CHAPTER IV

Findings

The purpose of this chapter is to present the analysis of the data. This study assesses the initial and exiting attitudes toward mathematics and academic outcomes of students placed in DVM001 Basic Arithmetic at a community college. The study included 329 freshman and sophomore students who were tested and placed in DVM001 Basic Arithmetic during the fall semester and who were present on the dates that the instruments were administered. The presentation of the data analysis is organized according to the four research questions.

Research Question One: What is the difference, if any, between the pretest and posttest attitudes toward mathematics of students placed in DVM001 Basic Arithmetic as measured by the Aiken Mathematics Attitude Survey?

Hypothesis 1.

There is no significant difference between the means of the initial and exiting attitudes of students placed in DVM001 Basic Arithmetic as measured by the Aiken Attitude Towards Mathematics Survey.

Dependent Variable**:** Attitude

Independent Variables: Age, Gender, and Age by Gender

Sub-questions: The sub-questions related to the initial and exiting attitudes are:

a. Is there an attitude change between the pretest and the posttest based on age?
b. Is there an attitude change between the pretest and the posttest based on gender?
c. Is there an attitude change between the pretest and the posttest based on ethnicity?

Analytical Approach: There are three variables age, gender, and age by gender utilized in this research question. A paired sample t test was used to test whether the means of the initial and exiting attitudes differ based on age, gender, and age by gender.

Statistical Analysis: The Aiken Attitude toward Mathematics survey included twenty statements (10 positive and 10 negative) with a maximum score of 80 (Appendix A). In

reporting the attitude toward mathematics scores, the cut off point to dichotomize the scores was 40. Scores 40 and above constituted a high attitude towards mathematics, and scores 40 and below constituted a low attitude towards mathematics.

In looking at the relationship of the initial and exiting attitude of students, enrolled in DVM 001 Basic Arithmetic, the attitude difference formula is posttest attitude score minus the pretest attitude score equals the attitude difference. The mean, standard deviation, and analysis of variance were calculated to determine if there was any significance.

The paired t-test was utilized to compare the means of the pretest and the posttest and a paired sample correlation was conducted to determine any significance. The study design for this test involves measuring each subject twice: pretest and the posttest after the course. The paired comparison t test was used to test if the means of the pretest and the posttest of the two measures differ significantly.

Findings: In the fall semester, 65 percent of the students (n=215) completed the Aiken initial attitude pretest (Table 9). The survey results revealed that 61 percent of the students (n=131) scored below 40 on the pretest showing low attitudes towards mathematics with a mean score of 37.88 and a standard deviation of 16.69. Students scoring higher than 40 on the pretest were 39 percent. The results show that 39 percent of the students had initial positive attitudes toward mathematics at the beginning of the semester in the DVM001 Basic Arithmetic course.

The Aiken exiting posttest revealed 58.7 percent of the students (n=193) completed the posttest with a mean score of 39.22 and a standard deviation of 16.46 (Table 10). The results show that 45 percent of the students have positive attitudes toward mathematics after the intervention of DVM001 Basic Arithmetic while 55 percent of the students completing the posttest scored below 40 on the Aiken Attitude Towards Mathematics survey.

Table 9

Descriptive Statistics – Pretest Attitude

Frequency Distribution

Student Score	Frequency	Percent	Cumulative Percent
less than 6	6	1.8	2.8
7-13	9	2.7	7.0
14-20	13	4.0	13.0
21-27	36	10.9	29.8
28-34	35	10.6	46.0
35-41	32	9.7	60.9
42-48	18	5.5	69.3
49-55	25	7.6	80.9
56-62	26	7.9	93.0
63-69	9	2.7	97.2
70-76	5	1.5	99.5
77-83	1	.3	100
Total	215	65.3	100
Missing Data	114	34.7	0
Total	329	100	100

Descriptive Statistics			
Aiken Test	N	Mean	Std. Deviation
Attitude Pretest	215	37.88	16.69
Attitude Posttest	193	39.22	16.46

Table 10

Descriptive Statistics – Posttest Attitude

Frequency Distribution

Student Scores	Frequency	Percent	Cumulative Percent
less than 6	1	.3	.5
7-13	10	3.0	5.7
14-20	15	4.6	13.5
21-27	27	8.2	27.5
28-34	25	7.6	40.4
35-41	29	8.8	55.4
42-48	20	6.1	65.8
49-55	31	9.4	81.9
56-62	20	6.1	92.2
63-69	8	2.4	96.4
70-76	6	1.8	99.5
77-83	1	.3	0
Total	193	58.7	58.7
Missing Data	136	41.3	41.3
Total	329	100	100

Descriptive Statistics			
Aiken Test	N	Mean	Std. Deviation
Attitude Pretest	215	37.88	16.69
Attitude Posttest	193	39.22	16.46

Table 11 shows that in the sample, the pretest attitude mean is 37.80 with a standard deviation of 16.25. The posttest attitude mean is 39.50 with a standard deviation of 16.58. A paired sample correlation was conducted that showed 185 students took both the pretest and the posttest. The correlation between the pretest attitude and the posttest attitude values is .640. Since the associated p value (significance) is very small .000 (<. 05) it indicates that the correlation is significant. The result is that there is a strong linear relation between the pretest attitude score and the posttest attitude score values. The findings of the paired samples test show the paired differences between the attitude towards mathematics posttest (39.50) and the pretest (37.80) is 1.70. Attitudes towards mathematics became more positive during the semester. A gain of 1.70 points in the mean of the attitude score of DVM001 Basic Arithmetic students was found. At the .05 level the gains were not significant. The pretest and the posttest were not significant at the .01 and .05 level. The hypothesis that there is no difference between the two means of the pretest attitude and posttest attitude means is accepted.

The sub questions related to the initial and exiting attitudes are:

a. Is this difference distributed equally across age groups? Cross-tabulation of attitude difference by age group revealed that 181 students completed the pretest, posttest, and the distribution for the five age groups (Table 12). An analysis of variance was performed to test whether the mean of the difference scores differ by age. An inspection of Table 13 reveals the level of significance (.429). The mean for the total group was .49 and the standard deviation was 7.06 (Table 13). The likelihood of differences in the means happening by chance when the population means are equal is greater than 5 in 100. Therefore, the null hypothesis is not rejected. It was found that there is no difference between the pretest and the posttest based on age.

Table 11

Paired Samples Statistics T Test, Correlation and Differences

of the Attitude Posttest and Pretest

Aiken Test	Mean	N	Std. Deviation	Std. Error Mean
Attitude Pretest	37.80	185	16.25	1.19
Attitude Posttest	39.50	185	16.58	1.22

Aiken Test	N	Correlation	Sig.
Attitude Pretest and Posttest	185	.640	.000

Aiken Test	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Attitude Posttest-Attitude Pretest	1.70	13.93	1.02	-3.72	.32	-1.663	184	.098

Table 12

Cross-tabulation of Attitude Posttest-Pretest Difference by Age Group

		Age Group					Total
		less than or equal to 21	22-29	30-39	40-49	50 and above	
Attitude Difference	-30.00				1		1
	-29.00	1					1
	-19.00	1					1
	-17.00	1			1		2
	-11.00	3	1	2			6
	-9.00	1		1	1		3
	-8.00	3					3
	-7.00	1					1
	-6.00	3	1	1			5
	-5.00	1		3			4
	-4.00	2	1	1	1		5
	-3.00	9	1	2			12
	-2.00	4	3	2			9
	-1.00	13	3	3	1	2	22
	.00	8	3	2	4	2	19
	1.00	14	2	3			19
	2.00	10	1	4			15
	3.00			5			5
	4.00	4		2			6
	5.00	8	1	1	1		11
	6.00	5		1			6
	7.00	1					1
	8.00	3	2				5
	9.00	4			1		5
	10.00	2		1			3
	11.00		1				1
	12.00	2					2
	14.00	2					2
	15.00	1			1		2
	16.00	1	1				2
	18.00	1					1
	27.00	1					1
Total		110	21	34	12	4	181

Table 13

Analysis of Variance Associated with Attitude Difference by Age Group

Age	N	Mean	SD	SE	Lower Bound	Upper Bound	Minimum	Maximum
Less than or equal to 21	110	1.0727	7.2955	.6956	-.3059	2.4514	-29.00	27.00
22-29	21	.9048	5.9825	1.3055	-1.818	3.6280	-11.00	16.00
30-39	34	-.4118	4.7041	.8067	-2.053	1.2296	-11.00	10.00
40-49	12	-2.6667	11.804	3.4075	-10.166	4.8332	-30.00	15.00
50 and above	4	-.5000	.5774	.2887	-1.418	.4187	-1.00	.00
Total	181	.4917	7.0605	.5248	-.5439	1.5273	-30.00	27.00

Analysis of Variance

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	192.108	4	48.027	.983	.429
Within Groups	8781.130	176	49.893		
Total	8973.238	180			

b. Is there an attitudinal change between the pretest and posttest based on gender?

In Table 14, the attitude difference mean for females was .1667 with a standard deviation of 7.5767. The attitude difference mean for males was 1.3673, with a standard deviation of 5.4033 (Table 15). There was an increase in the attitude scores from the pretest to the posttest for the females but there was no increase for the male scores.

c. Is there an attitude change between the pretest and the posttest based on ethnicity? The t test found the mean of the attitude difference for Black students was .2360 with a standard deviation of 7.2556 (Table 16). For the category Not Black students, the mean of the attitude difference was 2.55 with a standard deviation of 4.8933. The independent

sample test (Table 17) found that the attitude difference of the equal variances assumed had an F value of .308 and a p value of .580. The t test for Equality of Means (Table 17) found that the attitude difference Equal variances assumed had a t value of 1.386 with 179 degrees of freedom and a p value of .168. Based on these findings, there were not enough Not Black students to determine an attitude change between the pretest and the posttest scores based on ethnicity.

Table 14

Descriptive Statistics of Placement Score, Final Exam Score, Attitude Pretest, Attitude Posttest, Attitude Difference, and Age In Years - Female

Gender Female		Placement Score	Final Exam Score	Attitude Pretest	Attitude Post test	Attitude Difference	Age in Years
N	Students	190	166	135	141	132	216
	Missing Data	26	50	81	75	84	0
Mean		8.08	73.14	34.93	34.77	.1667	25.59
Std. Deviation		2.18	17.18	6.26	6.98	7.5767	9.08

Table 15

Descriptive Statistics of Placement Score, Final Exam Score, Attitude Pretest, Attitude Posttest, Attitude Difference, and Age in Years – Male

Gender Male		Placement Score	Final Exam Score	Attitude Pretest	Attitude Posttest	Attitude Difference	Age in Years
N	Students	102	68	51	52	49	113
	Missing Data	11	45	62	61	64	0
Mean		7.91	68.03	33.69	34.65	1.3673	22.41
Std. Deviation		2.46	15.46	6.34	6.43	5.4033	9.21

Table 16

Descriptive Statistics of Attitude Difference Based on Ethnicity

Ethnicity	N	Mean	Standard Deviation	Standard Error
Not Black	20	2.5500	4.8933	1.0942
Black	161	.2360	7.2556	.5718

Table 17

Independent Samples Test of Attitude Difference Based on Ethnicity

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Diff. Lower	95% Confidence Interval of the Diff. Upper
Attitude Difference	Equal Variances Assumed	1.386	179	.168	2.3140	1.6697	-.9809	5.6088
	Equal Variances Not Assumed	1.874	30.525	.070	2.3140	1.2346	-.2056	4.8335

		Levene's Test for Equality of Variances	
		F	Significance
Attitude Difference	Equal Variances Assumed	.308	.580
	Equal Variances Not Assumed		

Research Question Two: What is the effect, if any, of the placement test for students enrolled in Basic Arithmetic on the final exam score, attitude pretest score, and attitude change score?

Hypothesis 2.

There is no significant effect on the placement test for students enrolled in DVM001 Basic Arithmetic on the final exam score, attitude pretest score, and attitude change score.

Dependent Variable**:** Placement Test Score

Independent Variable: Final Exam Score, Attitude Pretest Score, and Attitude Change Score

Analytical Approach: The data were analyzed using an intercorrelation matrix to show the correlations between the dependent variable and each independent variable as well as the correlations between the independent variables.

Statistical Analysis: Correlations were performed between the placement scores, final exam scores, attitude pretest, and attitude difference by age and gender to test for significance at the .05 level.

Findings: The purpose of this analysis was to test if the placement score is associated with the final exam score, attitude pretest score, attitude change score, age and gender.

In Table 18, there is a positive relationship between the final exam score and the placement test. The results show that the scores are highly significant at the .01 level. The p correlation is .347. The placement score and the attitude pretest are not highly correlated and are not significant. Table 18 revealed a highly significant correlation of .343 between the final exam score and the age in years. The placement score and the final exam score showed a significant correlation of .347 and the attitude pretest and attitude difference was significant with a correlation of -.535 at the .01 level. Remaining independent variables such as placement score, attitude pretest and attitude difference were found to be non-significant in association with age.

Table 18

Correlations of Age in Years, Placement Score, Final Exam Score, Attitude Pretest, and Attitude Difference by Age

		Age In Years	Placement Score	Final Exam Score	Attitude Pretest	Attitude Difference
Age in Years	Pearson Correlation	1.000	.060	.343**	.091	-.111
	Sig. (2-tailed)	.	.330	.000	.244	.160
	N	301	265	213	166	161
Placement Score	Pearson Correlation	.060	1.000	.347**	.114	-.021
	Sig. (2-tailed)	.330	.	.000	.163	.802
	N	265	265	190	151	146
Final Exam Score	Pearson Correlation	.343**	.347**	1.000	.084	-.044
	Sig. (2-tailed)	.000	.000	.	.285	.578
	N	213	190	213	163	160
Attitude Pretest	Pearson Correlation	.091	.114	.084	1.000	-.535**
	Sig. (2-tailed)	.244	.163	.285	.	.000
	N	166	151	163	166	161
Attitude Difference	Pearson Correlation	-.111	-.021	-.044	-.535**	1.000
	Sig. (2-tailed)	.160	.802	.578	.000	.
	N	161	146	160	161	161

** Correlation is significant at the 0.01 level (2-tailed).

Research Question Three: What is the difference between the achievers and the nonachievers in Basic Arithmetic as measured by the Aiken Attitudes Towards Mathematics Survey?

*Hypothesis 3**:***

There is no significant difference between the means of those students who pass and those students who fail the DVM001 Basic Arithmetic as measured by the Aiken Attitude Towards Mathematics Survey.

Dependent Variables: Attitude Difference; Final Grade

Independent Variables: Passed (P) and Failed (F); Gender and Age Groups

Analytical Approach**:** To determine if the Aiken Attitude Towards Mathematics Survey differentiates between students who pass and students who fail based on their age groups and gender. Then, analyzing if the Aiken Attitude Towards Mathematics Test differentiates between Black Only students who pass and those students who failed based on their age groups and gender.

Statistical Analysis: The data was analyzed to find the frequency, mean, and standard deviation of the final grade. A one-way analysis of variance was used to determine if there was an attitude difference based on the student outcome of the final grade of those students who passed (P) and students who failed (F). Then, a two-way analysis of variance was utilized using attitude difference as the dependent variable with gender and age groups as the independent variables.

Findings: In Table 19, a total of 181 students completed the pretest and posttest to show an attitude difference based on 132 females and 49 males with a mean of .4917. The analysis of variance revealed a p value of .311 and an F value of 1.034. Therefore, there is no significant difference between the attitude differences based on gender (Table 20). An investigation of the Black Only student group shows 122 females and 39 males between the age ranges of less than 21 and 50 and above (Table 21). The ANOVA shows a p value of .990 and is not significant at the .05 level (Table 22). A final grade was submitted for 167 females and 64 males (Table 23). The age ranges were between less

than 21 and 50 and above years (Table 23). The results of the ANOVA tests in Table 24 shows a p value of .785 with an F value of .433. Therefore, the final grade is not significant based on the gender and age group of students who are enrolled in the DVM001 Basic Arithmetic course. The Aiken Attitude Towards Mathematics Survey does not differentiate between students who pass and students who fail based on gender and age group (Table 22).

Table 19

Descriptive Statistics of Attitude Difference Based on Gender

Attitude Difference

Gender	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Female	132	.1667	7.5767	.6595	-1.1379	1.4713	-30.00	27.00
Male	49	1.3673	5.4033	.7719	-.1847	2.9194	-11.00	14.00
Total	181	.4917	7.0605	.5248	-.5439	1.5273	-30.00	27.00

Table 20

Analysis of Variance Associated With Attitude Difference by Gender

ANOVA Attitude Difference

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	51.516	1	51.516	1.034	.311
Within Groups	8921.721	179	49.842		
Total	8973.238	180			

Table 21

Descriptive Statistics of Attitude Difference Based on Gender and Age Groups

Between-Subjects Factors			
		Value Label	N
Gender	1	Female	122
	2	Male	39
Age Group	1	21 and below	95
	2	22 - 29	19
	3	30 - 39	31
	4	40 - 49	12
	5	50 and above	4

* Black Only Students

Table 22

Analysis of Variance Associated With Attitude Difference of Blacks Only by Gender and Age Group

Tests of Between-Subjects Effects Dependent Variable: Attitude Difference					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	225.483(a)	8	28.185	.523	.838
Intercept	9.214E-03	1	9.214E-03	.000	.990
Gender	7.554	1	7.554	.140	.709
Age Group	35.261	4	8.815	.163	.957
Gender * Age Group	56.793	3	18.931	.351	.788
Error	8197.548	152	53.931		
Total	8432.000	161			
Corrected Total	8423.031	160			
a R Squared = .027 (Adjusted R Squared = -.024) Black Only Students					

Table 23

Descriptive Statistics of Final Grade by Gender and Age Group

Between-Subjects Factors			
		Value Label	N
Gender	1	Female	167
	2	Male	64
Age Group	1	21 and below	138
	2	22 - 29	31
	3	30 - 39	40
	4	40 - 49	17
	5	50 and above	5

Table 24

Analysis of Variance Associated With Final Grade, Gender, and Age Group

Tests of Between-Subjects Effects Dependent Variable: Final Grade					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4.775(a)	9	.531	2.618	.007
Intercept	27.333	1	27.333	134.881	.000
Gender	.237	1	.237	1.168	.281
Age Group	1.619	4	.405	1.997	.096
Gender * Age Group	.351	4	8.775E-02	.433	.785
Error	44.784	221	.203		
Total	159.000	231			
Corrected Total	49.558	230			
a R Squared = .096 (Adjusted R Squared = .060)					

Research Question Four: What is the difference between the achievers and nonachievers in Basic Arithmetic based on the demographic variables of age, gender, and ethnicity?

Hypothesis 4:

There is no significant difference between the students who passed and those students who failed the DVM001 Basic Arithmetic based on the demographic variables of age, gender, and ethnicity.

Dependent Variable: Student Outcome (Final Grade)

Independent Variables: Demographic Variables – Age group and Gender

Analytical Approach: A chi square test was utilized to determine if a relationship existed between the final grade and the demographic variables of age group and gender.

Statistical Analysis: To determine if there is a relationship between the achievers and nonachievers in the DVM001 Basic Arithmetic course, the data was analyzed to find the frequency of the various combinations of students who passed and students who failed based on age group (Table 25) and gender (Table 27) were tabulated and percentages were calculated. A two by two contingency table with a chi square test and one degree of freedom was constructed to show the relationship of the final grade and the demographic variables of age and gender (Tables 26 and 28). A chi square test was used to compare the final grade with age groups and the final grade with the gender of students.

Findings: The frequency and percent of students who received a pass or fail by age group was shown in Table 25. In the age groups, students less than 21 years and below have a higher percentage rate of failure (75.61) than students 22 years or older (Table 25). Students 21 years and below passed at a rate of 53.18 percent. A chi square test was performed and revealed the p value of 18.222 and was highly significant at the .001 level (Table 26). Frequencies for the gender of students was tabulated and percents were calculated and revealed 69.80 percent females (n=178) and 30.20 percent males (n=77) with a total of 255 students receiving a final grade (Table 27). A higher percentage of females passed the DVM001 Basic Arithmetic course than failed (Table 27).The p value of the chi square test was 5.789 and was highly significant at the .016 level (Table 28). The final grade is significant based on gender.

Table 25

Cross-tabulation of Percent of Final Grade by Age Group

		Age Group									
		21 and below		22 - 29		30 - 39		40 - 49		50 and above	
		Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %
Final Grade	Fail	62	75.6%	12	14.6%	7	8.5%	1	1.2%		
	Pass	92	53.2%	22	12.7%	38	22.0%	16	9.2%	5	2.9%
Total		154	60.4%	34	13.3%	45	17.6%	17	6.7%	5	2.0%

Table 26

Chi-Square Test by Final Grade and Age Group

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.222(a)	4	.001
Likelihood Ratio	22.040	4	.000
Linear-by-Linear Association	17.413	1	.000
N of Valid Cases	255		
a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 1.61.			

Table 27

Cross-tabulation of Percent of Final Grade by Gender

Final Grade by Gender Crosstabulation Count and Percent						
		Gender				
		Female	Row %	Male	Row %	Total
Final Grade	Fail	49	59.76	33	40.24	82
	Pass	129	74.57	44	25.43	173
Total		178	69.80	77	30.20	255

Table 28

Chi-Square Test by Final Grade and Gender

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.789	1	.016		
Continuity Correction	5.108	1	.024		
Likelihood Ratio	5.651	1	.017		
Fisher's Exact Test				.020	.013
Linear-by-Linear Association	5.767	1	.016		
Number of Student Cases	255				

Summary

This chapter has presented the findings of the research study on developmental mathematics, demographics of students, attitude towards mathematics, and placement of students in mathematics courses. Attitude scores for females are positively related to placement scores and the final examination score. Achievers, students who passed and nonachievers, students who failed, have the same attitude towards mathematics according to the results of the Aiken Attitude Towards Mathematics Survey. The t test found that there is no significant difference between the means of the initial and exiting attitude test scores based on age, gender or age by gender. The attitude change score based on gender showed an increase in the scores for females but no increase in the scores for males.

Scores on the placement test and the final exam were found to be highly significant and there is a positive relationship according to the results of the intercorrelational matrix (Table 18). Results found that the placement test and the attitude pretest are not highly correlated and are not significant. Over 67 percent of the students passed the DVM001 Basic Arithmetic course.

Analysis of variance found that the final grade is not significant based on gender and age group. It also found no significant difference between Black Only students based on gender and age groups. Based on the demographics of the study, the age factor results showed that those students who achieved tend to be older than those students who were nonachievers. Chi square test revealed that gender and age are related to the final exam score and are highly significant.