Motivational Strategies to Increase Completion of Assignments in Mathematics Classes

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Abstract: The purpose of this paper is to share the results of an 8-week study that focused on the effects of incorporating real-life applications and rewards to measure their impact on student motivation. The goal was to reduce the number of students unmotivated to complete their mathematics assignments satisfactorily.

There are many high school students who are not motivated to learn mathematics. Various reasons play a role, including students' perceptions about their own abilities, social factors, and lack of applicability and incentive to learn. Students need to practice math in order to succeed. Math is not a subject that can be memorized; it requires practice and comprehension. Mathematics teachers need to implement different strategies in the class to see which would lead to higher levels of engagement and motivation to succeed. This led me to the research question: Will using real-life applications and giving a reward improve students' motivation to increase completion of classroom assignments?

This study focused on 25 ninth-grade Algebra I students. They were all Hispanic students from Miami-Dade County in Florida. The study implemented real-life application problems related to the topic discussed in class by creating tangible scenarios the students could relate to in order to identify the importance of math, and modeling problems. Coupled with the real-life instructional technique, a reward was utilized at the end of each week. A homework pass was randomly rewarded to one student a week, who was selected from the pool of students who successfully finished their assignment.

Literature Review

Students' motivation has always been an important topic for mathematics teachers. Many students are less motivated at the middle school and high school level to learn and practice mathematics than at the elementary level. Students' motivation affects the success of students in learning mathematics in school as well as mathematical abilities that are necessary for potential future jobs.

One of the studies that focused on motivation is the one conducted by Sullivan, Tobias, and McDonough (2006); they assumed that low motivation of students is the determinant of the apparent lack of engagement. They incorporated Hannula's (2004) definition of motivation as "the potential to direct behavior that is built into the emotion control mechanisms. This potential may be manifested in cognition, emotion, emotion and/or behavior" (Sullivan et al., 2006, p. 82).

Some of the studies focused on a specific activity to determine whether it improves the motivation of students to complete and learn mathematics. For example, target mathematical models (Zbiek & Conner, 2006), virtual manipulatives (Durmus & Karakirik, 2006), and peer-assisted learning (Kroeger & Kouche, 2006) have been studied to determine if they improve students' engagement in mathematics classes.

Mathematics is a class that needs practice; as a teacher, I have found that math cannot be learned through reading, memorization, and explanations only. Math requires active participation in the classroom and in the completion of assignments/projects in order to acquire and

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successfully apply the skill sets. Therefore, student motivation is an important component of a math class. Students need to be engaged and to be active learners.

Many students at the high school level perceive themselves to be not good at math, which hinders their level of engagement in learning. This is confirmed by Sullivan et al. (2006) who reported in their article that school engagement of young adolescents declines compared to their engagement in elementary school.

Motivation in Mathematics

Some factors that may contribute to students' lack of motivation in mathematics classes during the adolescent years are lack of confidence, deficiency in skills, giving up easily, not being able to see the importance of math, or the feeling that they can be successful at school without putting in effort (Sullivan et al., 2006). In addition, peer pressure is also necessary to consider. Some students want to look cool, they want to be the center of attention, and they think that by not putting effort in class and not completing classroom activities they are going to be popular in the school. In the study done by Sullivan and colleagues (2006), when the students were asked why a student that was not good at mathematics will not try, half of the eighth-graders answered: to pass without trying; to be popular; not to get picked on, bullied, or teased; and it was not cool. This study, conducted with eighth graders in Australia from four different schools, concluded that motivation is related to socialization, trying to fit in social and cultural groups.

Sullivan et al. (2006) argued that positive student responses to school mathematics learning opportunities was not just remotely affected by factors such as lack of self awareness, lack of confidence, and lack of success. On the contrary, direct and indirect pressure by peers not to try hard in school may also be connected to students' needs. They concluded that "classroom culture may be a more important determinant of participation than curriculum, method of teaching, modes of assessment, teacher experience, level of resources, or anything else" (p. 97).

There are other factors that influence the students' engagement in completing assignments in a mathematics class. Often students are heard saying, "I used to be good at math, until high school" (Rothery, 2007, p. 526). Rothery argues that students who used to get As and Bs in math at the elementary level were doing their assignment and homework without putting in a lot of effort. At the high school level, math courses are more complex (higher level); more effort and practice is required to master a topic. Many students do not make the connection between putting in more effort and mastering a topic in mathematics. Rothery (2007) recommends helping students with strategies for note taking, completing homework, and test preparation.

Schwartz (2006) argued that learning mathematics takes attitude, perseverance, and courage. He said that "learning math is a two sided equation: one side is what the student brings to the process, the other side is the teacher" (p. 51). Teachers need to provide the students with great classes, but the students' engagement is also necessary to succeed in class. Schwartz (2006) talked about three aspects that he thinks are important. First, he mentioned the aspect of attitude—students should have a positive attitude about the class. Another aspect was perseverance, which is the ability to continue despite obstacles and failures. Students need to know that their effort is necessary and that it is the key point of their success in math. The last aspect he talked about was fearlessness; students need to know that making mistakes is part of learning math. Students should not be afraid of making mistakes and asking questions. When students are working on class assignments, they should have the opportunity to ask questions and be able to understand material that they did not understand during teacher's explanation.

Activities to Improve Students' Motivation in Mathematics

There are several studies on different activities that have been shown to increase students' engagement in mathematics classes. One of the activities is mathematical modeling, which is "a mathematizable situation, a mathematical object, a purpose or question that prompted the modeling activity, and the relationships between these things and the modeler" (Zbiek & Conner, 2006, p. 91). According to Zbiek and Conner (2006), mathematical modeling activity influences students learning through effects on motivation and through changes in understanding. Based on their study, they argued that mathematical modeling activities support three different types of motivation. The first type confirms that real world situations appeal to learners. The second type is the motivation to continue or not continue to study mathematics. The third type of motivation emerges when a student modeler embraces a purpose to add a new piece of knowledge or new connections among pieces of knowledge. Moreover, Zbiek and Conner (2006) concluded that modeling work provides opportunities to learn mathematics as well as to motivate to learn mathematics.

Padula (2005) suggested that literature should be included in mathematics, which is literature with mathematics as its major themes. These books provide the students with more explorations and real life applications. Padula notes that math fiction is also related to explorations in mathematics. Curiosity can develop the motivation to learn; by teaching math through stories, students may become more interested in the subject and may complete more assignments.

Another activity that research has shown to improve motivation is virtual manipulatives. Durmus and Karakirik (2006) claimed that the usage of manipulatives both increases students' conceptual understanding and problem solving skills and promotes their positive attitudes towards mathematics, because they provide concrete experiences that focus attention and increase motivation. Using manipulative materials in teaching mathematics will help students learn to (a) relate real world situations to mathematics symbolism, (b) work together cooperatively in solving problems, (c) discuss mathematical ideas and concepts, (d) verbalize their mathematics thinking, (e) make presentations in front of a large group, (f) solve problems in many different ways, (g) symbolize mathematics problems in many ways, and (h) solve mathematics problems without just following teachers' directions.

Another activity is Peer-Assisted Learning Strategies (PALS). PALS is a classwide peer tutoring approach that permits teachers to address challenging mathematics curriculum and attend to a wide diversity of math skills in the classroom. It supports the use of appropriate social skills. Kroeger and Kouche (2006) concluded from their study with 150 students that using PALS increased engagement and positive response to intervention, regardless of ability levels or past experiences or failures in math classes.

Rewards

Researchers have studied rewards and how they are effectively used in class to motivate students for many years. Schunk (1982) concluded that the anticipation of a reward consequence influences the students' perceptions of self-efficacy and achievement. Other studies confirm that rewards are beneficial for students' motivation in class (Cameron, Pierce, Banko, & Gear, 2005; Malala, Major, Maunez-Cuadra, & McCauley-Bell, 2007). For example, rewards impacted intrinsic motivation when students were rewarded for achievement while learning an activity (Malala et al., 2007). In addition, rewards in general are beneficial; however, the rewards should differ according to students' ages and population (Malala et al., 2007).

Procedures

My third period Algebra I class was chosen for the focus of this study. This class is composed of twenty-five 14- to 16-year-old ninth graders. All students in this class are Hispanics. I selected this period because it is the period before lunch, and some students lack motivation to do classwork. During assignment time, I always walk around the class to help students and make sure that they are working and understanding what they are doing. For the majority of assignments, students worked individually and a few times in pairs. However, some students in this class do not work on their assignment until I pass by their desk; without my vigilance, they make no progress on their assignment. This is evidence of the lack of motivation to complete their work.

For this study, the class lectures and assignments were modified to incorporate more real-life applications of Algebra I. The real-life application problems were word problems that described scenarios of everyday life. Even though the scenarios were related to their everyday life, students needed to use their new knowledge of the lesson in order to solve them. Sometimes the given problems required a little exploration to solve the problems. In addition, at the end of each week, one student from the group that completed satisfactorily all the classwork for the week was selected at random and received a reward. In order to pick the students at random, the students' name were placed in a cup and one student picked a name from the cup without looking. The prize was a homework pass, which allowed him/her to skip one of the homework assignments and still receive an A for that assignment.

Data Collection

Both quantitative and qualitative data were collected in this study. The students were observed for 4 weeks without any type of intervention, and 4 weeks of intervention as they were working with their classroom routine. I recorded the number of times that each student did not complete the classroom assignments. During the 4 weeks of intervention, I also recorded the number of times that students did not complete the classroom assignments. During the 4 weeks without the intervention and the 4 weeks after the intervention, the students had the same number of assignments. In addition, I observed students and made notes both on their class participation during assignment time and their motivation to do the work during the 8 weeks.

Data Analysis and Findings

There was a decrease in the number of class assignment that the students were not turning in after the intervention as shown in Figure 1. In Figure 1, series one represents the number of class assignments that students did not turn in during the first 4 weeks (without intervention). Series two represents the number of class assignments that students did not turn in during the last 4 weeks (intervention time). In addition, from the notes taken on students' participation in class and sharing with others, I saw an increase in the way students were engaged in class. They were asking more questions and trying to complete the assignment on their own. Out of 25 students in the class, 15 students (60%) decreased the amount of classwork not turned in by the end of the intervention. Nine out of the 25 students (36%) maintained the same amount or increased the number of missing assignments. Six of the 9 students who consistently had the same number of missing assignments never missed any assignments before or during intervention. The remaining 3 students were only missing one or two assignments. However, only one student increased the number of assignments not turned in by the end of the intervention. Without the intervention, the student was not missing any assignment, and by the end of the intervention, the student was missing one assignment. After looking at the data, I am able to say that there was an

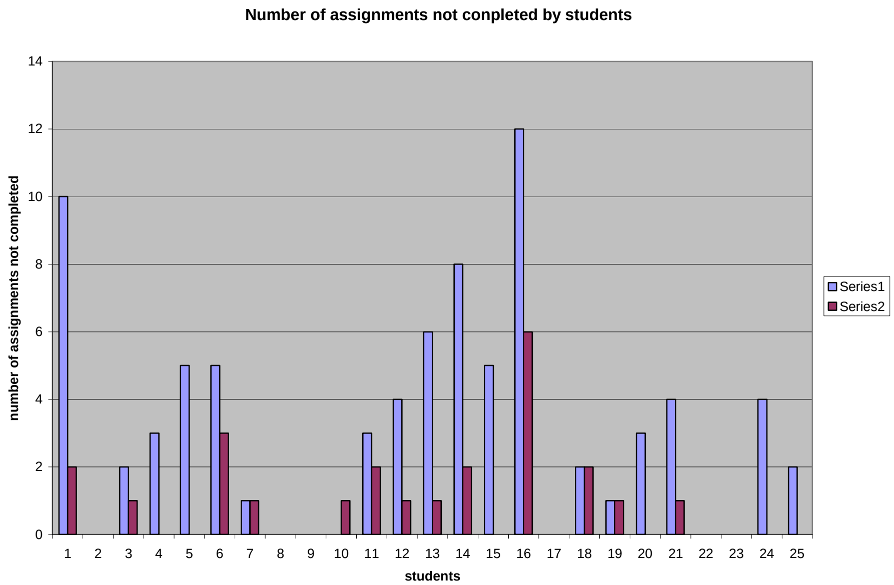

Figure 1. Bar graph of number of assignments not completed by students.

improvement in the reduction of assignments not turned in at the end of the intervention time. The pair sample t-test (Appendix) showed statistically significant results with a 95% confident interval. The study may not be effective with larger groups. However, for this study with a small group of students, there was an improvement in the class.

Summary and Discussion

Teachers can not just wait for students to be motivated on their own. If students are not motivated, it is the job of the teacher to try to actively engage as many students as possible in the classroom activities. Also, teachers need to address students' perceptions of not being good at mathematics. Analyzing the research question related to using real-life applications and giving a reward improve students' motivation to increase completion of classroom assignments provided the following conclusion. The students were more motivated with the reward and real-life application than before it was provided, resulting in more students completing the class assignments.

This study confirms the results of Zbiek and Conner (2006), which indicated that real-world situations motivate students to learn mathematics. Students in the study were more engaged in the applications problems than in the drill and practice problems. Also, this study confirms that rewards are beneficial for students' class motivation, augmenting Schunk's (1982) findings that the anticipation of a reward consequence influences the students' perceptions of self-efficacy and achievement.

One of the limitations of this study was time. I would like to see how the results would vary if the study was conducted for a longer period of time, perhaps a school year. Also, there were two other external variables that could have altered the results. One was the Florida Comprehensive Assessment Test (FCAT). FCAT testing was conducted towards the end of the intervention period. The FCAT preparation time also occurred during the middle of the research. Some of the topics that students were supposed to study were replaced with the FCAT review/ practice. FCAT material may have been easier for some students and could have influenced their motivation to complete assignments. The second was that the intervention period was closer to the end of the grading period. Some students tend to do more work towards the end of the nine weeks since they want to improve their grade.

Implications

For future research, it would be helpful to isolate the two systems—the use of more real-life applications and implementing rewards—to see which has the greatest effect on student motivation. The research could be divided into two parts. The first part would see whether students complete more assignment by using real-life application. The second part would use praise at the end of the week to see which variable was stronger in order to increase assignment completion satisfactorily.

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Appendix

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	NCWPRE	3.20	25	3.240	.648
	NCWPOST	.96	25	1.369	.274

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	NCWPRE & NCWPOST	25	.697	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference: Lower	Upper			
Pair 1	NCWPRE - NCWPOST	2.24	2.488	.498	1.21	3.27	4.502	24	.000