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## Utilization of Tarsia Puzzle in Improving Learning on Integers, Rationals, Patterns, And Algebra (Irpa) Among Senior High School Students in a Public School

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**Abstract:** The research was conducted in order to improve students' mastery level of the pre-requisite skills in General Mathematics such as integer, rational, patterns and algebra. The teacher observed that students' performance is greatly affected by their poor mastery of the pre-requisite skills. The research involves thirty student respondents who were purposively selected based on their score on the pre-test given to them at the beginning of the semester. Students were ranked based on the score they got in the pre-test. The bottom thirty were then selected as respondents of the study. The respondents were given Tarsia-aided remedial classes as intervention. Tarsia is a software that allows teachers to create a variety of puzzles like jigsaw and dominoes. Sixty-minute remedial classes of two to three session per week started on the month of September 2021. A blended learning modality was adapted. The researcher gathered data using the pre-test and post-test result of the respondent. It was found out that the average of the score of the thirty respondents in the 50-item pre-test is 8.13. The average of the scores of the students increased by 11.2 points during the post-test that was given after the intervention. Using t-test for paired samples, it was found out that there is a significant difference between students' pre-test and post-test scores. Thus, the Tarsia-aided remedial classes improved students' mastery of the pre-requisite skills.

**Keywords:** IRPA, Tarsia, General Mathematics Intervention, Action Research.

### Introduction

Mathematics is one of the subjects taught in the K to 12 classrooms. The conceptual framework of the K to 12 Basic Education Curriculum states that the twin goals of Mathematics in the basic education level are critical thinking and problem solving (K-12 Curriculum Guide, 2013). The curriculum is designed with competencies are aimed to develop students' problem-solving skills and critical thinking. To develop critical thinking among the learners, the curriculum offers an avenue for the learners to conceptualize, apply, analyze, synthesize and evaluate information. These skills if fully developed can serve as a foundation for higher Mathematics.

The K to 12 curriculum follows a spiral approach. This means that topics start from the basic and increases in difficulty and complexity. The skills learned will become scaffolds in learning the more complex skills. Thus, a good mastery of the prior skills and lessons learned is necessary. In a study conducted by Hailikari, et al (2008) among pharmacy students, it was found out that their prior knowledge from previous courses affects their achievement. In learning and retaining formal concepts in Mathematics, prerequisite skills are of help (Sharma, 2018)

In the Trends in International Mathematics and Science Study of 2012 Philippines scored significantly lower among 58 countries in the grade four math and science assessment. In the said assessment, the country scored 297 in Mathematics which is way lower that how the country performed in 2003 where we scored 358 (Bernardo, 2020).

This is an existing dilemma of the grade 11 students of Tacloban National Agricultural School.

The researcher has observed that the grade 11 students of the said school taking up General Mathematics subject have difficulty learning the competencies expected due to the lack of mastery of the basic Math skills. Mastery of basic Math skills is seen to be necessary in learning the General Mathematics competencies as these are pre-requisites. Mastery of these pre-requisites are like building blocks that will aid in acquiring new skills.

With this, the researcher proposed the use of Tarsia as a tool in the remedial class with the grade 11 Senior High School students. Tarsia is a software that allows teachers to create a variety of puzzles like jigsaw and dominoes. The inclusion of Tarsia puzzles in the remedial classes will make it game-based in nature. The researcher was hopeful that the remedial class aided with Tarsia will improve the students' mastery of the pre-requisite skills for General Mathematics which are integers, rational numbers, patterns and algebra or IRPA as supported in the study of Adams (2011) on the Grade 11 students before being administered to the respondents.

### **Review of Literature**

In a study conducted by Capate (2015), results revealed that most of the grade 8 students showed a beginning level of achievement in the formative tests and Mathematics Achievement Test and half of the tested contents were least mastered. The Math curriculum is spiral in nature which means that the skills taught in the early years in Basic Education are pre-requisites to the succeeding topics. If these least mastered skills are not revisited in the succeeding grade level, these least learned skills will then pile up. The piling up of these least learned skills will then hinder the learning of higher Math skills.

Similarly, in the study conducted by Capunan, et al (2019) revealed that eighty-eight (88) pupils from grades of the elementary department of a private higher education institution (HEI) were recommended by their Mathematics teacher to undergo remediation as they got a mark of 78 and below in Math from the previous academic. Result shows a positive relationship between the previous and current grade level's Math grades of the students who attended the remediation classes. Thus, remedial class in Mathematics is beneficial for increasing students' score in standardized test.

Game-based learning is a teaching approach where learning contexts that are designed by the teacher are explored by the learners through the use of a game. In order to add depth to the learning experience, collaborative inputs are given (EdTech Review, 2013). Game-based learning was proven to improve students' achievement in learning the American Sign Language (Kamnardsiri, Hongsit, Khuwuthyakorn, & Wongta, 2017). A similar result was shown in the study conducted in a Mathematics class among elementary and secondary students. They had a positive opinion about the game and suggest that the game could be a good learning tool (Katmada, Mavridis, & Tsiatsos, 2014).

### **Statement of the Problem**

The purpose of the study was to find out the effect of the Tarsia-aided remedial class in the mastery of the pre-requisite skills in Math.

This research attempted to answer the following research questions:

1. Is there a significant difference between the pre-test and post-test results?
2. How effective is Tarsia-aided remediation in improving students' performance?

### **Scope and Delimitation**

The study is focused on the use of Tarsia puzzles as an interactive computer-based mathematics software that serves as a remedial intervention material that is expected to improve the mastery level of grade 11 students of Tacloban National Agricultural School in pre-requisite skills in General mathematics such as Integers, Rationals, Patterns, and Algebra for school year 2021-2022.

Grade 11 students were given pre-test on General Mathematics. All of the Grade 11 students failed in the pretest on General Mathematics. In this case, the researcher used convenience sampling and chose one section to represent as participants of the study. Participants undergone three (3) months of remedial classes on the pre-requisite skills in General Mathematics using Tarsia puzzles. A post-test was administered after the intervention to check if there is a significant improvement on their mastery level of the said pre-requisite skills.

## Research Methodology

### Research Design

The study employed the use of One-Group Pretest- Posttest Design. The one-group pretest-posttest design is a type of quasi-experiment in which the outcome of interest is measured 2 times: once before and once after exposing a non-random group of participants to a certain intervention/treatment (Choueiry, n.d.). This type of research design was used to check the effectiveness of an intervention which is the use of Tarsia puzzles that improves the mastery level of selected Grade 11 students in General Mathematics.

### Population and Sample

Convenience Sampling was employed. All grade 11 students of Tacloban National Agricultural School taking up General Mathematics subject were given a pre-test covering the pre-requisite skills at the beginning of the semester. All of the Grade 11 students failed in the pretest on General Mathematics. In this case, the researcher used convenience sampling and chose one section consisted of 30 students to represent as participants of the study.

### Instrumentation

This study employed the collection quantitative data. The quantitative data were gathered using the results from the pre-test and post-test. A 50-item teacher-made test was administered to the students (pre-test) before the intervention. The pre-test assessed the mastery of the learners of the following pre-requisite skills: fractions, decimals, percents, translating English phrases to Mathematical phrase, evaluating algebraic expressions, polynomials; addition, subtraction, multiplication and division of polynomials, linear equations and inequalities, relations and functions, domain and range of functions. After the implementation, a post-test was given to the same students. Results were gathered for analysis.

### Data Analysis

The study used the mean score of the students in both pre-test and post-test to determine the mastery level of the Math pre-requisite skills and t-test of dependent means to assess if there is a significant difference between the performance of the students in the pre-test and post-test.

### Results

The grade 11 students of Tacloban National Agricultural School taking up General Mathematics subjects were given a 50-item pre-test covering the Basic Mathematics skills that are pre-requisites for said subject. All grade 11 students were ranked based on their scores. The bottom thirty students were selected.

**Table no. 1. Pre-test and Post-test Result**

Mean			
Pre-test	Post-test	$t_{comp}$	$t_{tab}$
8.13	19.33	9.654	2.045

It can be gleaned from table no. 1 that the average of the score of the thirty respondents in the 50-item pre-test is 8.13. The average of the scores of the students increased by 11.2 points during the post-test that was given after the intervention.

To assess if there is a significant difference between the performance of the students in the pre-test and post-test, t-test of dependent means was used. A computed t-value of 9.654 was obtained. At a level of significance set at 0.05, a t-value of 2.045 is needed for statistical significance. The computed value of 9.654 exceeds the given value for 0.05 level. This means that there is a significant difference between the students' pre-test and post-test results. Therefore, Tarsia-aided remediation is effective in improving students' performance.

### **Conclusion**

Based on the results, Tarsia-aided remedial improves the mastery of the pre-requisite skills in General Mathematics of the Grade 11 students of Tacloban National Agricultural School for school year 2021-2022.

### **Recommendations**

Based on the result, the following recommendations are made.

1. Remediation must be given on a regular basis to those students showing low mastery of the pre-requisite skills using Tarsia puzzles as an intervention material;
2. A similar study be conducted to other grade levels.

### **Policy Note**

#### **TARSIA for IRPA**

**NOTE:** This study focused to determine the effectiveness of Tarsia-aided remedial classes as intervention to the mastery of pre-requisite skills of Grade 11 students in General Mathematics.

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