

# The Effect of Integer Song-Aided Instruction in the Students' Performance in Mathematics

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**Abstract**— The purpose of this research was to test the effect of Integer Song Aided-Instruction in the students' performance in mathematics. A sequential explanatory design was used to investigate the effect of using integer song in teaching the operations of integers to Grade 7 K to 12 Basic Education Curriculum students. A pre-test was given to both groups. Group A (control group) received normal textbook (lecture-discussion) instruction, while Group B (experimental group) received the treatment, integer song-aided instruction. Pre-test-post-test scores and gain scores were used to compare gains in subject knowledge between the groups. After the experimentation, a qualitative phase was carried out to follow-up and refine quantitative results. Results of the quantitative phase of the study revealed that both groups were equal at the start of the experimentation. The pre-test-post-test difference demonstrated that both groups performed equally in the area of integers. However, in terms of the gain scores between the groups, the experimental group performed better than the control group. The qualitative data analysis revealed three (3) themes about their experiences: enjoyment, ease of learning, and energizing activity.

**Index Terms**— Integer Song, Mathematics Achievement, Music, Song-Aided Instruction

## 1 INTRODUCTION

LEARNING mathematics is challenging for many people. Mathematical concepts can be abstract and difficult to visualize. Consequently, math can be frustrating for students to the point where they lose interest in the subject which results in low performance. It could be seen from the results of the National Achievement Test (NAT). Despite the continuing and current school efforts in enhancing achievement in this learning area, the achievement rates of Tagum City National High School remain far below 75% passing rate: an MPS of 41.98, 48.93, 52.80, 53.77, 72.57, 62.19 from year 2010-2015.

On the other hand, studies have shown significant evidence that most teenagers love music (North and Hargreaves, 1999). Music is an important part of the experiences and interests of most teenagers.

Various theories exist about the reflective connections between math and music (Cohen, 1961), and engineering and music (Baggi, 2007). These theories help explain why studying music positively influences a learner's ability to think mathematically. Music involves rules, logic, notation, functions over time, and other concepts found in math.

Furthermore, integration of music in mathematics in the classroom has been shown to be an effective teaching strategy (Johnson and Edelson, 2003; Wright, 2009; Courey et al., 2012; Still and Bobis, 2005).

It is for these reasons that this research has been designed to address the need to raise the achievement of the students in Mathematics, and in order to motivate their interest toward the subject.

## 2 STATEMENT OF THE PROBLEM

This study was conducted to investigate the effect of integer song-aided instruction in the students' performance in Mathematics. The qualitative part of the study attempted to answer the following corollary sub-problems:

1. What is the level of the performance of the students in the experimental and control groups in terms of:
  - a. Pre-test; and
  - b. Post-test?
2. Is there a significant difference in the pre-test mean scores between the experimental and control group in the area of integers?
3. Is there a significant difference on the achievement of the students as shown their pre-test and post-test mean scores of the experimental group in the area of integers?
4. Is there a significant difference on the achievement of the students as shown by their pre-test and post-test scores of the control group in the area of integers?
5. Is there a significant difference on the achievement of the students as shown by their mean gain scores between the experimental and control group in the area of Integers?

The qualitative part of the action research tried to answer the following research questions:

1. What are the experiences of the students exposed to integer song-aided instruction?

2. What activities do the students like doing in the class?
3. How do the students feel about doing the activities?

### 3 HYPOTHESES

The research was guided by the following null hypotheses and were tested at 0.05 level of significance:

1. There is no significant difference in the pre-test mean scores between the experimental and control group in the area of integers.
2. There is no significant difference in the achievement of the students as shown by their pre-test and post-test in the experimental group in the area of integers.
3. There is no significant difference in the achievement of the students as shown by their pre-test and post-test scores in the control group in the area of integers.
4. There is no significant difference in the achievement of the students as shown by their mean gain scores between the experimental group and control group in the area of integers.

### 4 RESEARCH DESIGN

This research used the sequential explanatory design. In this design, the researchers carried out a quantitative method and then used a qualitative method to follow-up and refine quantitative findings. This quantitative part of the study made use of the quasi-experimental design of Campbell and Stanley (1963) called pre-test and post-test non-equivalent control group design. The design needs only two groups that are measured by a pre-test and post-test. Two intact groups were used in this study – the experimental group and control group. The experimental group was taught using the Integer Song-Aided Instruction while the control group was taught using the normal textbook (lecture-discussion) method of teaching. The qualitative part of the study involved in-depth interviews to refine the quantitative findings.

### 5 PARTICIPANTS

The participants of the quantitative part of the study were Grade 7 students coming from the selected two (2) sections of the K-12 Enhanced Basic Education Curriculum of Tagum City National High School for the school year 2015-2016. The control group was composed of thirty-two (32) students while the experimental group was composed of thirty-four (34) students. For the qualitative part, fourteen (14) students who exhibited large gain scores from the experimental group were subjected to key informant interviews.

### 6 DATA GATHERING PROCEDURE

Asking Permission to Conduct the Study. The researcher sought permission from the school head to commence the conduct of the study.

Conduct of the Quantitative Phase. Two (2) sections from the Grade 7 of Tagum City National High School during the SY 2015-2016 were chosen for the experiment. A pre-test prepared by the researchers and validated by one (1) Master Teacher and one (1) Head Teacher in Mathematics Department, was administered to the two (2) sections to determine if the groups are comparable before the start of the experiment. The instrument was subjected to reliability testing using test-retest method, and was found to have a reliability coefficient of 0.867. One of the researchers handled both classes. The experimentation lasted for one (1) month. After one (1) month, a post-test was given to determine the increase in the performance of the students in learning the subject.

Conduct of the Qualitative Phase. After the experimentation phase, statistical analysis of the raw data was carried out to determine the effect of using integer song aided instruction in the students' performance in mathematics. Fourteen (14) students who exhibited large gain scores from the experimental group were subjected to key informant interviews. Permission was sought first from the parents of the participants before the conduct of the in-depth interviews.

Data Analysis. The raw data of the quantitative study were analyzed using a statistical software. The qualitative data were analyzed using themes. According to Creswell (2007), "data analysis in qualitative research consists of preparing and organizing the data for analysis, then reducing the data into themes through a process of coding and condensing the codes, and finally representing the data in figures, tables or discussion". He further explained that "writers present their studies in stages (e.g., the multiple themes that can be combined into larger themes or perspectives) or layer their analysis from the particular to the general"

### 7 THEORETICAL FRAMEWORK

This research was based on three (3) theories, *Kolb's theory on experiential learning*, *Festinger's theory on dissonance*, and *McClelland's human motivation theory*.

In the first theory, Kolb stated that learning involves the acquisition of abstract concepts that can be applied flexibly in a range of situations. In Kolb's theory, the impetus for the development of new concepts is provided by new experiences. He further indicated that in the most effective learning situations, learners "must be able to involve themselves fully" in the process. He asserts that no matter what style the learner prefers, students must have the opportunities to "learn from feeling," "learn by watching and listening," "learn by thinking," and "learn by doing" (Jacoby, et al, 1996).

The second theory emphasized that a powerful motive to maintain cognitive consistency can give rise to irrational and sometimes maladaptive behavior. According to Festinger (1957), people hold many cognitions about the world

and themselves. When they clash, a discrepancy is evoked, resulting in a state of tension known as cognitive dissonance. As the experience of dissonance is unpleasant, people are motivated to reduce or eliminate it, and achieve consonance (i.e. agreement).

The third theory paved the way for identifying motivation drivers. McClelland identified three motivators that he believed we all have: a need for achievement, a need for affiliation, and a need for power. People will have different characteristics depending on their dominant motivator.

## 8 RESULTS AND DISCUSSION

### 8.1 Level of Performance of Students in Mathematics in the Area of Integers in the Control and Experimental Groups

Table 1.1 presents the level of performance of students in Mathematics in the area of integers in the control group. Based on the data presented, the control group had a mean score of 14.94 and 19.97 in the pre-test and post-test, respectively, gaining a qualitative rating of poor. It is also reflected in the table that all students or 100% in the control group did not meet the passing score in the pre-test as well as in the post-test.

Reflected in Table 1.2 is the level of performance of students in Mathematics in the area of integers in the experimental group. It showed that the experimental group had a mean score of 13.26 and 22.91 in the pre-test and post-test, respectively, gaining a qualitative rating of poor. However, it can still be deduced that the students in the experimental group performed better than the control group due to the fact that 2.94% of the class satisfactorily passed the post-test and 11.76% fairly performed the post-test.

Table 1.1 Level of Performance of Students in Mathematics in the Area of Integers (Control Group)

Range of Scores <sup>c/</sup>	Qualitative Rating	Frequency	Percent
Pre-test <sup>a/</sup>			
< 34	Poor, Failed	32	100
Post-test <sup>b/</sup>			
< 34	Poor, Failed	32	100

a/ The mean was 14.94 with a qualitative rating of poor.

b/ The mean was 19.97 with a qualitative rating of poor.

c/

Range of Scores	Qualitative Rating	Remarks
46 – 50	Outstanding	Passed
42 – 45	Very Satisfactory	Passed
38 – 41	Satisfactory	Passed
34 – 37	Fair	Failed
Below 34	Poor	Failed

Table 1.2 Level of Performance of Students in Mathematics in the Area of Integers (Experimental Group)

Range of Scores <sup>c/</sup>	Qualitative Rating	Frequency	Percent
Pre-test <sup>a/</sup>			
< 34	Poor, Failed	34	100
Post-test <sup>b/</sup>			
38 – 41	Satisfactory, Passed	1	2.94
34 – 37	Fair, Failed	4	11.76
Below 34	Poor, Failed	29	85.29

a/ The mean was 13.26 with a qualitative rating of poor.

b/ The mean was 22.91 with a qualitative rating of poor.

c/

Range of Scores	Qualitative Rating	Remarks
46 – 50	Outstanding	Passed
42 – 45	Very Satisfactory	Passed
38 – 41	Satisfactory	Passed
34 – 37	Fair	Failed
Below 34	Poor	Failed

### 8.2 Test on the Significant Difference Between Pre-test Mean Scores of the Students in the Experimental and the Control Group

Table 2 presents the pre-test mean scores of the students in the experimental group and the control group. Based on the data presented, the control group had a mean score of 14.94 while the experimental group had a mean score of 13.26.

Also shown in the Table 2 is the difference of the pre-test mean scores of the experimental and control groups. The table showed that the computed value was 1.361 at p-value 0.178. This indicated that there was no significant difference in the pre-test mean scores obtained by the experimental group and control group. Put simply, neither of the two groups had an edge over the other in terms of their knowledge about integers.

Table 2. T-test on the Significant Difference Between the Pre-test Mean Scores of the Students in the Experimental Group and Control Group

GROUP	MEAN	t-value	p-value	DECISION
Experimental	13.26	1.361	0.178	Do not reject H <sub>0</sub>
Control	14.94			

**8.3 Test on the Significant Difference Between Post-test and Pre-test Mean Scores of the Experimental Group**

Presented in Table 3 is the t-test on the significant difference between the pre-test and post-test mean scores of the experimental group in the area of integers. As shown in the table, the experimental group did show an increase in their mean scores from pre-test to post-test from 13.26 to 22.91.

Using t-test for correlated samples, the computed value of 8.104 with p-value 0.000 showed that there was significant difference in their pre-test and post-test scores. The result implied that integer song-aided instruction helped the students improve their cognitive skills and achieve better in the post-test. This finding can be attributed to the nature of teaching where students were given the opportunity to experience singing the rules of integers using the integer song. The result was supported by Courey, et al (2012) who said that integration of academic music with mathematics instruction can have a positive impact on learning.

Table 3. T-test on the Significant Difference Between the Post-test and Pre-test Mean Scores of the Experimental Group

TEST	MEAN	t-value	p-value	DECISION
Pre-test	13.26	8.104	0.000	Reject H <sub>0</sub>
Post-test	22.91			

**8.4 Test on the Significant Difference Between the Post-test and the Pre-test Mean Scores of the Control Group**

Presented in Table 4 is the t-test on the significant difference between the pre-test and post-test mean scores of the control group in the area of Integers. As reflected in Table 4, the control group did show an increase in their mean scores from pre-test to post-test from 14.94 to 19.97.

The control group, which was exposed to lecture-discussion method of teaching Mathematics, was found to have significant increase in their scores in the post-test as shown in the t-test computed value of 5.034 with p-value 0.000. The traditional method was equally effective with the Integer Song-Aided Instruction in teaching Mathematics in the area of Integers.

Table 4. T-test on the Significant Difference Between the Post-test and the Pre-test Mean Scores of the Control Group

TEST	MEAN	t-value	p-value	DECISION
Pre-test	14.94	5.034	0.000	Reject H <sub>0</sub>
Post-test	19.97			

**8.5 Test on the Significant Difference Between the Mean Gain Scores of the Experimental and Control Group**

The presentation of data in Table 5, proved that the teacher was able to raise the low achievement of students during the pre-test to significant result during the post-test as shown by their mean gain scores. As reflected in the table, the experimental group had a mean gain score of 9.65 while the control group had 5.03. The computed value of -2.951 at 0.004 p-value determined that there was a significant difference in the mean gain scores of the students between the experimental and the control group in the area of Integers. This result showed that integer song-aided instruction is a better method than the lecture-discussion method. In the studies of Olanaf and Krishner (1969), Delehantly (as cited in üendur and Akgül Barıú, 2002), Gardner, Fox, Jeffery and Knowles (1996), Shaw, Rouscher, Levine, Wight, Dennis and Newcomb (1997), Yoshida (2005), it is found out that music increases the students' performances in mathematics and enhances their skills.

Table 5. T-test on the Significant Difference of the Mean Gain Scores of the Experimental and Control Group

GROUP	MEAN	t-value	p-value	DECISION
Experimental	9.65	-2.951	0.004	Reject H <sub>0</sub>

**8.6 Experiences in Learning Mathematics Using Integer Song**

The fourteen (14) participants shared their experiences in learning mathematics using integer song. The qualitative data analysis revealed three (3) themes: enjoyment, ease of learning, and energizing activity.

Enjoyment. Many of the informants felt enjoyment when learning mathematics using integer song. They noted that the activity was a good way of making mathematics learning a fun endeavor. They remarked:

“Noong kumakanta ng integer song at ‘yong group-

ings ng chips - masaya din ako nong oras na yon. (*That when I sang the integer song and that grouping of chips – I was also happy during that time.*) (KII\_06)”

“Nung naglaro kami ng chips at nagkanta ng this is how to add masaya ako noon dahil masasagot ko ang ipapasagot ni Ma’am Flores dahil sa kanya marami akong natutunan habang siya pa ang aming guro. (*That when we played chips and sang ‘this is how to add’ – I was happy then because I can answer the questions of Ma’am Flores because of her, I learned a lot while she was still our teacher.*) (KII\_14)”

“Masaya kasi ang mga activity namin at pampasigla sa katawan katulad ng pagkanta at paunahan sa pagtayo kapag tinatawag na ang grupo at marami akong natutunan kang Ma’am Flores. (*Our activities were enjoyable and they energized our bodies like singing and competing whose going to stand first when the group is called, and I learned a lot from Ma’am Flores.*) (KII\_03)”

“Teaching us about integers and the integer song every time that Ma’am Alona in our class. We are always happy. (KII\_07)”

“Nung kumanta kami ng integer song napakaganda ng kanta na iyon, integer song sa addition of integers, subtraction of integers, and division and multiplication of integers. Nakaramdam ako ng saya. (*That when we sang the integer song – The song was very nice, integer song for addition of integers, subtraction of integers, and division and multiplication of integers. I felt happiness.*) (KII\_12)”

“The activity that using a song of integer because it feel happy song that I love singing. (KII\_10)”

“Ang akong experience kang Ma’am Flores kay enjoy dahil sa mga activity niya ug sa Math ug iyang mga kanta sa integers. (*My experience with Ma’am Flores was enjoyable because of the activities in Math and the songs on integers.*) (KII\_05)”

Ease of learning. The use of integer song, as noted by the informants, promoted ease of learning the operations of integers. The informants stressed:

“The activity that I did in the class of Ma’am Flores is were have a activity that we use a chips and we use the song of integers to remember how to put the chips to the right place. (KII\_09)”

“Pagkanta ng integers ay gusto ko rin dahil sa lahat ng sagot makukuha din sa kanta. (*I also like the singing of*

*integer song because all the answers can be found in the song.*) (KII\_14)”

“Yong activities na kumakanta ng integers song at ka-pag nag quiz ay naalala namin. (*Those activities that we sang the integer song and during the quiz, we remember it.*) (KII\_13)”

“Maraming akong natutunan sa kanya. Nakaramdam ako ng saya. Marami din akong natutunan sa math sa mga integers tapos gumawa pa siya ng integer song. (*I learne a lot from her. I felt joy. I also learned a lot in math about integers, and then she also made an integer song.*) (KII\_12)”

“How to multiply and divide integers with matching song to help us solve the problem easier. (KII\_11)”

Energizing activity. Besides enjoyment and ease of learning, informants stressed that the use of integers song made the students active in class. The informants emphasized:

“Ang integers song po ang aking nagustuhan dahil una po kami magsisimula ng klase ay kakanta pa po kami. (*I like the integer song because before we start the class, we sing it.*) (KII\_02)”

“My experiences in the class of Ma’am Flores is very fun because she inspires us or encourage us to learn and never let one of us to feel sleepy that’s why she teaches us integer song to energize us. Everybody sings when they heard the song even the other students in our room sings even they are already sleepy because that energizer is very nice. (KII\_11)”

## 9 CONCLUSION AND IMPLICATION

In the light of the results of the data analysis, it is concluded that, the use of integer song-aided instruction in teaching integers is more effective in enhancing the performance of the students than the lecture-discussion method of teaching based on the difference of the mean gain scores of the students under the experimental and control groups. Also, students who were taught using the integer song-aided instruction performed better in integers. Result of the t-test for uncorrelated samples for mean gain scores revealed significant increase in the performance of the students in Mathematics specifically in the area of integers, in favor of those exposed to the integer song.



### Implication for Practice

This study conducted on the effect of integer song-aided instruction in learning Integers has demonstrated positive effect on students' performance in learning Mathematics. It is suggested that teachers may use the intervention in order to encourage students to be more engaged in the classroom. In addition, songs promote learning, practice, and recall.

### Implication for Further Research

In as much as this study is limited to Tagum City National High School, the following implications for future research are encouraged:

1. Since the study is more on quantitative phase, a more in-depth qualitative phase is suggested to point out the perceptions and views of the students with regards to their exposure on the intervention. This to ensure also how beneficial is the integer song in learning integers.
2. Further study is recommended using larger population to confirm the findings and to establish the external validity of the study.

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