

**Math Anxiety in Junior/Intermediate Pre-Service Teachers**

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**Abstract;** In this session a description of a quantitative and qualitative study will be presented. The rationale for this study stems from the difficulties associated with teaching and learning mathematics. Those that will teach mathematics in elementary and intermediate schools and those that prepare those teachers in the pre-service program have borne witness to some hurdles in teaching mathematics to their students that appear to be mathematics specific. The guiding research question for this study is: How do Junior/Intermediate pre-service teachers feel about teaching mathematics? For the quantitative research, the MARS (Suinn, 1972) instrument developed by Dr. Richard Suinn was used for five pre-service classes. Anxiety trends among these future teachers have emerged both cross sections and cross ages.

**Background**

Mathematics as a discipline seems to have negative connotations for many people. This would not be such a dilemma if mathematics were an avoidable part of everyday life. However, this is not the case. Mathematics is a part of every person's life. It is an inescapable reality. We first learn how to manage mathematical problems beginning in elementary school and continue throughout the rest of our pre and post-secondary schooling. The study of mathematics can aid one in moving into a field that requires the use of mathematics or can simply prepare one for life in general. In either case, it is a needed part of schooling. Since mathematics is such a fundamental part of life, it seems important for people not to fear mathematics or shy away from it out of discomfort with the subject. It is an unneeded stress that is avoidable. As evident in the literature, it is already known what kinds of discomfort with mathematics are experienced and when they begin to appear. Using this knowledge we can begin to act to alleviate this discomfort. Treatment of this discomfort must begin in early schooling when this discomfort is first witnessed. Teacher training programs must be evaluated on their ability to prepare these teachers for students that have, or may develop this discomfort towards mathematics. Studying those pre-service teachers who share those feelings of discomfort with mathematics, and who may end up teaching at the Junior/Intermediate level, where these feelings have been found to begin to emerge, is a logical step in treatment. By studying this group we can not only ascertain what future teachers are feeling, but we can work with them towards alleviating that discomfort within themselves, as well as prepare them for students they may encounter with similar feelings.

The guiding research question for this study is: How do Junior/Intermediate pre-service teachers feel about teaching mathematics?

There is a vast amount of literature regarding mathematics anxiety. As Hembree (1990) noted, "Research of mathematics anxiety has prospered, spurred by increasing perceptions that the construct threatens both achievement and participation in mathematics" (p.34). This poses a very significant problem as mathematics is an inescapable part of everyday life. The literature ranges from discussing how the sexes differ on math anxiety to personality types that may be more prone to mathematics anxiety. The literature gives us a good platform from which to begin this study.

When first considering mathematics anxiety, we must be able to distinguish it from general test anxiety. Several researchers have differentiated between the two constructs and believe that the two constructs are separate. While general test anxiety and mathematics anxiety may be related, one group of researchers concluded "that mathematics anxiety and test anxiety may be separate phenomena" (Bailey, G., Cole, K., Hall, L., Holliday, D.C., Kazelskis, R., & Kersh, M.E., Larmon, M., Reeves, C., 2000, p.144). Hembree (1990) believes that mathematics

anxiety is not “purely restricted to testing. Rather, the construct appears to comprise a general fear of contact with mathematics, including classes, homework, and tests” (p. 45). Differentiating between these two constructs aids in our study so that we can narrow our focus and find an instrument that measures mathematics anxiety specifically. It would seem appropriate therefore to use the MARS (Mathematics Anxiety Rating Scale) instrument for this study.

### **Methodology and Instrument**

This study was conducted using both quantitative and qualitative measures combined. For the quantitative aspect of the study, the MARS (Richardson, F., & Suinn, R., 1972) was used. Eight open-ended questions (which were answered in writing) which followed the MARS made up the qualitative aspect of the study.

Two instruments were used in this study. One instrument was used for the quantitative research and one for the qualitative research. For the quantitative research, the MARS (Suinn, 1972) instrument developed by Dr. Richard Suinn was used. It is a 98-item, Likert format questionnaire with respondents answering by marking the appropriate circle to describe the degree of anxiety that the situation mentioned in each question aroused. Answers ranged from “not at all”, “a little”, “a fair amount”, “much” or “very much”. The instrument was scored by giving a value to each question answered with 1 value for “not at all”, 2 a value for “a little”, 3 a value for “a fair amount”, 4 a value for “much” and 5 a value for “very much”. Scores for each question on individuals questionnaires were added up for a total score for each participant. The MARS has been found to have a test-retest reliability coefficient of 0.78 (Suinn, 1972, p. 2). The second instrument used was an open ended questionnaire comprised of 8 items developed by the researchers. The participants were asked to respond to these questions in pen or pencil in the response booklets that were given to them with the sheet of open ended questions. The responses were analyzed by qualitative means. The response booklets were first coded, then the codes were placed into emergent categories and finally those categories were placed into themes that emerged from the categories. The two instruments were given to the participants during their regularly scheduled Junior/Intermediate mathematics methods course.

### **Data analysis**

Once the data was accumulated from the MARS instrument and the open ended questions, each corresponding MARS instrument and response booklets were numbered to provide case numbers. After which, each completed MARS instrument was then analyzed to establish a score following the procedures Dr. Richard Suinn outlined in the instructions for analysis that came with the instrument when it was delivered. These scores were then input into the Statistical Packages for Social Sciences version 11, (SPSS) along with the descriptive data for each case. As a multidimensional study, the data were then analyzed for levels of anxiety across gender, between gender, academic background, program, course section and age. Cross-tabulations were created to compare mean MARS scores as well as percentiles determined for the same purpose. Also, one way analysis of variance (ANOVA) tests, and independent samples t-tests were used to examine the differences between the MARS scores in light of the different sample descriptors. Lastly, a bivariate correlation analysis was also conducted.

### **Results**

#### *Class Section and MARS Scores*

Class sections were examined with regards to MARS scores in order to determine if there was a significant difference between class sections. Table 1 describes the class sections with regards to their mean MARS scores.

Table 1: Comparison of Class Section and Mean Score on MARS

Class Section	Mean	N	Std. Deviation	Minimum	Maximum	Range
YA	200.74	23	58.418	122	344	222
YB	179.78	27	49.842	110	254	144
YC	191.53	30	58.427	112	348	236
YD	183.26	31	61.497	98	376	278
YE	195.33	21	59.532	126	284	158
Total	189.39	132	57.326	98	376	278

Table 1 illustrates the mean MARS scores from each class section. In examining the table, it is apparent that class section YA had the highest mean MARS score, while YB had the lowest. It is also important to note that YB had the smallest range between highest and lowest MARS score within the class sections, signifying that the participants in YB's class section scored the most similar to one and other. YD experienced the most

variation in scores with a range of 278, however, this may also be accounted for by the fact that YD had more participants from its class section than any other class section.

A one way ANOVA test was conducted to see if there was a significant difference between the MARS scores of the class sections. Table 2 shows the results.

Table 2: One Way ANOVA for MARS Scores between Class Sections

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7502.345	4	1875.586	.563	.690
Within Groups	423003.170	127	3330.734		
Total	430505.515	131			

Table 2 illustrates the comparison between the class sections on the MARS scores. The high sig. value,  $p = 0.69$  and  $F = 0.563$ , demonstrate there is no significant difference among the means of the five sections involved, on the MARS scores.

### ***Age Interval and MARS Scores***

Age intervals were examined next in order to compare the age intervals of the participants and their MARS scores. Table 3 shows the descriptives of the age interval groups.

Table 3: Comparison of Age Interval and Mean Score on MARS

Age Interval	Mean	N	Std. Deviation	Minimum	Maximum	Range
20-24	196.78	73	55.697	98	376	278
25-29	182.37	35	63.345	110	348	238
30-34	178.42	12	47.588	106	275	169
35-39	177.50	6	50.749	133	245	112
40 and Over	174.33	6	68.649	112	288	176
Total	189.39	132	57.326	98	376	278

Table 3 illustrates the comparison between the age intervals of the participants and their mean MARS scores. Upon examining Table 3 it is evident that those participants in the sample that were between the ages of 20 and 24 had the highest mean MARS scores and were the more anxious individuals.. As seen in Table 3, mean MARS scores for age intervals decreased as age intervals went up. It is also noteworthy to mention that while the 20-24 age interval had the greatest range for MARS scores and accordingly the greatest number of participants, the greatest dispersion can be seen in the 40 and over age interval. This may indicate that the mean MARS score for the 40 and over age interval is not as representative of that sub-sample as it appears given the low number of participants.

Using a graphic representation of the above data can aid in examining possible meanings of this information. Figure 1 illustrates the above data in a graph.

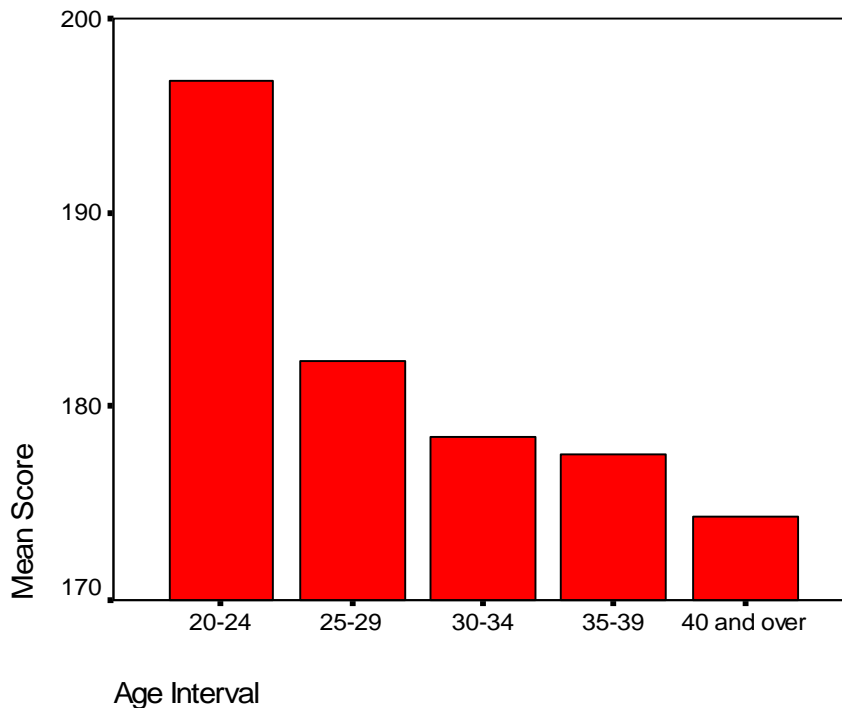


Figure 1: Age and Mean Score on the MARS

Figure 1 is a visual representation of the same data that is found in Table 3. Figure 1 visually illustrates the mean MARS scores for each age interval. As seen in the figure, those participants that are 20-24 years of age have a significantly higher mean MARS score than those participants that fall into all other age intervals. It can also be seen that as age goes up MARS scores decrease. It is, in a sense, a negative correlation relationship.

A bivariate correlation analysis was done to examine whether or not there is a significant correlation between age interval and mean MARS score. The table below displays the output (see Table 4).

Table 4: Bivariate Correlation on Age Interval and Mean MARS Scores

		Age Interval	Score
Age Interval	Pearson Correlation	1	-.132
	Sig. (2-tailed)	.	.130
	N	132	132

While Table 4 does not show a significant correlation ( $p = 0.130$ ), it does demonstrate the negative nature of the correlation between the age intervals and mean MARS score (- 0.132). This shows that as age intervals increased, mean MARS scores decreased. This means that the older participants in the study displayed less mathematics anxiety on the MARS than the younger participants.

## **Conclusions**

Participants in this study who were 20-24 years of age have the highest mean MARS score compared to the participants that fall into all other age intervals. Figure 1 shows that as age interval moves up, the corresponding MARS score decreases. This means that MARS mean score and age interval variables resemble a negative relationship. This has been confirmed by the bivariate correlation analysis expressed in Table 4 with the Pearson Correlation,  $r = -0.132$ .

This result contradicts other findings where older individuals were found to be more anxious than younger individuals (Hadfield & McNeil, 1994; Betz, 1978); Woodard (2004) found no difference between young (< 25 yrs) & old (> 25 yrs) in post-secondary education students.

## **References**

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