The "Wrong Answer Note": An Analysis of Students' Mistakes

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Abstract: This research study aimed to determine the different types of students' mistakes in quizzes of selected topics in Mathematics based on the reasons why these mistakes were committed. Participants came from three different intact classes namely Grade 7 Basic Algebra, Grade 8 Geometry, and Grade 10 Analytical Geometry. Through the use of the "Wrong Answer Note", students revisited their mistakes in quizzes, reflected on these and explained why these were committed. Students' lack of understanding and mastery, insufficient time to finish answering the item, carelessness, failure to study, and miscalculation, among others, were some of the reasons students gave. Based on these given reasons, errors were classified as conceptual, value-based, problem solving error, or carelessness. Recommendations were given both to the teachers and students in order to address these errors.

Key Words: assessment; types of errors; wrong answer note;

1. INTRODUCTION

Teachers play an important role in supervising students in their learning by giving them relevant tasks that can boost achievement. The teacher must be able to communicate with the students, provide them advise and develop their self-directed and objective-oriented learning (Kim, 2013). One way for teachers to do this is by causing students to pause and reflect on their mistakes and by giving feedback to their reflections.

Assessment

Iseni (2011) defined assessment as "the systematic collection, review and use of information about educational programs undertaken for the purpose of improving learning and development". Assessment provides teachers feedback on the effectiveness of the instruction, and students if their progress in learning (Jabbarifar, 2009). Hence, it is vital in the teaching and learning process. Furthermore, assessment also affects student performance and attitude towards the subject (Kavaliauskiene, 2012).

Iseni (2011) enumerated the various reasons for doing assessments – 1) to test students' prior knowledge and skills, 2) to confirm teachers' assumptions regarding students' capabilities, 3) to give students more opportunities to showcase their knowledge and skills, among others. Assessments however do not end on examinations provided by teachers. Teachers' feedback on students' work are vital not only in letting students know their progress and achievement, but also to correct their mistakes (Kavaliauskiene, 2012).

Nowadays, schools are leaning towards a more student-centered education by supporting personalized learning. One way to do this is knowing students' errors and their causes (Ha & Kim, 2015).

Types of Errors in Mathematics

According to Abdullah, Krishnasamy and Veloo (2015), students commit four different kinds of errors in mathematics. Firstly, the conceptual error is committed due to misconceptions and lack of understanding and mastery of mathematical concepts. Secondly, the value-based error is made due to confusion, insufficient time, and anxiety.

Thirdly, the problem-solving error is committed due to erroneous application of mathematical concepts and forgotten procedures. Lastly, carelessness error is made due to negligence in transcribing information from the question, guesswork, and carelessness.

According to 'Jeong (1999), there must be educational considerations provided in handling students' mistakes; at the same time, students' errors must be analyzed by both the teacher and the learners for them to be able to diagnose which part of the lessons needs to be given more attention. 'Jeong (1999) also stated in his study that wrong answers should be given more importance than correct answers because these could guide teachers and students in identifying students' weaknesses and understand better the cause of such errors.

One of the effective ways to improve students' academic performance is by understanding students' misconceptions during formative assessments (Schnepper & McCoy, 2013). Students' mistakes if analyzed properly, may inform teachers if remediation or re-teaching is necessary, who among the students need remediation, to what extend is the remediation and how errors could be addressed.

Objective of the Study

Since formative assessment plays an important role of informing teachers about student conceptions, this research study aims to use the "Wrong Answer Note" (WAN) in order to determine the types of students' mistakes based on the reasons students give in committing these in their quizzes.

2. METHODOLOGY

The study is part of an action research that utilized a quasi-experimental design. The participants were not selected and grouped randomly but was based on the intact classes assigned to the researchers during their teaching internship.

Participants consisted of fifty-five science high school students from three different year levels – 17 Grade 7 students, 27 Grade 8 students and 11 Grade 10 students. In the K-12 Spiral curriculum, the corresponding subject matter of these cohorts during the conduct of the study were basic algebra, geometry and analytic geometry.

The WAN was the main research tool used in this study. The said tool was adapted from the study of Ha and Kim (2015). In WAN, students copied both the question and the answer of items they committed a mistake in the test, explained the reason for committing it, and proposed a correct solution and answer. The teacher then collected and analyzed students' WAN and wrote their feedback.

There were three short quizzes from which the mistakes were drawn. Each quiz consisted of 10 items. The test items were constructed based on the curriculum guidelines set by the Department of Education. All quizzes were content validated by the researchers' coordinating teachers who had been teaching the subject matter for more than 5 years.

Students were taught how to write the WAN. A short quiz was administered after each class instruction. Each time students received their checked quiz, they wrote a WAN for every mistake they have.

Based on students' reasons for committing the mistake, errors were categorized using the classifications provided in the study of Abdullah, Krishnasamy & Veloo (2015). I.e., errors were categorized as conceptual, value-based, problem solving and carelessness. Students' given reasons were analyzed thematically and frequency count was made in similar responses under the same category.

3. RESULTS AND DISCUSSION

Types of Errors in Mathematics

Students in different grade levels committed all types of errors. However, the frequency of committing these errors vary depending on the year level and the subject matter. Table 1 shows that the most frequent errors committed in Basic Algebra, Geometry and Analytic Geometry are value-based, conceptual, and problem solving, respectively. This implies that the type of error may be due to the year level where the student belongs and the subject matter. Algebra is the branch of mathematics that deals with variables, constants and symbols. Thus, students do a lot of computations and tend to commit errors that are value-based since students easily get confused with the operations, may have insufficient

Table 1
Frequency of Errors Committed based on its Type grouped by Grade Level

Type of Error	Grade 7 Basic Algebra	Grade 8 Geometry	Grade 10 Analytic Geometry
Conceptual Error	10	52	3
Value-Based Error	21	22	14
Problem Solving Error	3	5	17
Carelessness Error	14	34	14
Total	510	810	330

time to complete the task and experience anxiety due to the abstract nature of Algebra. Whereas Geometry deals with shapes, objects and solids, and its properties, students tend to find difficulty in understanding its concepts. Since Analytic Geometry requires students' understanding of the interconnectivity of Algebra and Geometry, most of the errors were due to erroneous applications of both mathematical concepts and procedures.
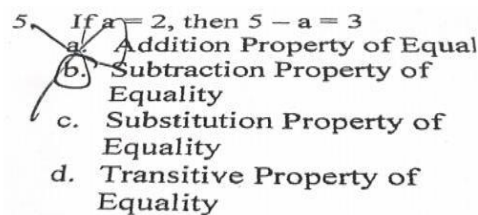

Figure 1. An Example of a Conceptual Error

Figure 1 shows an example where the student committed a conceptual error. The student attributed this error to not fully understanding the lesson, "for the properties of equality, I did not quite understand it because we did not have time to take notes and the lesson was really fast." This shows that the student has not mastered the lesson yet. Thus, the conceptual error.

The mistake in Figure 2 is categorized as value-based error because the student got confused on the characteristics of each type of equation. According to him, "The reason why I committed this error is because I get confused about the characteristics and clues of each type of equation."
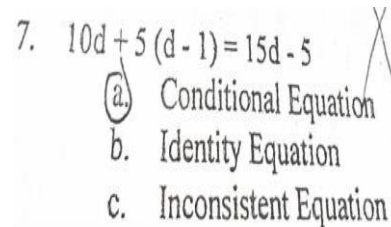

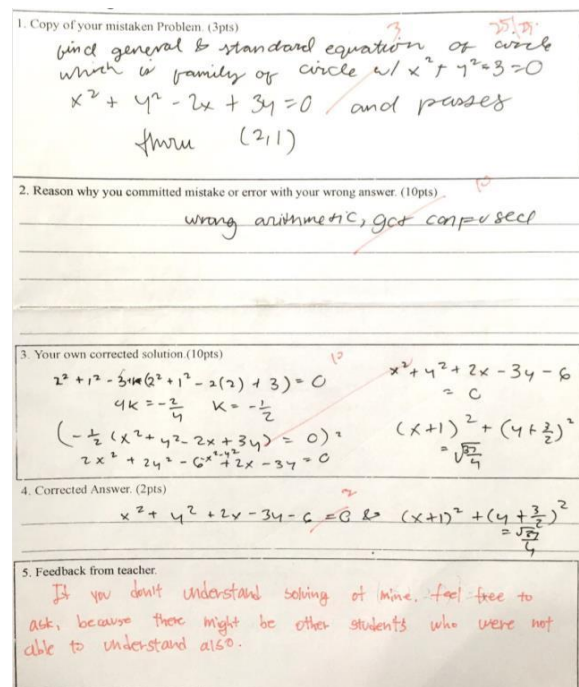*Figure 2.* An Example of a Value-based Error

Figure 3. An Example of WAN with Value-based and Problem Solving Error

The WAN of a Grade 10 student in Figure 3 shows that the student got confused and made some calculation mistakes.
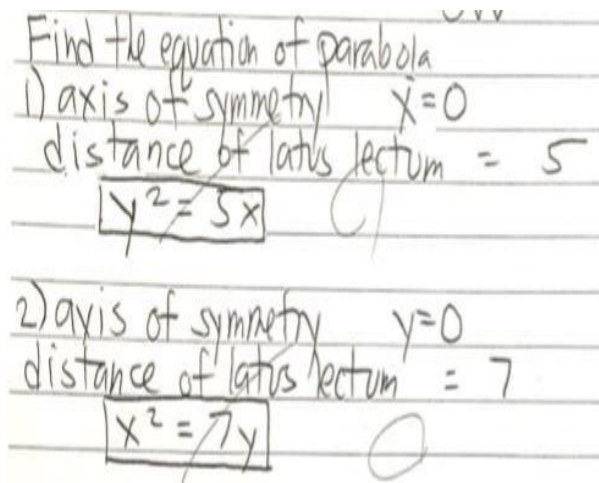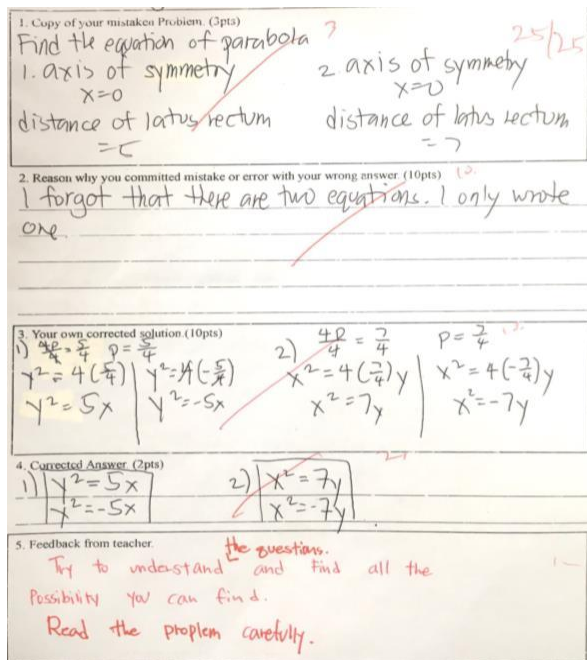

Figure 4. An Example of a Carelessness Error

Figure 5. An Example of WAN with Carelessness Error

Figure 4 shows the work of a student where he was asked to write the equation in both the standard and general form. The student wrote in his WAN that he forgot about this direction. Please see Figure 5. Nonetheless, still in the supposedly corrected version, the student incorrectly wrote the general form of the equation and the teacher has yet to call the attention of the student to correct it.

A detailed breakdown of students' written reasons for committing the mistakes is given in Table 2.

Table 2
Frequency Count of Students' Reasons for Committing Errors

Errors Committed	Grade 7 Basic Algebra	Grade 8 Geometry	Grade 10 Analytic Geometry
Lack of Understanding and/or Mastery of the Lesson	11	37	4
Confusion	16	16	4
Insufficient Time	6	3	11
Forgotten Procedures in Solving	1	1	9
Miscalculation	2	4	12
Failure to Entirely Comprehend the Question	5	23	N/A
Guesswork	1	8	0
Carelessness	8	27	13
Did not Review or Study	N/A	10	N/A
Total	510	810	330

As can be gleaned in Table 2, the most common reasons students professed to have caused errors vary across grade levels. Grade 7 students are mostly confused, Grade 8 commonly lack understanding and mastery of the lesson while Grade 10 had carelessness and miscalculation.

4. CONCLUSIONS

Knowing why students commit mistakes can help both the teacher and students to address the occurrence of such mistakes. For example, students will be more careful in solving and will go over their answers when there is still time to review these before submitting their papers. Teachers can address students' lack of understanding by giving more examples. Students will become more careful in reading test directions if mistakes are caused by lack of comprehension of the given instruction. Other reasons underlying students' lack of preparation for the quiz as in the case of not reviewing or studying for the quiz might be poor study habits, family problems, lack of resources, lack of self-regulatory strategies and keeping of an organized scheduling or planner, could also be addressed by teaching self-regulatory strategies, involving parents' support, etc.

Results of the study show that students attempt to correct their solutions and answers albeit the teacher has to pay attention to these supposedly corrected solutions. A different type of error may arise in students' attempt to correct a previous error. Teacher's specific feedback is therefore warranted and another cycle of reflecting on mistake and correcting it in the WAN is recommended.

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