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Using Expressive Writing Tasks in Reducing Students' Learning Anxieties in an Online Chemistry Class

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ABSTRACT

The abrupt changes in the way how students learn was greatly affected by the covid-19 pandemic. Increasing number of reports on excessive worrying came from students. They had trouble sleeping and expressing their thoughts because of depression, stress, and anxiety. This action research was designed to reduce anxiety of students related to chemistry and taking test in an online learning through expressive writing. A total of twenty-six participants collaborated for a 4-week expressive writing program. Participants baseline measurements of their anxieties were recorded before they undergone a 20-minute writing task every week for the entire duration of the intervention. Data gathered revealed a significant reduction in the anxieties of the participants with medium effect for both chemistry and testing. It has been found out that female participants were significantly more anxious than male for both areas. Interview data revealed that participants' anxieties were cause by self-doubt and overthinking, experience of failure, lack of prior knowledge and time. However, expressive writing provided sense of achievement, student's empowerment, opportunity to control emotion, and feeling of relief.

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1. INTRODUCTION

The current situation, COVID-19 pandemic, challenges the world to change in many different aspects especially in the field of education. More than 1.2 billion learners are affected globally. This condition has forced the education sector to shift from the traditional way of face-to-face interaction to distance learning [1]. Distance learning is a form of education wherein the learners and teacher are physically separated, and the mode of instruction relies on different technologies to enable communication between them [2]. This pandemic has exposed various gaps in the system such as access to electricity, internet, and device. This would become obstacles to successfully implement the new mode of learning [3].

Students' reports on excessive worrying have been greatly increased. Students are experiencing difficulties in sleeping and expressing their thoughts and feelings which were brought by depression, stress, and anxiety due to the pandemic [4]. Anxiety is defined as "an emotion characterized by feelings of tension, worried thoughts and physical changes like increased blood pressure" [5]. People who have anxiety disorder may have trouble with their daily routines which could affect job performance, schoolwork, and relationships [6]. The Philippines mental healthcare systems may not be ready when the cases of anxiety and depression escalates as the COVID-19 pandemic continues [7].

Anxiety also exists in the classroom specifically in chemistry [8]. In effect it will be difficult for learners to deal with the learning process in this condition [9]. Science is considered one the most difficult subjects in high school that is why most students are not interested and hate Science [10]. Science Anxiety refers to the fear or hatred towards science concepts, scientists, and science related activities [9]. Aside from the aforementioned anxieties, fear and worry on taking assessment has also manifested within the students, it might be another cause of poor performance among learners [11]. While online and/or distance learning which has come to limelight during the pandemic, it also poses anxiety to students. It was mentioned that anxiety has significant effect on students' performance [12].

Expressive writing is a form of writing wherein emotions, thoughts and feelings are the primary subjects which focus on traumatic, stressful, or emotional events. It is a tool for self-reflection. Generally, expressive writing can be done every 20 minutes per day for 4 consecutive days. There are no restrictions on the topic to be written. Continuous writing should be observed for 20 minutes or more. Grammatical rules do not apply on the writing procedures. Expressive writing is an exercise wherein the participant writes only for himself without being forced to write things which he is not comfortable with. Being depressed or sad after the writing exercise is normal. Improved performance has been observed for students who did expressive writing prior to taking the examination. [13].

Many beneficial effects have been observed with the use of expressive writing in biological and psychological aspects as well as behavioral changes [13]. Studies on the use expressive writing to alleviate anxiety in the field of education has been realized. For instance, a reduction in general and mathematics anxiety in high school students has also been observed [14]. Expressive writing also exhibited improved performance for students with high math anxiety by offloading their anxiety-related worries [15].

This action research aims to assess the existence of various anxieties in Senior High School (SHS) students and its possible reduction through Expressive Writing. Specifically, it aims to answer the following questions: 1) What are the students' perceptions towards prior to learning chemistry and taking test in an online learning environment? 2) What are the students' responses to the expressive writing tasks in terms of authenticity, and emotional tone? 3) What are the changes in students' perceptions towards learning chemistry and taking test in an online learning environment?

2. RESEARCH AND METHOD

This action research encompasses the use of Expressive Writing (EW) as a reflective tool for self-therapy wherein participants write about their fears and worries in Chemistry and testing in an online setting. EW will help participants to confide their feelings and thoughts through writing to improve their general well-being. Anxieties of the participants will be assessed using two different questionnaires, Revised Derived Chemistry Anxiety Scale and Cognitive Test Anxiety Scale 2.0, which measure fears and worries towards Chemistry and testing. This intervention is expected to reduce the anxiety of participants towards learning chemistry and evaluation online. Also, modification in cognitive, psychological, and emotional processes are expected to manifest. EW is to improve and lower the anxieties of the participants throughout the intervention process as shown in Figure 1.

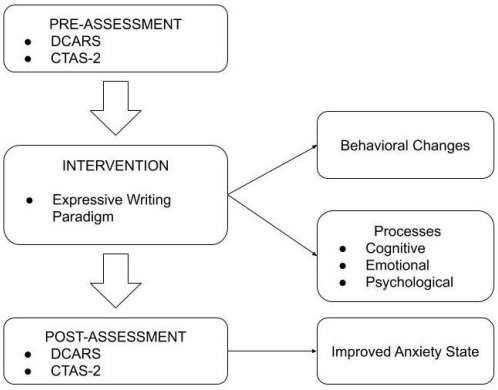

Figure 1. Conceptual Framework

This study utilized the Plan-Do-Study-Act (PDSA) Model that provides a cyclical approach in improving educational practice through action research which stipulates ownership for the researcher in continuous transformation. It also used a mixed method approach in determining the effects of expressive writing as an intervention for reducing Chemistry Anxiety and Cognitive Test Anxiety among Senior High School students in an online setting. Quantitative data were gathered using rating scales through Google Forms while interviews and

writing entries were used for acquiring qualitative data through Google Meet and Google Forms respectively. Triangulation approach was also employed using the data from the interview and rating scales.

There were 73 expected participants who submitted their consent forms and took part in the pre-assessment phase of the study. However, only 54 grade 11 students of one school in Paranaque under the STEM strand proceeded with the program during the 1st session. Attrition continued until 4th week of the session which resulted to a total of 42 participants. However, upon data screening, only 26 participants had completed all the forms and writing tasks which will qualify for data analysis consisting of 7 male and 19 female participants.

3. RESULT AND DUSCUSSION

a. Pre-Intervention Stage

Prior to the administration of the intervention, baseline measurements of both chemistry and test anxiety were measured. The results are shown in Table 1.

Table 1. Summary of Pre-Assessment Results

Anxiety Scale	Mean	SD	Interpretation
RDCARS	78.92	15.584	Moderate
CTAS	74.42	9.989	High

The mean chemistry anxiety level of the participants was 78.92 with a standard deviation of 15.584. Based on the severity standards presented on Table 1, these results suggested that the participants' anxiety fell on moderate level. However, the standard deviation suggested that the scores were a bit dispersed, thus, there were participants who got scores distant from the mean. On the other hand, cognitive test mean anxiety level was 74.42 with a standard deviation of 9.989, this result revealed that most of the participants' anxiety fell on high category. Also, the scores were less dispersed compared to chemistry anxiety.

Table 2. Mean Score of Selected Items in Pre-RDCARS

Items	Mean	SD	Interpretation
5. Waiting to get a chemistry test returned in which you expected to do well.	3.92	1.354	Quite a bit
8. Being given a "pop" quiz in a chemistry class.	4.65	.689	Extreme
10. Taking an online examination (quiz) in a chemistry course.	4.15	1.047	Quite a bit
13. Being given a homework assignment of many difficult problems which is due the next chemistry class meeting.	4.54	.706	Extreme
17. Solving a difficult problem on a chemistry test.	4.38	.852	Extreme
20. Taking an online examination (final) in a chemistry course.	4.62	.637	Extreme
22. Thinking about an upcoming online chemistry test one day before.	4.12	1.033	Quite a bit

For chemistry anxiety, Table 2 shows the mean scores of selected items in RDCARS taken prior to intervention. Based on the data, item numbers 5, 8, 10, 13, 17, 20, and 22, contributed greatly to the chemistry anxiety of the participants. The aforementioned items were under the chemistry evaluation subscale. Chemistry evaluation subscale have higher mean anxiety compared to learning chemistry.

Table 3. Mean Score of Selected Items in Pre-CTAS

CTAS	Mean	Interpretation
20. After taking an online test, I feel I should have done better than I actually did.	3.81	Very
22. I often realize mistakes I made right after turning in a test.	3.65	Very
23. When I finish a hard test, I am afraid to see the score.	3.54	Very

For cognitive test anxiety, Table 3 shows the mean scores of selected items in CTAS taken before the administration of the intervention program. Based on the data, item 20, "After taking an online test, I feel I should have done better than I actually did.", scored the highest mean of 3.81 and standard deviation of 0.491 among all items in the rating scale. This perception of the participants greatly contributed to their anxiety towards taking test online. Also, the standard deviation suggests a minimal dispersion of the scores, thus, many participants rated high on this item. It was followed by item 22, "I often realize mistakes I made right after turning in a test.", with a mean of 3.65 and a standard deviation of 0.689. Also, item 23, "When I finish a hard test, I am afraid to see the score.", scored a bit high in term of the mean with a value of 3.54 and a standard deviation of 0.859. Considering these 3 items, it seemed that participants still exhibit anxiety even after the examination has been taken.

Upon careful analysis of the interview transcripts, the following themes for pre-intervention were generated. Participants worries and anxieties were rooted mainly on their self-doubt and overthinking, failure, prior knowledge, and time.

b. Intervention Stage

Table 4. LIWC Result for Week 1

Summary Variables	Mean	SD
Analytic	24.29	10.986
Clout	21.01	12.432
Authenticity	86.05	11.087
Emotional Tone	19.65	18.879

Highest Possible Score: 100

Table 4 shows the mean and standard deviation of the summary variables generated by Linguistic Inquiry and Word Count software. The summary variable mean scores were 24.29, 21, 01, 86.05, and 19.65 for analytical thinking, cloud, authenticity, and emotional tone respectively. Authenticity mean score revealed that participants showed honesty in their writing during the first session. On the other hand, emotional tone mean score of 19.65 exposed the negative emotions of the participants in their writing.

Table 5. LIWC Result for Week 4

Summary Variables	Mean	SD
Analytic	35.57	16.825
Clout	26.72	20.940
Authenticity	77.39	23.703
Emotional Tone	38.60	30.203

Highest Possible Score: 100

The following results in Table 5 were generated from the 4th week writing session with analytical thinking mean score of 35.57, clout mean score of 26.76, authenticity mean score of 77.39 and emotional tone mean score of 38.60. Authenticity result showed an honest writing but lower compared to the 1st writing task. On the other hand, emotional tone depicted a negative emotion in the participants writing, however the mean score was higher compared to the 1st session. Analytical thinking showed a higher mean for 4th week compared to 1st week of writing similar to clout.

c. Post-Intervention Stage

Table 6 shows mean scores of the participants in terms of their anxieties towards Chemistry and testing after the intervention was administered.

Table 6. Summary of Post-Assessment Results

Anxiety	Mean	SD	Interpretation
Chemistry	70.81	18.942	Moderate
Test	69.96	13.742	High

The mean chemistry anxiety level of the participants was 70.81 with a standard deviation of 18.942. This result suggested that most participants lie within the moderate level of anxiety in terms of chemistry. However, for cognitive test anxiety mean score, 69.96 denoted that most participants were still highly anxious after the program was implemented.

Considering the trend followed by the data, a reduction on participants' anxieties could be deduced. A 50% (n=4) reduction of highly anxious participants was observed with chemistry anxiety while 23.81% (n=5) was reduced for cognitive test anxiety on the same level. Moderate level of anxiety in chemistry was also decreased by 18.75% (n=3) while participants with low level anxiety towards chemistry increased from 5 to 9. On the other, an increase in number of moderately and low anxious participants was observed for cognitive test anxiety, 80% (n=4) for moderate and 100% (n=1) for low as shown in Figure 2.

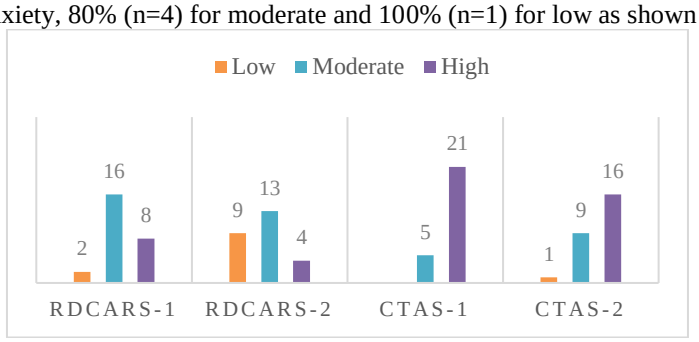

Figure 2. Summary of Participants' Anxieties Before and after the Intervention

Table 7. Mean Score of Selected Items in Post-RDCARS

Items	Mean	SD	Interpretation
5. Waiting to get a chemistry test returned in which you expected to do well.	3.92	1.230	Quite a bit
8. Being given a "pop" quiz in a chemistry class.	4.38	.941	Extreme
10. Taking an online examination (quiz) in a chemistry course.	4.12	1.033	Quite a bit
13. Being given a homework assignment of many difficult problems which is due the next chemistry class meeting.	4.19	1.132	Extreme
17. Solving a difficult problem on a chemistry test.	4.00	1.131	Extreme
20. Taking an online examination (final) in a chemistry course.	4.54	.859	Extreme

Table 7 shows the mean scores of selected items in RDCARS taken after the intervention. Results have revealed that items 5, 8, 10, 13, 17, and 20 made great contributions in the chemistry anxiety of the participants under chemistry evaluation subscale. These were the same items which obtained high mean scores during the pre-assessment. However, in the post-assessment of chemistry anxiety, item 20, "Taking an online examination (final) in a chemistry course.", got the highest mean of 4.54 with a standard deviation of 0.859. Still, after the intervention, being assessed in chemistry contributed to the participants' anxiety.

Table 8. Mean Scores of Selected Items in Post-CTAS

CTAS	Mean	Interpretation
2. I worry more about doing well on online tests than I should.	3.42	Very
3. I get distracted from studying for online tests by thoughts of failing.	3.15	Quite
9. When I take an online test that is difficult, I feel defeated before I even start.	3.04	Quite
13. When I take an online test, my nervousness causes me to make careless errors.	3.19	Quite
14. My mind goes blank when I am pressured for an answer on an online test.	3.27	Very
20. After taking an online test, I feel I should have done better than I actually did.	3.35	Very
22. I often realize mistakes I made right after turning in a test.	3.46	Very
23. When I finish a hard test, I am afraid to see the score.	3.31	Very

Mean scores of selected items in CTAS after the intervention was calculated as shown in Table 8. Results showed that items 2, 3, 9, 13, 14, 20, 22, and 23 contributed to the overall high mean score of the participants. It was noted in the pre-assessment that items 20, 22, and 23 got the highest mean scores. Post-assessment results revealed a consistent data. Participants' anxieties tend to increase even after the examination was already taken.

Table 9. Mean Anxiety Level According to Gender

Anxiety Scale	Mean	SD	Interpretation
RDCARS			
Male	53.43	12.804	Low
Female	77.21	16.821	Moderate
CTAS			
Male	58.57	13.088	Moderate
Female	74.16	11.668	High

Post-intervention results showed that there was a significant difference between male and female for both chemistry and test anxiety. Male participants were considered less anxious than female after the intervention as shown in Table 9. A Kruskal-Wallis H test showed that there was a statistically significant difference in chemistry anxiety ($x^2 = 8.380$, $p = 0.004$) and cognitive test anxiety between gender ($x^2 = 5.226$, $p = 0.022$).

Table 10. RDCARS Pre and Post-Assessment Results

RDCARS	Mean	SD
PRE	78.92	15.584
POST	70.81	18.942

Anxiety of participants in terms of chemistry had decreased based on the mean scores of pre- and post-assessments as shown in Table 10. A Wilcoxon signed-rank test showed that a 4-week administration of expressive writing in reducing chemistry anxiety made a statistically significant change in the chemistry anxiety of the participants ($Z = -2.289$, $p = 0.022$) with a medium effect size ($r = 0.449$).

Table 11. CTAS Pre and Post-Assessment Results

CTAS	Mean	SD
PRE	74.42	9.989
POST	69.96	13.742

Table 11 shows the pre- and post-assessment mean results of CTAS. Based on the data, there was reduction in the anxiety of participants in terms of testing. A Wilcoxon signed-rank test indicated that a 4-week administration of expressive writing in reducing test anxiety made a statistically significant change in the test anxiety of the participants (Z = -2.047, p = 0.041) with a medium effect size (r = 0.401).

Table 12. Mean Score for Week 1 and Week 4 LIWC Summary Variable Results

Summary Variables	Mean	
	1st	4th
Analytic	24.29	35.57
Clout	21.01	26.72
Authenticity	86.05	77.39
Emotional Tone	19.65	38.60

As shown in Table 19, it was noteworthy to mention that analytical thinking increased significantly (Z = -3.340, p = 0.001) after 4 weeks of expressive writing. This result may be attributed to the study increase in working memory capacity as the program progresses [16]. Clout did not make any significant difference from week 1 to 4. Authenticity had decreased. However, the change was considered not significant (Z = -1.168, p = 0.243). On the other hand, emotional tone mean score increased. A Wilcoxon signed-rank test indicated that a 4-week administration of expressive writing made a statistically significant change in the emotional tone of the participants (Z = -2.624, p = 0.009) with a large effect size (r = 0.515). Authenticity result suggests that participants' honesty towards writing did not differ significantly. On the other hand, the increase in emotional tone suggests that participants had significantly change the emotions in their writing from being sad or upset towards being neutral to happy which expressive writing has intended to fulfill.

Thematic analysis generated the following themes for post-intervention: 1) sense of achievement, 2) student's empowerment, 3) controlled emotion, and the 4) feeling of relief.

4. CONCLUSION

Analysis of the data revealed the following:

a. Baseline measurements showed that participants were moderately anxious about chemistry but highly anxious on testing. For both chemistry anxiety and test anxiety, female mean anxiety was significantly higher than male. It was also noted that for chemistry anxiety, situations belonging to the chemistry evaluation subscale played a big part in the anxiety of the participants.
b. During the intervention program, emotional tone significantly improved as compared to the first week of writing session. It was backed up by the self-reported writing intervention as well as the interview. Authenticity, on the other hand, did not differ significantly on the fourth week of the intervention.
c. After the intervention, anxiety measurements showed that participants were still moderately anxious about chemistry and highly anxious on testing. The mean anxiety level interpretations of both chemistry and testing were the same as pre-intervention stage. However, the reduction in mean anxiety level of both chemistry and test anxieties were considered significant. This result was supported with the effect size calculation with medium effect for both chemistry and testing. In terms of gender, female participants were still significantly more anxious than male.
d. Thematic analysis revealed the following themes responsible for the anxiety of students namely self-doubt and overthinking, failure, prior knowledge, and time. On the other hand, for post-intervention stage, the themes generated after using the intervention were sense of achievement, student's empowerment, controlled emotion, and the feeling of relief.

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