Submission Number	:	**133**
Presentation Title	:	**Use of assessment to tackle Student's Careless Mistakes**
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Abstract

The purpose of this study is to tackle the issue of students' **careless mistakes** during mathematics assessment. It is hope that the students who have this issue of careless will be able to overcome it through the intervention and build their confidence in the handling of the subject and improve their learning experiences. A group of students who displayed that they tend to be careless were selected to go through the intervention. The intervention is based the study on Newman Procedure which classify their careless mistakes into Reading Errors (R), Comprehension Errors (C), Transformation Errors (T), Process Errors (P), Encoding Errors (E). Students going through the intervention were guided to **classify** their mistakes. It was to raise their **awareness** of where they were likely to make the mistakes. They were then given help to enable them to build up their competence. The students were led through the Conscious Competence Learning Model. To measure the effectiveness of the intervention, the team used the Cohen's Effect Size the students' performance in assessment before and after the intervention.

Introduction

The team observed that students tend to make careless mistakes during summative assessments. This results in some of the students fairly badly and although the students might be have already master the concepts. Some of the students also expressed helpless in how to tackle their carelessness. With this is mind, the team aimed to tackle this issue and reduce the marks students lose due to their careless. In particular, the team aim to help students to be able to differentiate their careless mistakes and equipped them with means to tackle this issue. The team decided to base the project on the Newman Error Analysis Procedure and employed the Conscious Competence Learning Model.

Research Question

Does raising students' consciousness of their careless mistakes help to improve their mathematics performance during summative assessments?

Hypothesis

Getting students to be conscious of their careless mistakes will help to improve their mathematics performance during summative assessments.

Literature Review on Newman Error Analysis Procedure

The team did readings on the Newman Error Analysis Procedure. The team read the article "Mathematics Performance of Primary School Students in Assam (India) : An Analysis Using Newman Procedure" Vol II, Issue 1, March 2012 in the International Journal of Computer Applications in Engineering Science. In the study, under the Newman Error Analysis Procedure, when an error was classified as careless, it was further classified into Reading Errors (R), Comprehension Errors (C), Transformation Errors (T), Process Errors (P), Encoding Errors (E). The classification of the errors is below:

Reading Errors (R)

If a student could not read a key word of symbol that prevented him/her from proceeding further.

Comprehension Errors (C)

The student read all the word or symbol correctly but had not understood the overall meaning and thus unable to proceed further.

Transformation Errors (T)

The student is unable to identify the operation, or series of operation.

Process Errors (P)

The student was able to identify the appropriate operation, or series of operations, but did not know the necessary measures to carry out these operations perfectly.

Encoding Errors (E)

The student worked out a solution to a problem but could not express the solution in an acceptable written form.

Newman recommended be used in interviews that are carried out in order to classify students' errors on written mathematical tasks:

1. Please read the question to me. *(Reading)*
2. Tell me what the question is asking you to do. *(Comprehension)*
3. Tell me a method you can use to find and answer to the question. *(Transformation)*
4. Show me how you worked out the answer to the question. Explain to me what you are doing as you do it. *(Process Skills)*
5. Now write down your answer to the question. *(Encoding)*

Through these five questions, the interview would be able to obtain information whether the error could be attributed to motivational factor or due to a specific category of errors.

Literature Review on Conscious Learning Model

The team read up the Conscious Learning Model. There are four stages in this model.

Stage 1 : Unconscious incompetence

At this stage, the person is not aware of the existence or relevance of the skill area, he may not be aware that he has a particular deficiency in the area concerned. He may also deny the relevance or usefulness of the new skill. In order to acquire the new skills, he must be conscious of his incompetence before development of the new skill or learning can begin. The aim of the teacher is to move the person into the 'conscious competence' stage, by demonstrating the skill or ability and the benefit that it will bring to the person's effectiveness
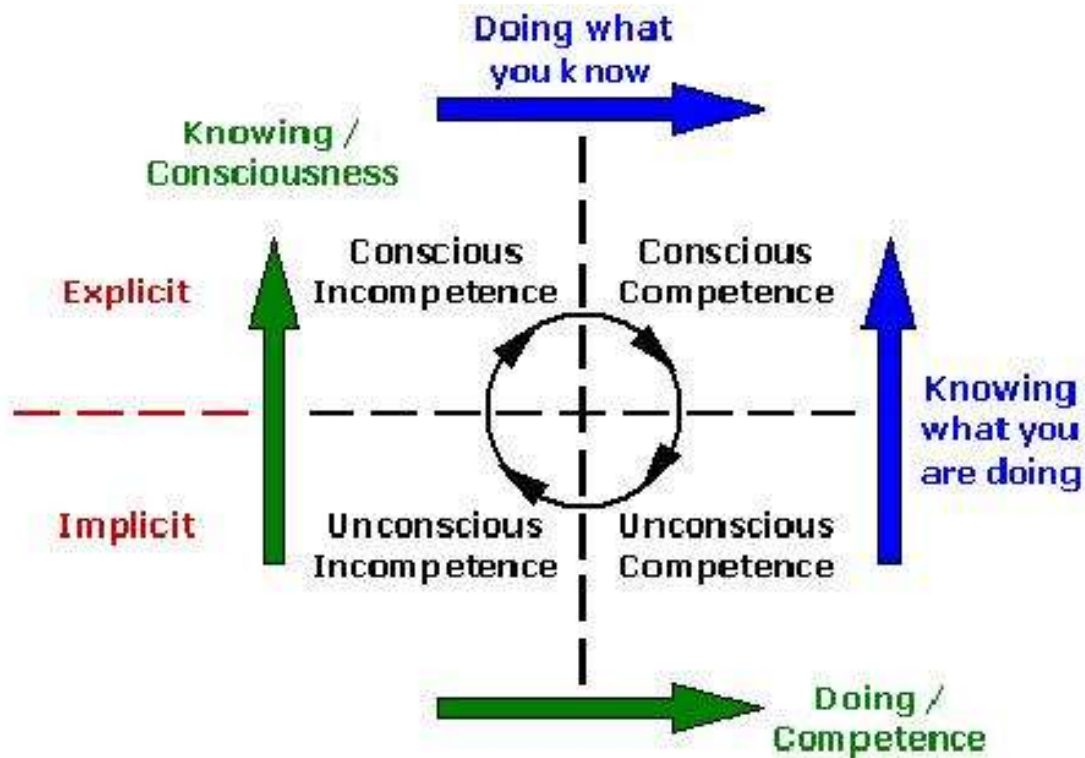
Stage 2 : Conscious incompetence

A person is conscious incompetence when he becomes aware of the existence and relevance of the skill. He is also aware of their deficiency in this area when he attempts to use the skill. He realises that by improving their skill or ability in this area, his effectiveness will improve. Ideally the person has a measure of the extent of their deficiency in the relevant skill, and a measure of what level of skill is required for their own competence and he makes a commitment to learn and practice the new skill, and to move to the 'conscious competence' stage.

Stage 3 : Conscious competence

A person achieves 'conscious competence' in a skill when they can perform it reliably at will. He will need to concentrate and think in order to perform the skill. He can perform the skill without assistance. He will not reliably perform the skill unless thinking about it - the skill is not yet 'second nature' or 'automatic'. He should be able to demonstrate the skill to another, but is unlikely to be able to teach it well to another person. He should ideally continue to practise the new skill, and if appropriate commit to becoming 'unconsciously competent' (stage 4) at the new skill through practise.

Stage 4 : Unconscious competence

       The skill becomes so practised that it enters the unconscious parts of the brain and become 'second nature'. A common examples are driving, sports activities, typing, listening and communicating, it becomes possible for certain skills to be performed while doing something else, for example, knitting while reading a book. The person might now be able to teach others in the skill concerned, although after some time of being unconsciously competent the person might actually have difficulty in explaining exactly how they do it.

       The learner who does not see the need to acquire a necessary skill is at the unconscious incompetence stage. At this stage is it essential to bring this awareness to the learner and direct to see the need to acquire the skill. This will move him into the conscious incompetence stage. It is only at this stage that once he is aware of the need to acquire that skill that he will respond to training and derive personal benefit. In this sense, the progress is from unconscious incompetence to conscious incompetence and then move on to the conscious competence and unconscious competence stage. It is not possible to jump stages. The progress from one stage to another will also let the learner feels a sense of accomplishment. The learner will develop competence only when he sees the relevance of his own incompetence and acknowledge the benefits that comes with his competence in that particular skill.

Reflections on the Literature Review

The team reflected on the reading and found The Newman's classification of errors helps to identify the careless mistakes that our students are making. The team also found the classification to be relevant in the teaching of mathematics in our school context and the mistakes made by our students could be grouped into one of the five category. The team also found that once the student are able to classify their error, it will give me them a better focus on how to tackle their problem of careless. They will also be more aware of their possible source of errors and know what to look out for while checking their work. The team also found the approach of interview the students to find out the root cause of their mistakes ideal, although the team will need to look how it could be implemented in our school context.

The team also found the Conscious Learning Model could help our students to overcome their problem of careless. Some students may not even be aware that their loss of marks is due to their careless (**unconscious competency**). Some may know that they are careless but have a feeling of helplessness (**conscious incompetency**). The team hopes that through the interventions, the students will know how they could tackle their careless mistakes (**conscious competency**) and subsequently no longer make any careless mistakes (**unconscious competency**).

Intervention

The intervention was carried out in five Sec 4 classes in term 3 – Sec 4A, 4B, 4C, 4D and Sec 4G. In total, there were 163 students involved in the study. Due to the number of students involved, the team decided that instead of conducting interview, the team will direct the students to do a personal reflection using a form to help them to classify their errors as well as to make them aware of the impact of the loss of marks due to careless.

Before the intervention was carried out, the classes did a mathematics paper 1. This mathematics paper 1 served as the data for the pre-test. After they had done the paper, the teacher guided the students to go through the paper and identify where and what is the type of their careless mistakes they had made. For a start, to avoid confusion and misunderstanding, we only exposed students to 3 (Reading, Process Skills and Encoding) of the terms instead of all the 5 terms. To measure the effects of the intervention, the students sat for another mathematics paper 1 and data was collected.

Sample of the form used by students

Name : _____		Class : _____

So, how careless was I?..........

Title of test/assignment : __Methodist Girls School 2011__

Score of test/assignment : _____

Total marks loss due to careless mistakes : _____

Question No.	Marks loss due to careless mistakes	Pick a tick on the type of careless mistakes you made		
		Reading	Process skills	Encoding
1.				

22.					
23.					

Type of errors:

Reading error - If the student could not read a key word or symbol that prevent him/her from proceeding further.
Process skills error - The student was able to identify the appropriate operation, or series of operations, but did not know the necessary measure to carry out these operations.
Encoding error - The student worked out the solution to a problem, but could not express the solution in an acceptable written form.

Data Analysis & Measurement

The students' score are collected and compiled for analysis. Below shows how the student's score are compiled for analysis as well a sample of the completed form done by the student.

Tabulation of the scores of the students.

	A	B	C	D	E	F	G	H	I	J	K	L
1		Class: 4B			Class: 4B			Class: 4C			Class: 4C	
2		Catholic High School Prelim 3			Methodist Girl's School Prelim 1			Catholic High School P1			Methodist Girl's School Prelim 1	
3												
4		Score of Test	Total marks loss		Score of Test	Total marks loss		Score of Test	Total marks loss		Score of Test	Total marks loss
5	1	51	8		53	10		60	8		50	5
6	2	63	7		49	6		42	19		44	17
7	3	56	7		54	5		40	2		19	1
8	4	56	10		48	2		42	8		43	6
9	5	59	7		60	8		62	6		55	3
10	6	41	5		16	3		50	3		33	7
11	7	65	5					48	18		59	9
12	8	50	5		58	2		50	5		38	4
13	9	60	6		62	2		48	19		52	6
14	10							45	5		40	1
15	11	58	15		37	6		66	24		43	7
16	12	43	19		49	3		62	9		54	3
17	13	57	11		49	4		57	10		17	11
18	14	68	6		63	5		55	9		46	9
19	15	73	4		75	2		57	23		40	12
20	16	41	2		42	3		48	21		61	9
21	17	63	6		44	2		56	7		59	4
22	18	69	6		72	7		9	0		8	0

Sample of Students' Completed Forms

Pre test

Post test

6

To measure the effectiveness of the intervention, the statistical tool, effect size was used. Effect size is calculated by taking the difference in two mean scores and then dividing this figure by the average spread of student scores

$$\text{Effect Size}(ES) = \frac{\left|\text{Average of the post-test scores} - \text{Average of the pretest scores}\right|}{\text{Average standard deviation}}$$

The mean and standard deviation of the classes are calculated. It was used to determine the effect sizes of the classes. Effect size is calculated using an online effect size calculator by University of Colorado Colorado Springs. http://www.uccs.edu/~lbecker/

Findings and Results

Below were the results of the various classes that went through the intervention.

Class	Mean (Pre)	Mean (Post)	Standard deviation (Pre)	Standard deviation (Pos)	Effect Size
4A (40)	6.08	5.90	3.98	3.32	0.02
4B (38)	7.29	4.13	4.26	2.76	0.40
4C (33)	10.21	6.33	7.14	4.00	0.32
4D (20)	8.95	4.90	6.23	3.84	0.36
4G (32)	8.56	6.66	4.67	4.04	0.21

There was a drop in the mean marks loss by all the classes suggesting that students had become more aware of their careless mistakes. A smaller standard deviation in all the classes showed the consistency of the results. It showed that the intervention did create awareness to the students on their careless mistakes.

Class 4D had a drop of 4.05 marks loss due to careless mistakes. The intervention had raised their consciousness of where they loss marks due to careless mistakes thus providing them a means to tackle it.

Class 4A had the least drop of marks. This is likely due to the class being a high ability class had more students who were already *unconscious competence* thus not likely to loss marks due to careless mistakes.

The effect size shows that the intervention had medium influence on classes 4B, C, D, and G and a low influence on class 4A. The results seem to indicate that students of higher ability might not encounter this issue of marks loss to careless mistakes as compared to average ability students.

Challenges

There were some challenges that the team faced. Some students' faced difficulties classifying their careless mistakes although the team embarked on using 3 instead of the 5 categories. Some of the students might also not be able to clearly distinguish between what they do not know how to do from what they know how to do but are careless. Lastly, there were a few teachers involved in the intervention thus there might be some variance in the method of instruction.

Recommendations

The intervention indicated a positive result although there might still be a need to review some of the processes. There is also a need to standardize the types of questions in the paper used in the pre and post to measure the intervention. It is recommended to use the same paper although it might pose a motivation issue as they had done it before.

It is also recommended to have a more focused group to go through the intervention. The group can be formed through a data collected from perception survey, academic performance and teacher's observation. This will help to filter out students who do not have an issue of being careless in the study.

To have a better measure of the effectiveness of the intervention, the frequency and duration needs to be longer. It could have been a better choice to conduct in term 2 as a form of revision prior to Prelim 2 as compared to term 3. Alternatively, this practice can be started at Secondary 1 itself, so that we are able to tackle the problem from the beginning.

The team did not conscious mentioned to the students concerning the conscious learning model. The team might want to expose the model to the students as this might help them to have a better understanding of the process that they are going through in the study.

Conclusion

Is there a cure for careless mistakes? Are the students helpless in tackling the issue of being careless? The study shows a positive result that through making the students conscious that they have this issue and giving them a means to classify their careless mistake will help them to tackle this problem.

Possible future developments

A possible development of this project is to develop teaching materials that could address student's misconception as that could have been a cause of their careless mistakes. This would give an enriching learning experience to improve students' learning in the mathematics.

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The End