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RESEARCH ARTICLE

EVERY STUDENT AN EXPRESSIVE AND REFLECTIVE WRITER: ADDRESSING MATH ANXIETY

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Abstract

This study determined the effectiveness of the fusion of expressive writing of anxiety and reflective writing on content journal-writing activity in reducing Math anxiety among Grade 11 students in a public senior high school in Northern Mindanao, Philippines. A modified Math anxiety scale test was utilized in this quasi-experimental pretest-posttest controlled group research anchoring on the concepts enshrined in Vygotsky's Socio-Cultural Theory. Using descriptive statistics and Analysis of Covariance (ANCOVA), the effect of expressive and reflective journal writing intervention was examined. Results revealed that there was a statistically significant difference between the groups' anxiety level, proving that the intervention did have a substantial effect on the level of anxiety experienced by the students in their Math class in favor of the control group. The study concluded that the expressive and reflective journal writing does not only help students express negative thoughts, but it makes teachers and students connect their ideas, thereby mitigating emotional apprehensions in a Mathematics class.

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Introduction:-

Mathematics is the cradle of all creations. In the non-existence of math, the world can hardly move an inch. Regardless of whether a person is a cook or a farmer, a carpenter or a mechanic, a shopkeeper or a doctor, an engineer or a scientist, a musician or a magician, a driver or a passenger, a seller or buyer; everyone needs mathematics in his/her day-to-day life (Vidyalaya, 2015).

In today's information age, many jobs which generate higher salary are related to mathematics such as accounting, engineering, architecture, and Information Technology-related occupations. Despite the importance of mathematical concepts and skills in daily life and potential career, still many students are showing a lack of interest in Math and poor math performance in school (Blazer, 2011).

In a global survey, Singapore tops the list, and the Philippines ranks 115th out of 142 countries concerning the perception of students on the quality of Math and Science education. The results are based on the World Economic Forum's (WEF) Global Competitiveness Report for 2011-2012, which ranks Taiwan, 5th; Hong Kong, 11th; and South Korea, 12th (Tandoc, 2012).

The Department of Education of the Philippines designed standardized tests known as National Achievement Test (NAT) taken by Grade 7 and Grade 11 students to determine students' academic levels, strengths, and weaknesses in English, Filipino, Math, Science, and Araling Panlipunan. It also aims to enable every Filipino to create his destiny

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for the global community. The outcome served as an indicator of the students' performance in general. The NAT Mean Percentage Score (MPS) of 75% is currently set as the goal of the DepEd (DepEd Memorandum Nos 7 & 266, s.2011).

In Gingoog City Comprehensive National High School (GCCNHS), Gingoog City, the following were the NAT Mean Percentage Score (MPS) results as of 2014; 40% in Mathematics, 52% in Science, 58% Araling Panlipunan, 62% in Filipino and 65% in English, Mathematics scored the lowest.

Addressing this problem on mathematics achievement entails delving into some factors that significantly affect the students' math performance. One of the widely recognized factors that impact math success is math anxiety, which has never been studied by previous researchers in Gingoog City Comprehensive National High School.

Math anxiety is highly rampant across the globe and is undeniably considered as a strong predictor among other variables related to poor Math performance (Beilock et al. 2010). In other words, it is a proxy of poor performance in Math.

Researchers defined math anxiety as a person's adverse affective reaction to a situation involving mathematics or a feeling of tension, apprehension, or fear interfering with an individual's math performance (Banken, 2015). It is a state of agony that weakens mathematic reasoning, performance, and the students' attitude and leads to avoiding courses with mathematics content (Escalera-Chavez et al., 2016). The failure to concentrate and feelings of incompetence, worry, and humiliation are the Math anxiety psychological symptoms. In contrast, its behavioral symptoms include escaping of Math classes, ignoring Math homework until the last minute, and not studying math lessons regularly (Plaisance, 2009).

Math anxiety was mostly developed in classroom learning. Thus, math teachers as classroom facilitators play an essential role in helping students cope with their math anxiety. In this connection, the researchers aimed to assess the effectiveness of expressive and reflective writing as a teacher-student strategy in reducing stress of the Gr.11-Temperance students of Gingoog City Comprehensive National High School.

Framework

Math anxiety, in general, has been distinguished as a non-intellectual factor that hinders math achievement. Some students who perform poorly on Math assessment "have a full understanding of the mathematical concepts being tested; however, their anxiety interferes with their ability to solve mathematical problems" (Blazer, 2011). To reduce Math anxiety of the participants under experimental group, journal writing or operationally referred to in this study as expressive and reflective writing was utilized. The Sociocultural Theory of Vygotsky explains how expressive and reflective writing reduces Math anxiety.

Sociocultural Theory places an individual in the specific historical, cultural, and institutional contexts. It concentrates on ways wherein adults and peers impact the individual's learning and methods in which cultural beliefs and attitudes affect how instruction and learning occur (Cerry, 2013). This Theory was proposed by Vygotsky, who stated that every function in the child's cultural development appears twice. First, on the social level, subsequently proceeding to the individual level. The social level is between people or inter-psychological and then inside the child or the intra-psychological. It applies equally to voluntary attention, logical memory, and the formation of concepts. All the higher functions emanate as fundamental relationships between individuals (Vygotsky 1978 as cited by Adeyemi 2015). In Vygotsky's Theory, there are three stages of speech, namely, social, egocentric, and inner. Children utilize their communication for pure thoughts and emotions in Social speech. On the other hand, Egocentric speech involves children talking aloud to themselves. Usually, children aged three to seven will speak to themselves despite being alone to guide their behavior, while Inner speech is the opposite of the second stage. It comprises higher mental functions, the scene where children and adults can direct their actions internally (Vygotsky 1978, as cited by Emmert, 2015).

Vygotsky's stages of speech are related to journal writing for mathematics. Children must begin with the self-examination process to become self-aware. Writing allows students to collect their divided thoughts into organized pieces. It assists in organizing their inner thoughts, promoting their verbal fluency. The process of journal writing connects perceptions to reality. Students can begin to process their anxiety about mathematics and, in turn, enter to identify the effects.

Journal writing is a method utilized to lessen negative experiences and thoughts (Emmert, 2015). Private speech is a means to communicate with oneself and learning to self-regulate. When a child can guide their thinking process and actions, then they are better able to think about the material (Vygotsky, 1978) critically. The gap between social and psychological domains in a child is bridged through children's private speech. Once this bridge has been built, independent thinking, effective writing, and higher mental functions are utilized.

Various literatures and studies support this Theory. The opportunity to write short expressive pieces have been shown to minimize deficits of test performance, especially for students with mathematics anxiety (Ramirez & Beilock, 2011). Distress and anxiety can be reduced through writing about emotional topics, such as Mathematics anxiety. When a child holds onto negative emotions and feelings, it is stressful; but when they can express their feelings, it reduces stress and anxiety (Park & Ramirez, 2014). Accordingly, writing down students' negative thoughts reduce the burden of worry. Stating the students' fear about Mathematics, telling past experience of failure or success, and communicating feelings of hardships and other negative thoughts about the subject help the journal writers learn about themselves and reflection takes place where writers will be able to take steps towards overcoming perceived difficulties (Frattaroli et al., 2011). Journal writing could help lessen the fear that causes working memory distraction, thus improves comprehension (Ramirez & Beilock, 2011).

Moreover, the idea of journaling or writing in Mathematics subject was developed from the belief that learning results from writing as students record their questions and thoughts. It encourages the underpinning of content, self-reflection, critical thinking, and student understanding of one's thought processes or metacognition (Emmert, 2015).

Research Method:-

Research Model

The study utilized the quasi-experimental non- equivalent controlled group design. It is similar to the pretest-posttest control group design except that there is no random assignment of subjects to the experimental and control groups.

Participants

The participants in this study were the 66 Senior High School students of GCCNHS. Thirty-three students from Gr.11 –Temperance served as the experimental group, and 33 students from Gr.11- Fortitude constituted the control group. A coin was tossed to determine the experimental group (head) and control group (tail).

Data Collection Tools

Math Anxiety Questionnaire

It is a modified questionnaire from by Munoz and Mato (2007), "Test for Measuring Anxiety Towards Mathematics." This questionnaire consists of 20 items. The survey questionnaire was piloted and subjected to a reliability test. The reliability coefficient resulted in .920 for anxiety test using Cronbach Alpha Coefficient test for internal consistency. The instrument was accepted to be reliable.

Intervention

Modified Journal (Expressive Writing on Anxiety and Reflective Writing on Content) was utilized to determine its effect on the Math anxiety of students. The benefits of expressive writing in reducing anxiety has been empirically documented (Furner & Duffy, 2002; Banken 2015).

The novelty of this study is that the researchers designed a journal with the fusion of two writing components, the expressive writing for anxiety and the reflective writing on content. In other words, there are two pages, namely, the anxiety page and the content page. Researchers usually used either of the two methods in journaling, but for this study, the methods were merged. Expressive writing for anxiety were used by Ramirez and Beilock (2012); Emmert (2015); Banken (2015).

Collection of Data

The researcher sought the approval of the school administration for the conduct of the study. Then, the researcher floated a questionnaire, modified survey designed by Muñoz and Mato (2007) to measure math anxiety. Pretest and posttest of the anxiety questionnaire was floated to the respondents to determine the anxiety level of both the experimental and control group before and after the expressive and reflective writing intervention.

For the actual data collection procedure using the modified journal. The participants write their anxiety before any seatwork or quiz in 2 minutes only on the anxiety page. On the other hand, the reflective writing on the content page is done after the checking of the seatwork or the conduct of a quiz 5 minutes before the end of the period.

The duration of the treatment lasted for 30 school days only. Smythe (1998), as cited by Emmert (2015), concluded that for journal writing to be a more forceful technique, it must last over time. Students should not write in a journal once and expect higher gains in Math performance. The longer the duration, the stronger is the effect.

With the intervention, the participants in the experimental group used a big notebook as their journals. The past negative experiences in math of the students from elementary up to high school years were written in the beginning pages of the journal entitled "My Math Experiences in the Past Years" as Day 1 of the intervention period. From Day 2- Day 30, the participants wrote their previous and current emotions towards math on the anxiety page. How they evaluated the process of the topic, the difficulty, their learning, and other thoughts in solving the tasks given were written on the content page. Each day, a 5-7 minute writing session took place before and after activities. Found in the journal notebook is the anxiety page and reflection page per topic or event, date, and signature of the student and the teacher. The medium of writing could be in Cebuano, Filipino, or English as long as the respondents can clearly and fully express their thoughts and feelings.

In the anxiety page, the teacher serves as a facilitator. The interaction is between the coordination of the senses of the student from the inward feelings and writing or perception to reality (Vgotzsky, 2012). In other words, there will be no effect on the treatment of whether the teacher has or has not read the writings because the teacher has no hold in this process. This process is a technique used in Psychology in unleashing anxieties to improve the function of working memory (Chang & Beilock, 2015). Moreover, if expressive writing helps free up working memory, it may also help regulate or control emotions, as working-memory availability predicts more effective emotion-regulation processes. The good point here is that the teacher will know the root of anxiety, which serves as a springboard for finding preventive ways to curb another occurrence of anxiety. It is, therefore, essential to identify the sources of anxiety towards mathematics and to control, reduce, or even eliminate them from educational practice. Another positive impact is the establishment of trust and openness through writing signatures of both the students and the teacher. As teachers become readers of their students' stories, they can, in turn, become better teachers.

While on the reflective writing of content, students communicate new ideas and concepts in their own words and illustrations. They can build connections with the content while creating lasting associations that may be used for new, complex situations and problems (Zull, 2002 as cited by Banken, 2015). It encourages the underpinning of content, self-reflection, critical thinking, and student understanding of their thought processes or metacognition. Another significant output of the strategy is that it established a study habit of the students due to the narrative reflection of the essential concepts as an assignment. It serves as a guide where the teacher will refer to for her reflection in the lesson plan at the end of the day. It, in effect, becomes an avenue to identify the mastered competency and the least learned competency without waiting for a summative or quarterly test. Logically, it is the source where the teacher can design remedial class, and easily group the students according to the competency they least mastered. It can also be an ideal time for collaborative learning. Students with learned skills will teach students with the least learned skills.

The strategy is not an additional burden on the teachers for two reasons. One, the anxiety page is optional to be read. Two, in the reflective page, the teacher will directly read the annotation for the least mastered skill. Students will not stand and volunteer to share in the class their confusion about but express it through their journals. In this way, they will be confident in expressing their thoughts without reservation and fear of embarrassment.

Below is the format of the expressive writing journal of this study.

<p align="center">Anxiety Page (Expressive Writing of Anxiety)</p>	<p align="center">Content Page (Reflective Writing on Content)</p>
<p>Writing about fears, worries, or any negative experiences in their journals reduces their negative attitude towards Math (Chang & Beilock, 2015).</p>	<p>When learners share new ideas and concepts in their own words and illustrations, they can build connections with the content while sustaining associations for new situations and problems (Zull,2002 as cited by Banken 2015)</p>
<p>Guide Questions:</p>	<p>Guide Questions:</p>

Write your current feelings about Math?	A. In the discussion, what did you find easy?
	B. In the discussion, what did you find challenging?
	C. As an assignment, write the detailed procedure of the concept you find comfortable.

Data Analysis

The researchers used descriptive statistics, such as the mean, frequency, and percentage distribution to determine the respondents' anxiety level in Math and Math achievement. The Analysis of Co-Variance (ANCOVA) determined if journal writing has significantly affected the anxiety level of the respondents before and after the intervention.

Validity and Credibility

The quantitative tool used in this study underwent a rigid face and content validation and reliability tests. The questionnaire on Math anxiety was subjected to vocabulary examination by 10 Junior High School, ascertaining that the target-respondents understand the words in the instrument. After submitting to the mentioned rigors, reliability testing was carried out using Cronbach's Alpha for the tool on Math anxiety of which the reliability coefficient resulted to 0.920.

Findings

A scrutiny of the differences in the anxiety levels was done. Table 3 shows the difference in the anxiety level of students exposed and not exposed to the modified expressive writing intervention. It indicates the pre and post-implementation mean scores and standard deviation between groups.

Table 1:- Anxiety of the respondents of the Control and Experimental Groups Before and After Intervention.

	Control (Without Journal Writing)			Experimental (With Journal Writing)		
	Mean	SD	QD	Mean	SD	QD
Pre-Test	2.60	0.89	Moderate Anxiety	3.09	0.89	High Anxiety
Post-test	2.14	0.56	Moderate Anxiety	2.60	0.70	Moderate Anxiety

As shown in the pretest, the control group had a moderate anxiety ($\bar{x} = 2.60$, $SD = 0.89$), while the experimental group had high anxiety level ($\bar{x} = 3.09$, $SD = 0.89$).

In the posttest, both the control group ($\bar{x} = 2.14$, $SD = 0.56$) and the experimental group ($\bar{x} = 2.60$, $SD = 0.70$) had moderate anxiety level towards Math. The small dispersion of the means or the standard deviations suggests more or less homogeneity of anxiety levels among the respondents. The finding further implies that the two groups had decreased anxiety levels.

It is worthwhile to note, however, that students exposed to the modified expressive writing showed a more decreased level of anxiety compared to the control group, which did not receive the treatment. This result conforms to the findings of Emmert (2015) that mathematics journals can assist in reducing mathematics anxiety. Accordingly, writing down students' negative thoughts minimizes the burden of anxiety.

Another aim of the study was to determine the effect of the modified expressive writing activity on the level of anxiety of students.

Table 2 shows the Analysis of Covariance of posttest results between treatments. As can be gleaned from the table, the pretest anxiety result was used as the covariate to statistically equate different predictive variables, which may affect the analysis.

Table 2:- ANCOVA for the Comparison of Posttest Results.

Group	N	Mean	SD	Adjusted Mean	
Experimental	33	2.60	.704	2.569	
Control	33	2.14	.631	2.128	
Source	Df	MS	F-value	Sig.	Partial Eta Squared
Pre anxiety (Covariate)	1	1.281	2.953	.091 NS	.045

Group	1	2.995	6.904	.011 S	.099
Error	63	.434			
Total	66				

The ANCOVA found that there was a statistically significant difference between the groups' anxiety level. It means that the expressive writing activity did have a significant effect ($F(1,66)=6.904, p=0.11$) on the level of anxiety experienced by the students in their Math class in favor of the treatment group. The partial eta square ($\eta^2=0.99$) suggests that the groupings can explain about 10% of the variation in the posttest. It further means that the expressive and reflective writing journal writing intervention proved effective in lessening the anxiety levels of the students in their Math class.

Conclusion:-

The study aimed to determine the impact of the modified expressive and reflective writing intervention on students' Math anxiety based on conceptual and research literature discussed. It was on this premise that the following conclusions were drawn:

This study concluded that expressive and reflective writing has a significant effect in lowering the anxiety level of students in Math subject. Although several researchers already espoused the problem on math anxiety as a significant predictor to poor math performance (Beilock et al. 2010), one strategy explored by educators was the employment of journal writing that reduced anxiety (Furner & Duffy, 2002; Banken 2015). This study proved itself as one with those researches that confirmed the efficacy of expressive and reflective writing through journal writing in math learning.

The journal page may appear as an ordinary paper with writings, but it does contain hidden feelings and sentiments of the students about the subject, whether positive or negative. These thoughts could be equated as more valuable than the correct or incorrect answers in a math activity. Hence, is also concluded that expressive and reflective writing is not merely a tool for releasing negative thoughts and feelings but a rendezvous page between the two persons, the teacher, and students, where they can exchange emotions, ideas, thoughts, and share detailed processes of the subject matter thereby mitigating emotional apprehensions in a mathematics class.

The findings of this study may be a ready reference for teachers, should they discover that their students experience high level of anxiety in the subject. The expressive and reflective journal writing could serve as a direct evaluation and reflection of not only teachers' teaching strategies but also of students' concealed anxiety over Mathematics. Writing students' thoughts, understanding, and feelings is a passive way of getting the answers from the students of the unspoken reasons why they cannot understand the topic.

This study recommends that correlating Math anxiety with Math academic performance with expressive and reflective writing as an intervention following the methodologies of experimental research design be conducted to establish the the interrelationships existing between anxiety and academic performance while examining the efficacy of journal writing in a controlled setting.

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