Academic Emotions and Mathematics Achievement in the New Normal: Experiences of University Students

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Abstract: Many students nowadays encounter a range of academic-related emotions and feelings in our classrooms (Kumar, 2010). Empirical evidence reveals that these emotions, in addition to cognitive and motivational dimensions, have a major impact in students' academic engagement and achievement (Pekrun, 2006). Emotional experiences can have an influence on people's functioning in both positive and unfavorable aspects. Thus, in this research investigation, the researcher explored the academic emotions and achievement of college students in a higher educational institution in the Philippines. When grouped according to achievement, the results indicated that students belonging to the high achieving group endorsed positive academic emotions higher than the students from the lower group. Students in the lower group, on the contrary, endorsed negative intellectual feelings more than their counterparts. Further investigation found that only enjoyment predicted students' mathematical achievement among positive emotions (enjoyment, hope, and pride). Furthermore, among the negative emotions, only worry predicted their achievement (anxiety, shame, and hopelessness). As a result of the synergy between academic emotions and accomplishment, it is vital for mathematics educators to understand students' emotions and determine the quality of support provided to them since they may impact their emotions, which will influence their mathematical achievement. Thus, math teachers must create a learning atmosphere that fosters good academic emotions while restricting negative emotions.

Keywords— Academic Emotions; Mathematics Achievement; Synergy; COVID-19 Pandemic

1. INTRODUCTION

Everyone acknowledges the relevance of mathematics in everyday life and in the advancement of contemporary technological devices (Acelajado, 2006). Mathematics is an essential topic; its use spans many aspects of life, including business, science, computer processing, engineering, and music. According to Petti (2009), it is evident that mathematics can be found in practically every aspect of life, including nature and the technology we use.

However, it is quite ironic that something so vital is disliked and feared by so many students. Some students even regard it as barrier rather than a gateway to a profession. As a result, mathematics teachers are faced with the issue of addressing barriers and challenges to mathematics learning in the classroom. Therefore, it becomes imperative for the teacher to motivate the students to love mathematics for it will prepare them for more challenging tasks in the future.

It is an obligation of teachers to help in the improvement of their students to be effective learners. Aside from the strategies and methods employed in the classroom, another facet of teaching is recognizing the nature of the students. Understanding the characteristics of the students entails not just assessing what they can and cannot do in the classroom, but also their psychological make-up and feelings.

Many learners experience different academic emotions in our schools today (Kumar, 2010). Empirical evidence reveals that emotions, in addition to cognitive and motivational components, play an essential influence in students' academic

engagement and accomplishment (Pekrun, 2006). Over the last decade, there has been a rise of interest in the psychological study of students' emotional states and/or experiences as they relate to learning performance. An emotion originates with an individual's perception of a circumstance. It begins with the processing of information at the conscious and unconscious levels of an individual (Andries, 2011). People's functioning can be influenced by their emotional experiences in both positive and bad ways. Positive emotions have the power to broaden knowledge, but negative emotions operate as a barrier to information acquisition (Garcia, 2016).

Understanding students' academic emotions during the mathematics teaching and learning process is one of several strategies for assisting them in performing better in class. People who experience pleasant emotions, according to studies, seem to be more successful and accomplished. Contrariwise, individuals with a high level of negative emotions prefer to remove themselves from accomplishments (Stiles, 2008). Garcellano (2014) investigated the association between academic emotions and academic accomplishment in the setting of high school pupils. She found out that anxiety predicted students' math grades, that is, higher anxiety is associated with lower achievement. She suggested that students need feel more relaxed to perform well in their mathematics class. In line of teaching mathematics courses for to tertiary students, the researcher has observed that students come to class with different structures of academic emotions and these structures significantly affect students' performance in some ways. Thinking along this line, it is the researcher's belief that the study of academic emotions is promising and would help for a better understanding towards mathematics'

teaching, motivation, and self-regulated learning. Hence, the researcher's questions about the role of academic emotions to mathematics achievement becomes the impetus for this study.

2. METHODOLOGY

The nature of the research problems presented in this inquiry lend themselves to a mixed method design defined by the collection and analysis of quantitative data followed by the collection and analysis of qualitative data. The primary goal of this research is to identify the patterns of academic emotions experienced by students in mathematics classrooms. Furthermore, the analysis assesses if these emotions predict students' mathematical success.

The researcher developed and used the Academic Emotions Questionnaire (AEQ) created by in the quantitative portion of this study (Pekrun, 2006). This emotional tool assisted the researcher in determining the academic feelings of students in their mathematics lesson. AEQ will be used to measure the emotions that students feel while studying mathematics. This measure's training will often ask students how they feel, typically in a mathematics lesson.

Meanwhile, the qualitative portion of the study included interviews conducted via Focus Group Discussion (FGD) to elicit students' emotions and how these emotions impact their mathematical learning. Students will be classified as having dominant negative or positive academic emotions based on their responses to an affective questionnaire (AEQ) designed to estimate their academic emotions. FGD was used to collect qualitative information. The focus of FGD is to use the interaction between a group of interviewees to generate discussion about a topic- academic emotions- in this investigation. According to David (2002), FGD also hold out the possibility of giving the interviewees greater control of the talk as they bounce off each other, rather than simply with the interviewer. It is thus expected that FGD works by means of creating a group dynamic. In this research study, groups were composed of 10-12 students as suggested by Morgan (1998) as cited by Garcellano (2014). With this number, the FGD became more economical in terms of time use and money than do individual interviews. Further, the researcher also prepared an interview guide and/or guide questions for smooth flow of discussion.

200 college students in a higher education institution in the Philippines were considered for the quantitative data. Moreover, a group of 10 to 12 members were identified for the basis of their cumulative scores on the negative and positive academic emotions.

Descriptive statistics such as frequency, mean, standard deviation, and percentages were used in the study to determine the level of academic emotions experienced by the students in mathematics classroom. Mean, as one of the measures of central tendency will help the researcher in identifying the structures of students' academic emotions since mean represents a typical value in a set of data distribution. Moreover, to test the relationship between students' academic emotions and their achievement in mathematics, Pearson Product Moment Correlation or Pearson r was utilized since this statistical treatment will determine whether there is a relationship exist between bivariate data – Academic Emotions and Mathematics Achievement. Further, to test the difference between the academic emotions experienced by high achieving and low achieving students, t-test for independent samples was also used. In addition, all statistical hypotheses were tested at 0.05 level of significance. Further, for convenience, Statistical Package for Social Sciences (SPSS) Version 23 and Smith's Statistical Package (SSP) were used to analyze the data gathered.

3. RESULTS AND DISCUSSION

STUDENTS' GRADE POINT AVERAGE (GPA) IN MATH CORE COURSES

Table 1 shows the level of mathematics achievement of the 200 college students involved in this investigation. As been stated in the previous part of this study, students' level of achievement in mathematics was described by their General Point Average (GPA) in their mathematics core. As presented in Table 1, it can be gleaned that majority or 68 (34%) of the students got a GPA of 2.01 to 2.25. This data was followed by 44 (22%) and 28 (14%) whose GPA ranges from 2.26 – 2.50 and 1.76 – 2.0, respectively.

Table 1
Respondents' Level of Mathematics Achievement

Qualitative Description	GPA	Frequency (f)	Percentage (%)
Excellent	1.0 – 1.25	0	0%
Excellent	1.26 – 1.50	2	1%
Highly Satisfactory	1.51 – 1.75	15	7.5%
Highly Satisfactory	1.76 – 2.0	44	22%
Satisfactory	2.01 – 2.25	68	34%
Satisfactory	2.26 – 2.50	28	14%
Fairly Satisfactory	2.51 – 2.75	23	11.5%
Passed	2.76 – 3.0	20	10%
TOTAL		**200**	**100%**

STUDENTS' ACADEMIC EMOTIONS

As explicitly suggested by the data captured by Table 2, patterns of answers can be drawn on the different dimensions of students' positive and negative academic emotions felt in mathematics class. When grouped according to their achievement, it can be gleaned that those students belonging to the high achieving group endorsed positive academic emotions (enjoyment, hope, and pride) higher than the students from the lower group. Conversely, this same group of students indicated the least endorsement of all the three negative academic emotions (anxiety, shame, and hopelessness. On the

other hand, students from the lower group endorsed negative academic emotions higher than their counterparts as shown by their mean scores. Hence, these findings corroborate with the study conducted by Garcellano (2014) that high achievers have higher endorsement of al positive academic emotions while low achievers have higher endorsement of negative academic emotions.

Moreover, further analysis revealed that when compared according to achievement, students' structure of positive and negative academic emotions was significantly different. These results validated the researcher's hypothesis that the high achievers manifest all positive emotions while low achievers manifest negative emotions. Using Analysis of Variance (ANOVA) to investigate possible differences between the two groups compared, the p – values confirm that there is variability of emotions felt by students when grouped according to their achievement in mathematics.

Table 2
Respondents' Academic Emotions

	Academic Emotions	Group	Mean	p - value
Positive Academic Emotions	Enjoyment	UG	4.35^a	0.002**
		LG	2.71^b	
	Hope	UG	4.15^a	0.035**
		LG	3.06^b	
	Pride	UG	4.19^a	0.029**
		LG	3.34^b	
Negative Academic Emotions	Anxiety	UG	1.90^b	0.001**
		LG	3.93^a	
	Shame	UG	1.98^b	0.035**
		LG	3.48^a	
	Hopelessness	UG	2.03^b	0.017**
		LG	3.75^a	

Legend:
    1.0 – 1. 80 – Very low endorsement of emotion
    1.81 – 2. 60 – Low endorsement of emotion
    2.61 – 3.40 – Moderate endorsement of emotion
    3.41 – 4.20 – High endorsement of emotion
    4.21 – 5.0 – Very high endorsement of emotion
**Significant at 0.05 level of significance

RELATIONSHIP BETWEEN ACADEMIC EMOTIONS AND MATHEMATICS ACHIEVEMENT

Table 3 shows that, using Pearson Product Moment Correlation, only enjoyment was found as a determinant of students' success in mathematics among the positive academic emotions addressed in this study. The p - value of 0.0012 confirms the statistical significance of the relationship between student enjoyment and achievement. Only anxiety predicted students' mathematics success among negative emotions. The p – value of 0.00029 indicates that for the said group of

students, it was anxiety that prevented them to perform well in their mathematics class.

Table 3
Relationship between Self-Efficacy and Self-Concept and Math Achievement

	Academic Emotions	p - value
Positive Academic Emotions	Enjoyment	0.0012**
	Hope	0.125
	Pride	0.093
Negative Academic Emotions	Anxiety	0.0029**
	Shame	0.309
	Hopelessness	0.624

Note: **Significant at 0.05 level of significance

4. RECOMMENDATIONS

The goal of this study is to gain a more complete understanding of the connection between academic emotions and math success in a sample of college students. As a result of the study's results and conclusions, the following suggestions are made:

1. Mathematics educators must develop an understanding on how emotions felt by the students in mathematics classroom influence their achievement.

2. Mathematics teachers may be reminded once again that they can design learning environment in mathematics classroom which will enable students to embrace positive emotions.

3. Since enjoyment was discovered to be a determinant of students' performance in mathematics, more exciting ways for teaching and learning mathematics may be implemented to increase student enjoyment.

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