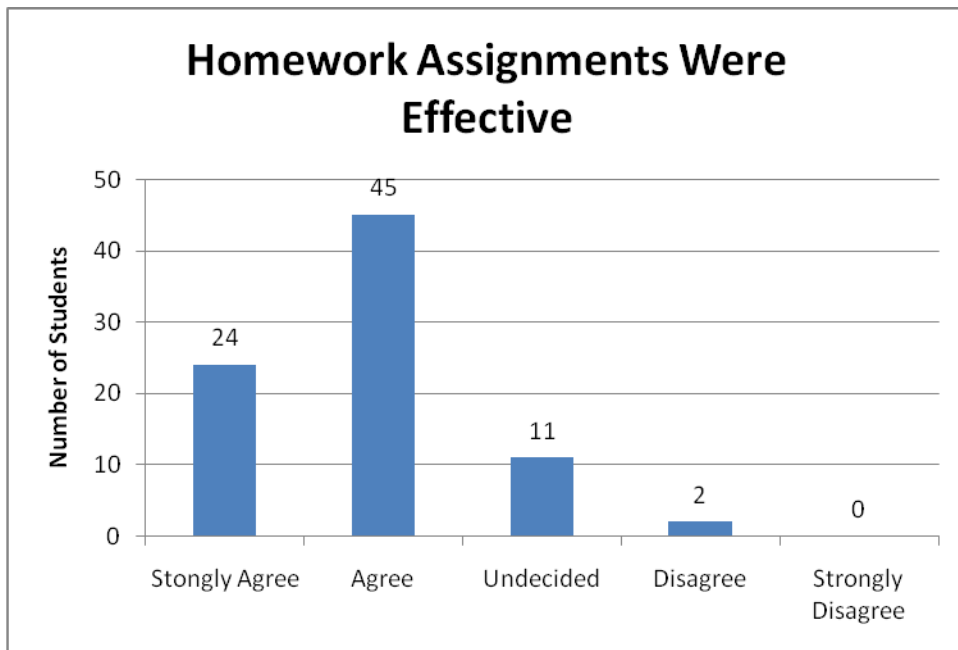
## Results of the Study

Student perception showed that homework, quizzes and class discussions were most effective in leading to student learning, and warm-ups were effective but to a lesser extent. The questionnaire data showed mean responses for the effectiveness of homework, quizzes and class discussions as 4.11, 4.23, and 4.09 respectively. Responses were given based on a Likert scale which ranged from five to one. All of these had an average slightly above the agreement level. The mean response for the effectiveness of warm-ups was 3.45, which was between the levels of agree and undecided.

The responses to the statement “Homework assignments were effective in helping my overall learning in Algebra 3-4/Trig.” were summarized in figure 1. The data showed that most students perceived homework assignments to be effective in helping them learn. The comments students wrote about this item matched their responses well. Many students reiterated that they thought homework was effective in helping them learn. Also, they liked that homework was not graded for correctness because they could still attempt the problems to get full credit and then get questions cleared up the next day in class. One student commented, “Whenever I was struggling with a homework problem I gave it my best shot, then circled it so I could get help later.” Another student wrote, “In class we can do only one or two problems of each type, but homework assignments help us to solve all kinds of problems.” A few students felt that

homework wasn't effective because they could understand the material from the notes alone and from class discussions.

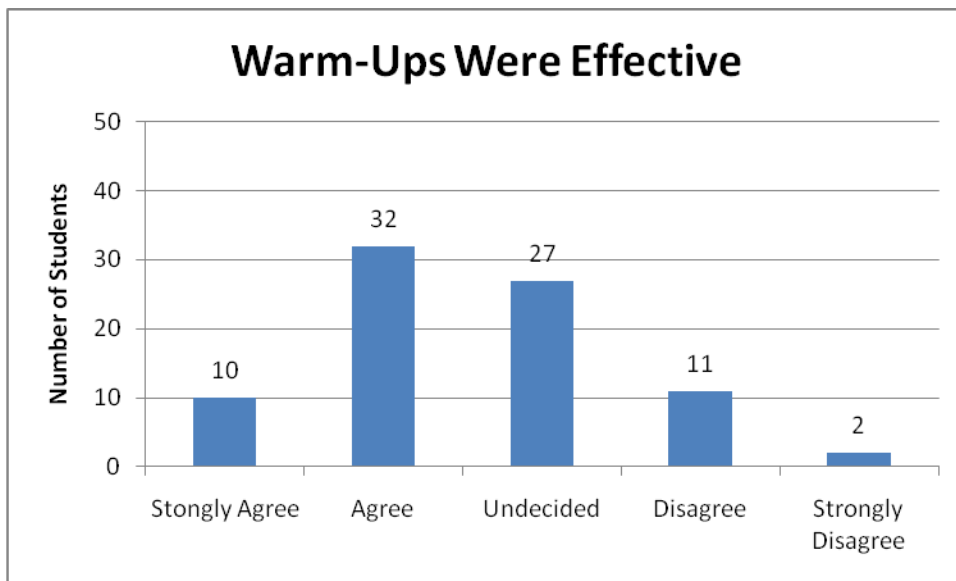
**Figure 1**



The second item stated, "Warm-ups were effective in helping my overall learning of Algebra 3-4/Trig." Student responses showed they believed warm-ups were the least effective formative assessment, as shown in figure 2. Of the students who commented on this item, the most common feelings were that warm-ups were an ineffective use of time, and they were of little value because they were not worth any points toward their grades. After the warm-up, when students selected at random gave their answers, several students responded with "out of my comfort zone." One student said it was a good thing, because it provided motivation to learn and avoided embarrassment while others did not like

that feeling. Of students who thought warm-ups were effective, the common reason was that warm-ups helped them to identify what they were supposed to know, and what areas they needed to improve on.

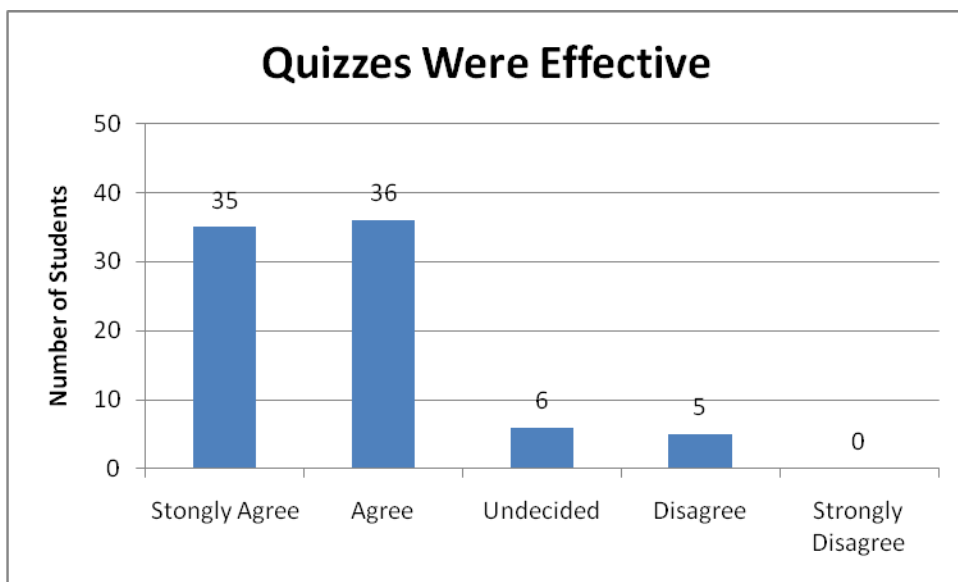
**Figure 2**



Quizzes were definitely the formative assessment the students thought was most effective. The questionnaire showed 43% of students strongly agreed and 44% agreed with the statement, “Quizzes were effective in helping my overall learning of Algebra 3-4/Trig.” The complete responses were shown in figure 3. There were no negative comments written about quizzes. Students believed quizzes were effective because they were similar to the test which helped them prepare for it. Quizzes also showed them where they needed help. One student wrote, “I’ve never had a good way to study for math tests until this class. Now, I

can study what I missed on the quizzes and it makes such a difference on the tests.” Many students stated that they used their quizzes to study for chapter tests. Several students commented that they liked quizzes because of score replacement if they showed improvement on the test. One student, who reported having test anxiety, stated, “By taking the quiz I was able to relax without feeling the normal pressure.”

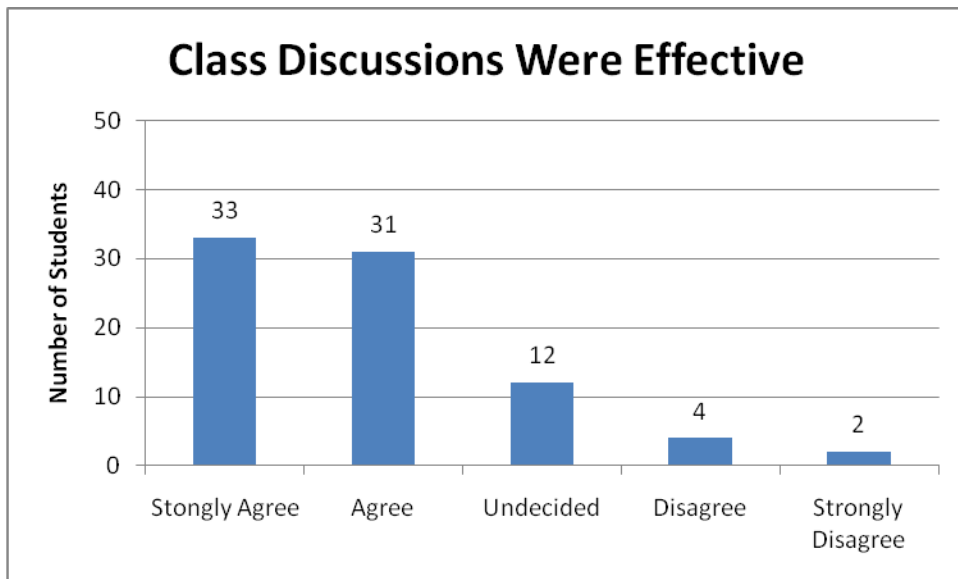
**Figure 3**



More students chose strongly agree than any other response to the statement, “Class discussions were effective in helping my overall learning of Algebra 3-4/Trig,” as shown in figure 4. In addition, of the four formative assessments, the largest number of students commented that they thought class discussions were the most effective. Students liked that they could get specific

help when they needed it. In one student’s words, “He made it clear and explained in detail each topic we discussed.” Several students commented that they thought class discussions wasted time if they already knew it. One insightful student wrote, “Sometimes I thought our class discussions and note-taking were longer than necessary but for some students it probably helped a lot.”

**Figure 4**



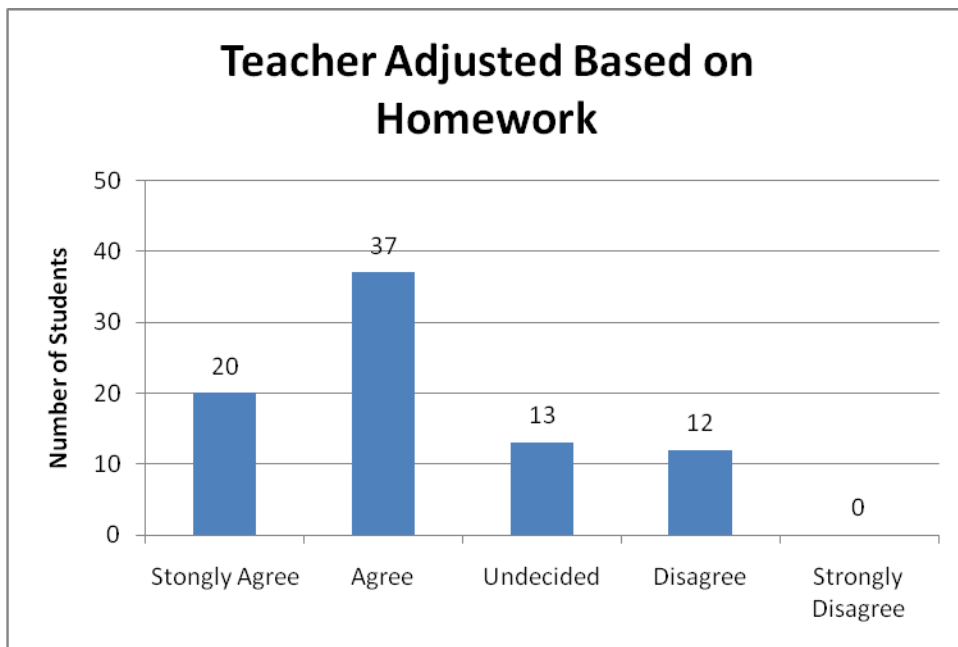
The last four items on the questionnaire focused on how the teacher adjusted instruction based on the outcomes of each formative assessment. The mean responses for homework, warm-ups, quizzes, and class discussions were 3.79, 3.43, 3.79, and 3.90 respectively. The students’ comments on these items were less frequent and less specific than the first four questionnaire items. One student pointed out the difficulty, “I am not sure how much the teacher altered lesson plans because if he ever did I am not sure he told us. I am assuming he did,

however.” There were also many generic responses grouping the last four items into a single comment, such as, “The teacher adjusted well to the way we as a class learned things.”

Item five stated, “The teacher adjusted instruction as necessary based on the outcomes of homework.” The responses were given in figure 5. One student noted:

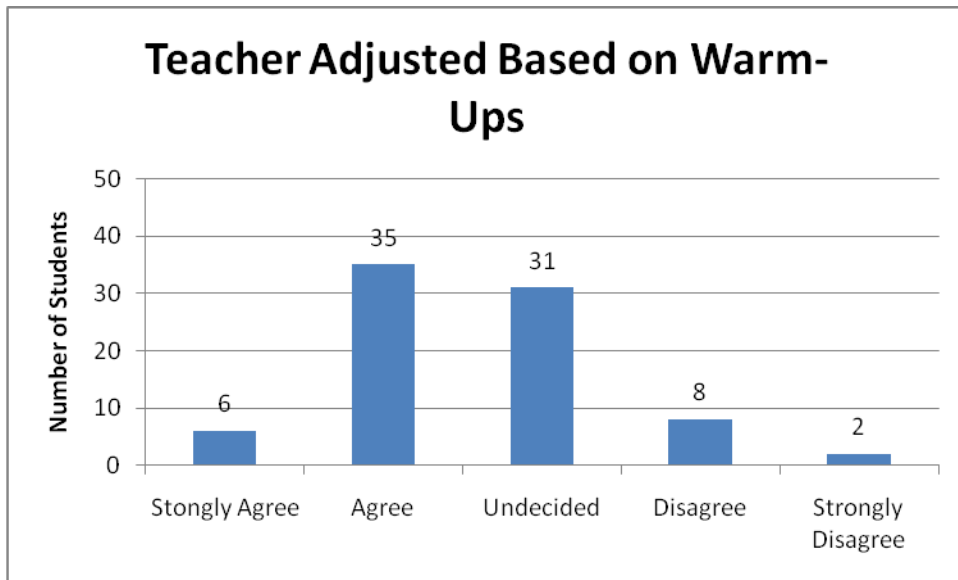
He seems to plan the lesson of each day by looking at the homework the students had done. If he sees a lot of confusion on the homework he would use more time on class discussion. He would then shorten the notes, but still cover the important points of the lesson.

**Figure 5**



As shown in figure 6, students responded less positively to the item, “The teacher adjusted instruction as necessary based on the outcomes of warm-ups.” There were no comments directly addressing teacher adjustment based on the outcomes of warm-ups.

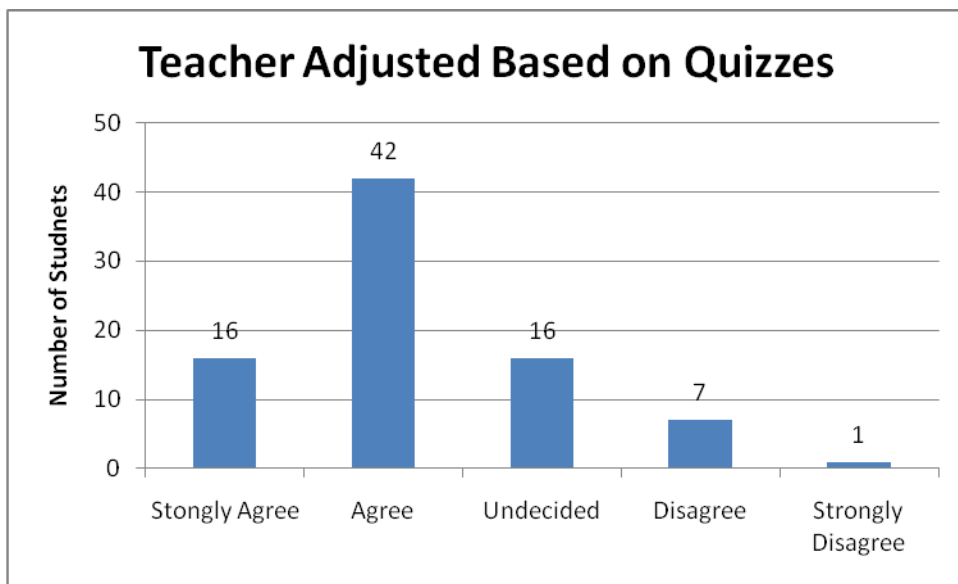
**Figure 6**





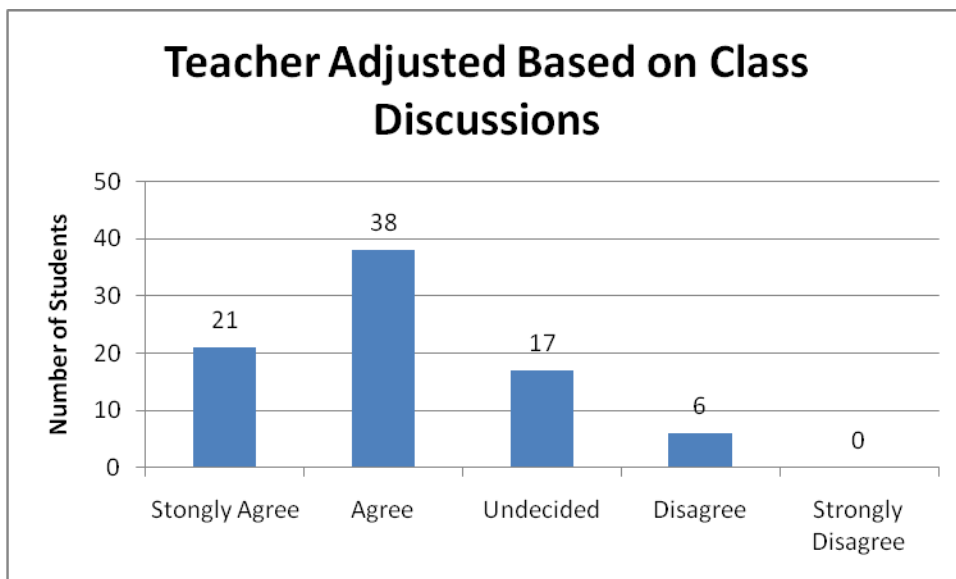
Most students agreed with the seventh questionnaire item, “The teacher adjusted instruction as necessary based on the outcomes of quizzes.” The responses were shown in figure 7. Several students commented on this item, however, they had divergent viewpoints. One stated, “Sometimes we would do poor on a quiz and instead of fixing it we would just move on,” while another said, “I really liked how the teacher slowed the pace if we needed it after a quiz.”

**Figure 7**



The final questionnaire item stated, “The teacher adjusted instruction as necessary based on the outcomes of class discussions,” and had the most positive response of the teacher adjustment items. The only comment directly concerning this item stated, “When the majority of the class struggled with one thing it was focused on more which helps very much.”

**Figure 8**



Some students alluded to a belief that the teacher had hidden knowledge. For example, “The teacher seemed to know beforehand which sections we would have a hard time with.” And “I feel the teacher had already adjusted his lesson plan based on the outcome of other classes.”

## Findings

This research set out to determine which formative assessments students perceived as most effective in leading them to learn in Honors Algebra/Trigonometry 3-4. The research found that students thought all four formative assessments were effective in helping them learn. However, they believed that quizzes were the most effective, with a mean of 4.23. This value was slightly higher than homework, 4.11, and class discussions, 4.08 and warm-ups were less effective with a significantly lower mean of 3.45.

The research also found that students believed that the teacher adjusted instruction as necessary only to a moderate extent. The average responses for these items were between the levels of agree and undecided. However, many students were not sure how to judge this, or report their opinions on these questionnaire items. Student comments concerning these items were less frequent, more general and often vague.

## Discussion

The purpose of this project was to determine the effectiveness of four formative assessments so that effective assessments could be continued and ineffective assessments could be altered or removed. The data supported that all formative assessments included in this study were effective. However, students believed that warm-ups were less effective than the others. This data also supported that the teacher, while able to create meaningful formative assessments

for students, was not as proficient at using the data to make instructional decisions.

This finding was consistent with current literature. Heritage and others (2009) studied the ability of teachers to take action based on the outcomes of formative assessments. Their research found that teachers were better at determining a student's level of understanding based on a formative assessment than they were at using that information to guide future instruction. However, the research of Heritage and others (2009) directly examined the teacher's ability. The study in this research project examined students' perceptions of formative assessments and of the teacher's ability, and therefore was an indirect measurement. This may have had an impact on the result.

The study in this research project also had a similar outcome as the literature indicated regarding motivation. Vaden-Goad (2009) found that using the score replacement technique improved motivation for students to keep trying. The findings of this study supported his claim. Not only were quizzes found to be highly effective, but many students reported that they really liked score replacement on quizzes. They also reported that the format made it easier to study for tests because the test and quizzes had similar problem types.

### Summary

Overall, the questionnaire provided both numerical data and narrative data. The numerical data came in the form of responses to statements regarding

formative assessments, and provided an indication of how effective each assessment was, and how the teacher adjusted accordingly. The narrative data was in the form of written comments on the questionnaire, and suggested why students responded the way they did. The findings of this study had several similarities to related literature. Specifically, teachers had difficulty using formative assessment data to guide instructional decisions, and the score replacement technique had a motivational quality. Both types of data supported that all formative assessments being utilized in the classroom were effective. However, warm-ups were found to be less effective. The data also showed that students believed that the assessments were effective more than they believed the teacher adjusted instruction as necessary.

## CHAPTER 5

### Summary, Conclusions and Recommendations

#### Introduction

This research project examined student perception of the effect on student learning of formative assessments used by the researcher in Honors Algebra / Trigonometry 3-4. The formative assessments used in this project were homework, quizzes, warm-ups, and class discussions. The purpose was to identify if formative assessments were being used effectively to promote student learning, so that ineffective assessments could be altered, removed or replaced. In addition, a crucial part of formative assessment was how the results were used to inform educational decisions during the learning process. Therefore, this project also examined student perception of how the teacher adjusted instruction based on formative assessments. Overall, this project aimed to increase student learning through the improvement of formative assessments.

#### Summary

Literature on the topic of formative assessments indicated that improving formative assessments was an effective means to increase student achievement. Formative assessments provided two main functions. First, they were a learning tool for students, and second, they provided the teacher with data to make educational decisions during the learning process. Literature indicated that teachers were better at using formative assessments to determine their students'

level of understanding than they were at using that information to guide future instruction. Lastly, the literature noted that formative assessments provided a potential to increase students' motivation, particularly through score replacement.

This research project utilized a qualitative approach because it examined student perception. Data was collected through a questionnaire which asked students to respond with their level of agreement to statements regarding the effectiveness of formative assessments to increase student learning and the teacher's adjustment based on the outcomes. The questionnaire also included a section for comments, and students were encouraged to address why they believed the way that they did.

The data showed that students perceived all four formative assessments to be effective. However, they perceived warm-ups to be effective to a lesser extent. When asked to respond to how the teacher adjusted instruction as necessary, students responded between the levels of agree and neutral. This was in line with the literature. Their comments indicated that they knew some adjustments happened behind the scene.

### Conclusions

As a result of the data, several conclusions were drawn. First, the data implied that homework, quizzes, and class discussions were effective as formative assessment and led students to learn. Warm-ups, however, were only moderately effective.

The data also showed that the score replacement method of quizzing was motivational to students. Students appreciated that they could increase their quiz score by doing well on the test, prompting them to study more. In addition, this method also helped students to study effectively for tests because the tests were in the same format, and contained similar types of problems as the quiz.

Class discussions were particularly useful if students had questions, or needed clarification on topics. However, students that already had a clear understanding of the material thought that a class discussion was not useful, and their time could have been spent better doing something else. Despite this criticism, students believed that, overall, class discussions were effective in helping them learn.

The final conclusions pertained to how the teacher adjusted instruction based on the outcome of formative assessments. The data from this study agreed with the research of Heritage and others (2009) showing that teachers may have difficulty translating the outcomes of formative assessments into the decision-making process. However, the data also suggested that the students had limited knowledge and may not have been capable of accurately describing how well the teacher adjusted instruction based on the outcomes of formative assessments.

### Recommendations

Based on the conclusions of this research project there are several recommendations to be made. First, as homework, quizzes, and class discussions



were found to be most effective, they should continue to be used as formative assessments without reservation.

One slight change might be warranted for class discussions. Students who had a firm understanding of the topic reported that class discussions were not beneficial to them. These students chose not to actively participate in the discussion. However, they could be utilized to assist other students, under the guidance of the teacher, which would in turn deepen their own understanding.

Warm-ups, though found to be somewhat effective, need to be examined more closely. The researcher would like to know if students thought that warm-ups were less effective because they were often similar to the homework. Additionally, there was no intervention between the homework and warm-up for students to improve if they did not understand the homework. Also, did student shyness have a role in their opinions because they could be called at random to share their answers? Finally, the researcher would like to know how students' opinions would change if the warm-ups counted toward their grades. These issues could be addressed thoroughly by conducting several focus groups with students. However, until these issues are addressed, there is no cause, nor a direction, to adapt the use of warm-ups. Warm-ups should be continued to be used as a formative assessment while under scrutiny.

The final recommendation is concerning how the teacher adjusts instruction based on the outcomes of formative assessments. While this study

indicated that the teacher had difficulty translating the outcomes of formative assessments into the decision-making process, it also noted that students may not be capable of identifying how the teacher accomplishes this task. Therefore, further investigation is needed to test how the teacher adjusts instruction. This investigation should not be based on student perception. Rather, it should be a direct measurement of the teacher by an expert on formative assessments. This type of investigation could be achieved through narrative research or a case study. Either of these would more accurately gauge how the teacher adjusts instruction as necessary and would be beneficial to the knowledge-base on effective formative assessments.

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## APPENDICES

Letter to Parents of Participants



## Southridge High School

3520 Southridge Boulevard

Kennewick, WA 99338

(509) 222-7200

(509) 222-7201 Fax

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May 16, 2011

Dear Parent or Guardian,

This letter is to inform you that I am requesting that your student participate in research I am conducting as a part of my Masters in Teaching program at Heritage University. I am studying student perception on the effectiveness of formative assessments (homework, warm-ups, quizzes and class discussions). The students' role will be to complete an anonymous survey based on their experiences in my class. No names will be collected or included in the research. The survey is about eight questions long and should take about five minutes. If you do not wish to have your student participate, please let me know by May 23rd and I will find an appropriate alternate activity for him/her while the class completes the survey.

Sincerely,

Charles Heimbigner

Math Teacher

Southridge High School

[charles.heimbigner@ksd.org](mailto:charles.heimbigner@ksd.org)

(509) 222-7200

## Formative Assessment Questionnaire

Please respond to each survey item regarding your level of agreement with each statement based on your experiences this year in Honors Algebra 3-4/Trig. Please write any comments in the space provided.

### Section 1: Student Learning

1. Homework assignments were effective in helping my overall learning of Algebra 3-4/Trig.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
5	4	3	2	1

2. Warm-ups were effective in helping my overall learning of Algebra 3-4/Trig.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
5	4	3	2	1

3. Quizzes were effective in helping my overall learning of Algebra 3-4/Trig.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
5	4	3	2	1

4. Class discussions were effective in helping my overall learning of Algebra 3-4/Trig.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
5	4	3	2	1

### Section 2: Teacher Reaction

5. The teacher adjusted instruction as necessary based on the outcomes of homework.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
5	4	3	2	1

6. The teacher adjusted instruction as necessary based on the outcomes of warm-ups.

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
5	4	3	2	1





### Numeric Questionnaire Responses

Survey #	<i>Item 1</i>	Item 2	Item 3	Item 4	item 5	Item 6	Item 7	Item 8
1	4	5	5	3	3	4	4	3
2	4	3	4	4	5	4	4	4
3	4	5	4	5	5	4	4	5
4	2	4	5	5	5	4	4	5
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6	4	3	4	2	3	4	4	4
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