Interactions

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age AGE	191	17	54	25.84	8.241
AGE_Centered age centered	191	-8.84	28.16	-.0023	8.24109
OverallSATScore Overall Satisfaction Score	190	27.06	68.22	53.0596	7.22985
Valid N (listwise)	190				

Frequency Tables

Group: Learning Approach group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00 EIQ/Summarization	42	22.0	22.0	22.0
	2.00 Summarization	49	25.7	25.7	47.6
	3.00 EIQ	52	27.2	27.2	74.9
	4.00 Control	48	25.1	25.1	100.0
	Total	191	100.0	100.0	

Female Is the participant female?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00 Male	54	28.3	28.3	28.3
	1.00 Female	137	71.7	71.7	100.0
	Total	191	100.0	100.0	

**Model 1: Main Effect for Female only.

Tests of Between-Subjects Effects

Dependent Variable:OverallSATScore Overall Satisfaction Score

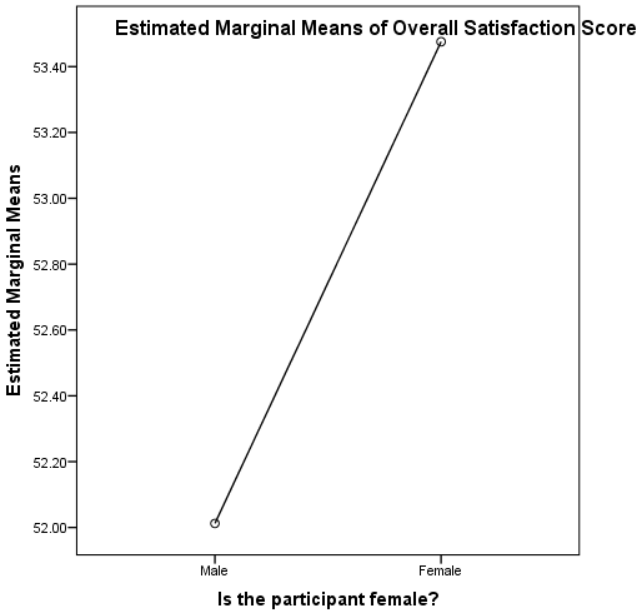
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Female	82.747	1	82.747	1.588	.209
Error	9796.422	188	52.109		
Total	544791.179	190			
Corrected Total	9879.170	189			

a. R Squared = .008 (Adjusted R Squared = .003)

Parameter	B	Std. Error	t	Sig.
Intercept	53.475	.619	86.391	.000
[Female=.00]	-1.463	1.161	-1.260	.209
[Female=1.00]	0[a]	.	.	.

E(Satisfaction) = 53.475 -1.463Female

Is the participant female?	Mean	Std. Error
.00 Male	52.012	.982
1.00 Female	53.475	.619



```
**Model 2: Main Effect for Group only.
```

Tests of Between-Subjects Effects

Dependent Variable:OverallSATScore Overall Satisfaction Score

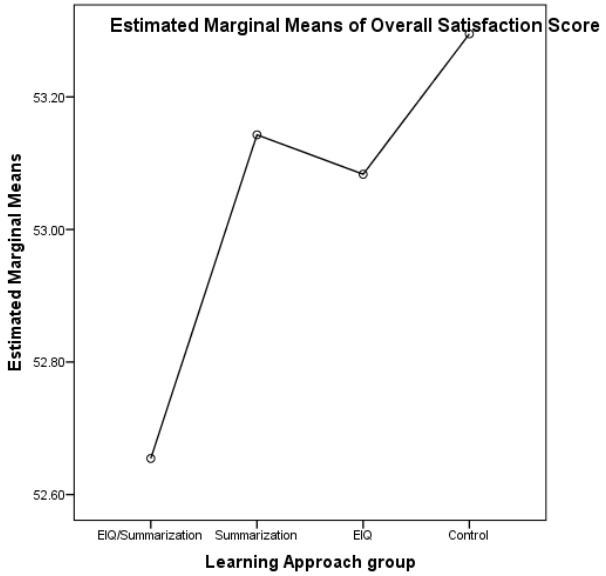
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
group	9.761	3	3.254	.061	.980
Error	9869.408	186	53.061		
Total	544791.179	190			
Corrected Total	9879.170	189			

a. R Squared = .001 (Adjusted R Squared = -.015)

Parameter	B	Std. Error	t	Sig.
Intercept	53.295	1.051	50.690	.000
[group=1.00]	-.641	1.549	-.414	.680
[group=2.00]	-.152	1.479	-.103	.918
[group=3.00]	-.212	1.458	-.145	.885
[group=4.00]	0[a]	.	.	.

E(Satisfaction) = 53.295 -.641EIQ/Summ - .152Summ - .212EIQ

Learning Approach group	Mean	Std. Error
1.00 EIQ/Summarization	52.654	1.138
2.00 Summarization	53.143	1.041
3.00 EIQ	53.083	1.010
4.00 Control	53.295	1.051



```
**Model 3: Group*Female Interaction.
```

Tests of Between-Subjects Effects

Dependent Variable:OverallSATScore Overall Satisfaction Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
group	97.520	3	32.507	.635	.594
Female	26.469	1	26.469	.517	.473
group * Female	465.623	3	155.208	3.030	.031
Error	9322.719	182	51.224		
Total	544791.179	190			
Corrected Total	9879.170	189			

a. R Squared = .056 (Adjusted R Squared = .020)

Parameter	B	Std. Error	t	Sig.
Intercept	52.603	1.146	45.899	.000
[group=1.00]	-.024	1.755	-.014	.989
[group=2.00]	.943	1.679	.562	.575
[group=3.00]	2.569	1.679	1.530	.128
[group=4.00]	0[a]	.	.	.
[Female=.00]	3.694	2.647	1.396	.165
[Female=1.00]	0[a]	.	.	.
[group=1.00] * [Female=.00]	-3.434	3.611	-.951	.343
[group=1.00] * [Female=1.00]	0[a]	.	.	.
[group=2.00] * [Female=.00]	-5.010	3.453	-1.451	.149
[group=2.00] * [Female=1.00]	0[a]	.	.	.
[group=3.00] * [Female=.00]	-9.726	3.370	-2.886	.004
[group=3.00] * [Female=1.00]	0[a]	.	.	.
[group=4.00] * [Female=.00]	0[a]	.	.	.
[group=4.00] * [Female=1.00]	0[a]	.	.	.

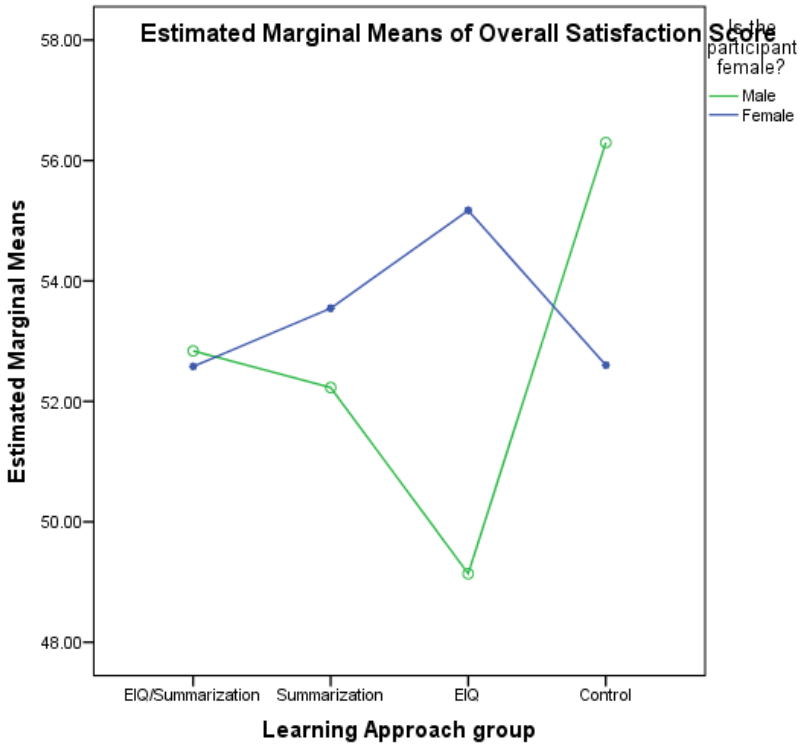
E(Satisfaction) = 52.603 -.024EIQ/Summ + .943Summ + 2.569EIQ

+ 3.694Female -3.434EIQ/Summ*Female -5.010Summ*Female -9.726EIQ*Female

Learning Approach group * Is the participant female?

Dependent Variable:OverallSATScore Overall Satisfaction Score

Learning Approach group	Is the participant female?	Mean	Std. Error
1.00 EIQ/Summarization	.00 Male	52.838	2.066
	1.00 Female	52.579	1.329
2.00 Summarization	.00 Male	52.230	1.848
	1.00 Female	53.546	1.227
3.00 EIQ	.00 Male	49.139	1.687
	1.00 Female	55.172	1.227
4.00 Control	.00 Male	56.296	2.386
	1.00 Female	**52.603**	1.146



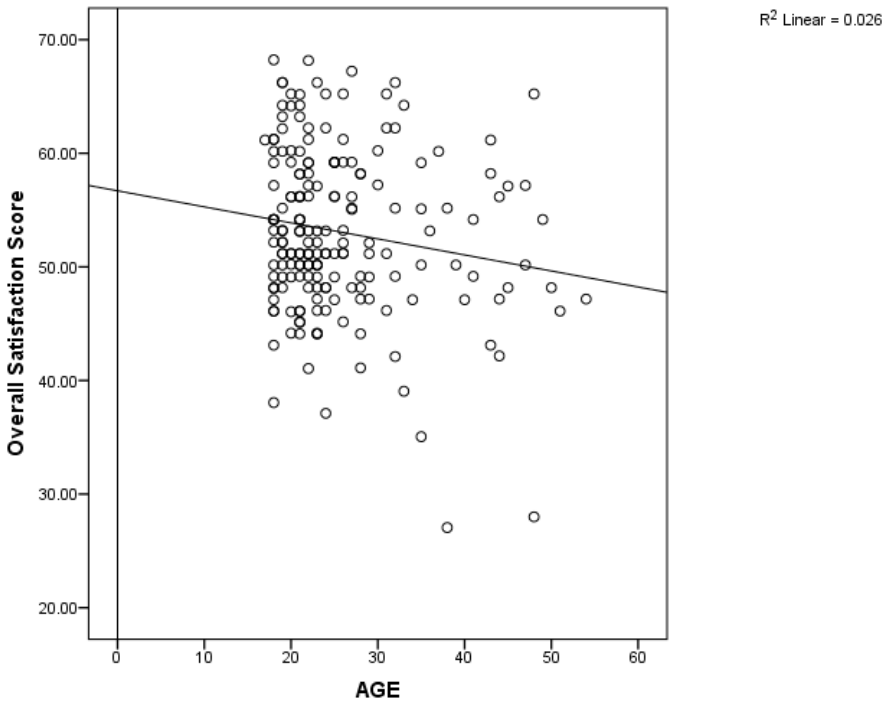
**Model 4: Covariate Age only.

Tests of Between-Subjects Effects

Dependent Variable:OverallSATScore Overall Satisfaction Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	254.734[a]	1	254.734	4.976	.027
Intercept	56196.496	1	56196.496	1097.721	.000
Age	254.734	1	254.734	4.976	.027
Error	9624.436	188	51.194		
Total	544791.179	190			
Corrected Total	9879.170	189			

a. R Squared = .026 (Adjusted R Squared = .021)



Parameter Estimates

Dependent Variable:OverallSATScore Overall Satisfaction Score

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	56.697	1.711	33.132	.000	53.321	60.073
Age	-.141	.063	-2.231	.027	-.266	-.016

E(Satisfaction) = 56.687 - .141Age

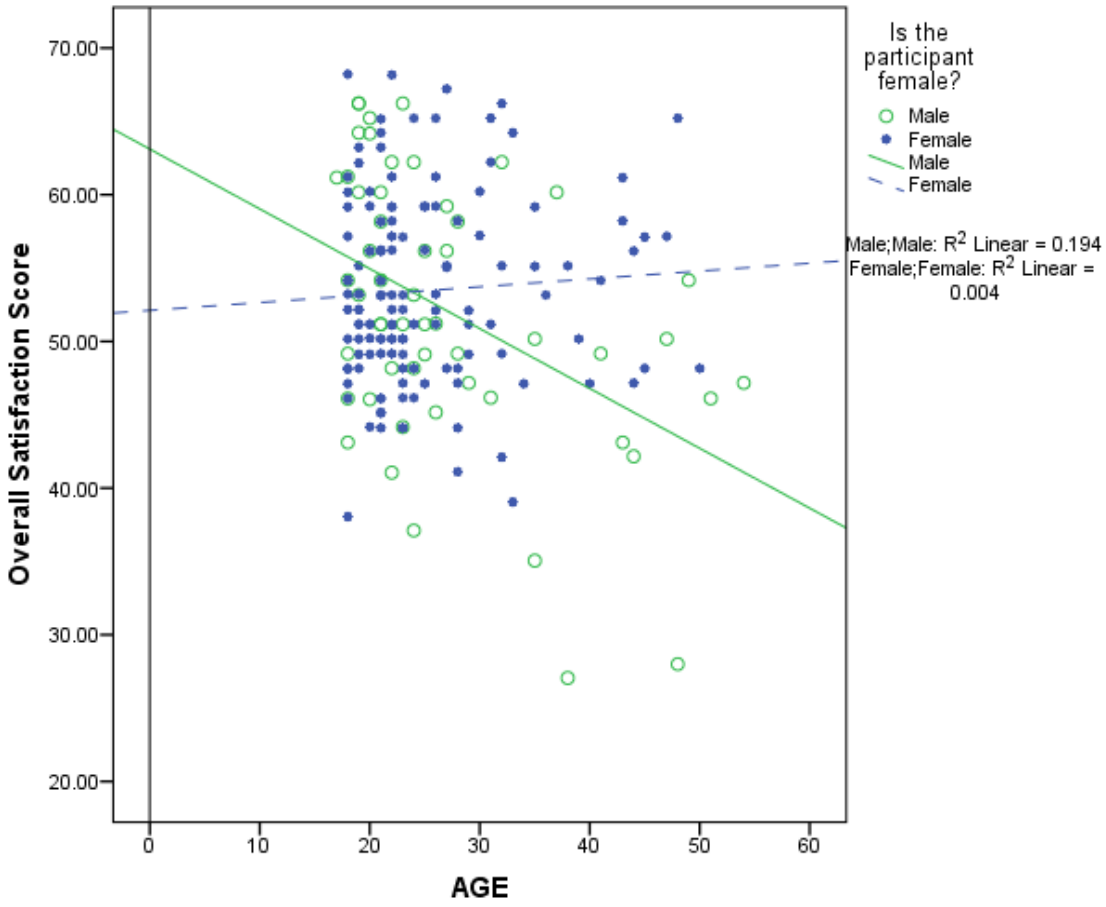
```
**Model 5: Include Age*Female Interaction.
```

Tests of Between-Subjects Effects

Dependent Variable:OverallSATScore Overall Satisfaction Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	959.408[a]	3	319.803	6.669	.000
Intercept	52156.993	1	52156.993	1087.608	.000
Female	474.066	1	474.066	9.885	.002
Age	382.985	1	382.985	7.986	.005
Female * Age	649.895	1	649.895	13.552	.000
Error	8919.761	186	47.956		
Total	544791.179	190			
Corrected Total	9879.170	189			

a. R Squared = .097 (Adjusted R Squared = .083)



**Interpretation 5A: The focus here is on the difference in slopes. Reported usually when the covariate (Age) is the main variable of interest, and you want to see when and how this slope differs in different groups. No interest in any main effect for Gender.

Parameter	B	Std. Error	t	Sig.
Intercept	52.123	2.101	24.807	.000
[Female=.00]	10.986	3.494	3.144	.002
[Female=1.00]	0[a]	.	.	.
Age	.054	.080	.671	.503
[Female=.00] * Age	-.462	.125	-3.681	.000
[Female=1.00] * Age	0[a]	.	.	.

E(Satisfaction) = 52.123 +10.986Female + .054Age -.462Female*Age

2. Is the participant female?

Dependent Variable:OverallSATScore Overall Satisfaction Score

Is the participant female?	Mean	Std. Error
.00 Male	63.109[a]	2.792
1.00 Female	52.123[a]	2.101

a. Covariates appearing in the model are evaluated at the following values: Age AGE = 0.

Pairwise Comparisons

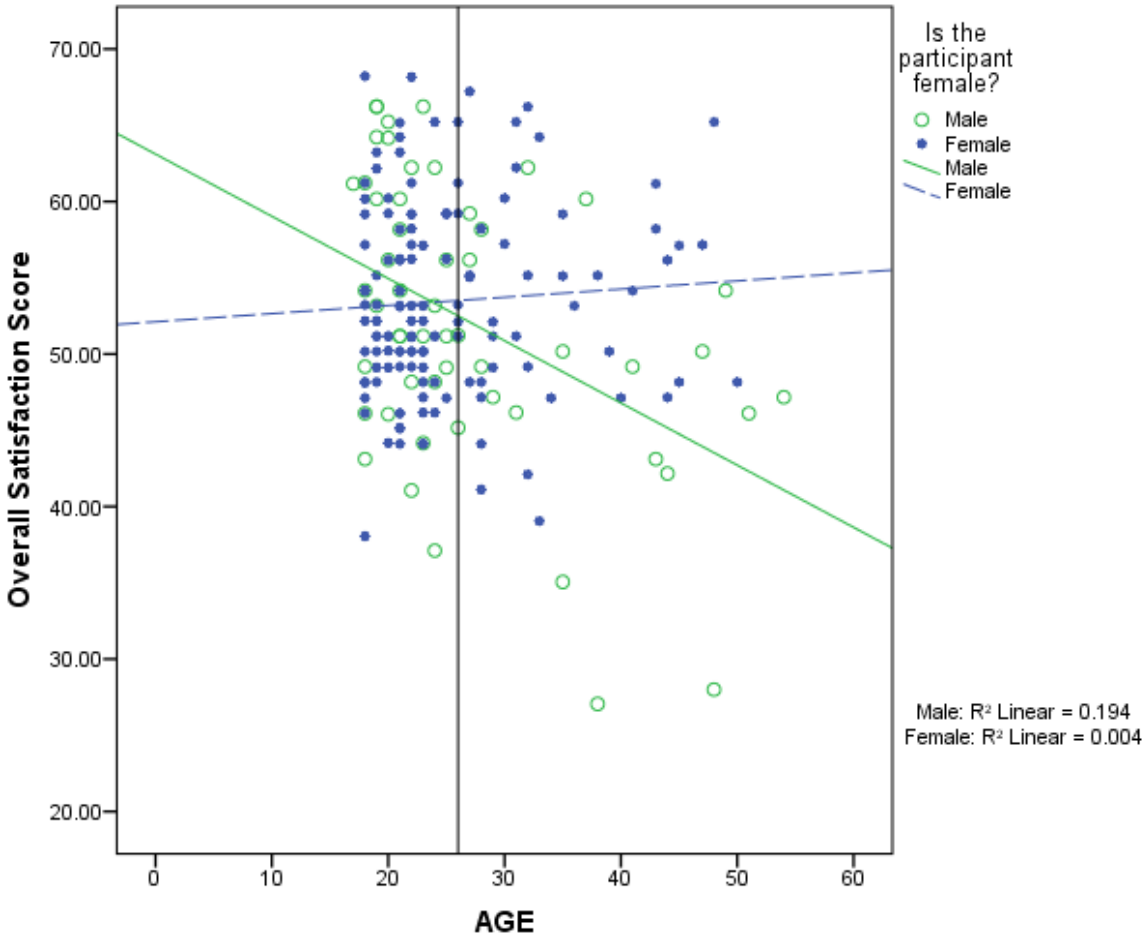
Dependent Variable:OverallSATScore Overall Satisfaction Score

(I) Is the participant female?	(J) Is the participant female?	Mean Difference (I-J)	Std. Error	Sig.[a]
.00 Male	1.00 Female	10.986*	3.494	.002
1.00 Female	.00 Male	-10.986*	3.494	.002

Based on estimated marginal means

*. The mean difference is significant at the .05 level.
a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

**Interpretation 5b: when Age is held constant at the mean, to assess the main effect of Gender. This is done when Age is a nuisance variable, but it doesn't really help you to understand the interaction.



1. Is the participant female?

Dependent Variable:OverallSATScore Overall Satisfaction Score

Is the participant female?	Mean	Std. Error
.00 Male	52.591[a]	.952
1.00 Female	53.506[a]	.596

a. Covariates appearing in the model are evaluated at the following values: Age AGE = 25.78.

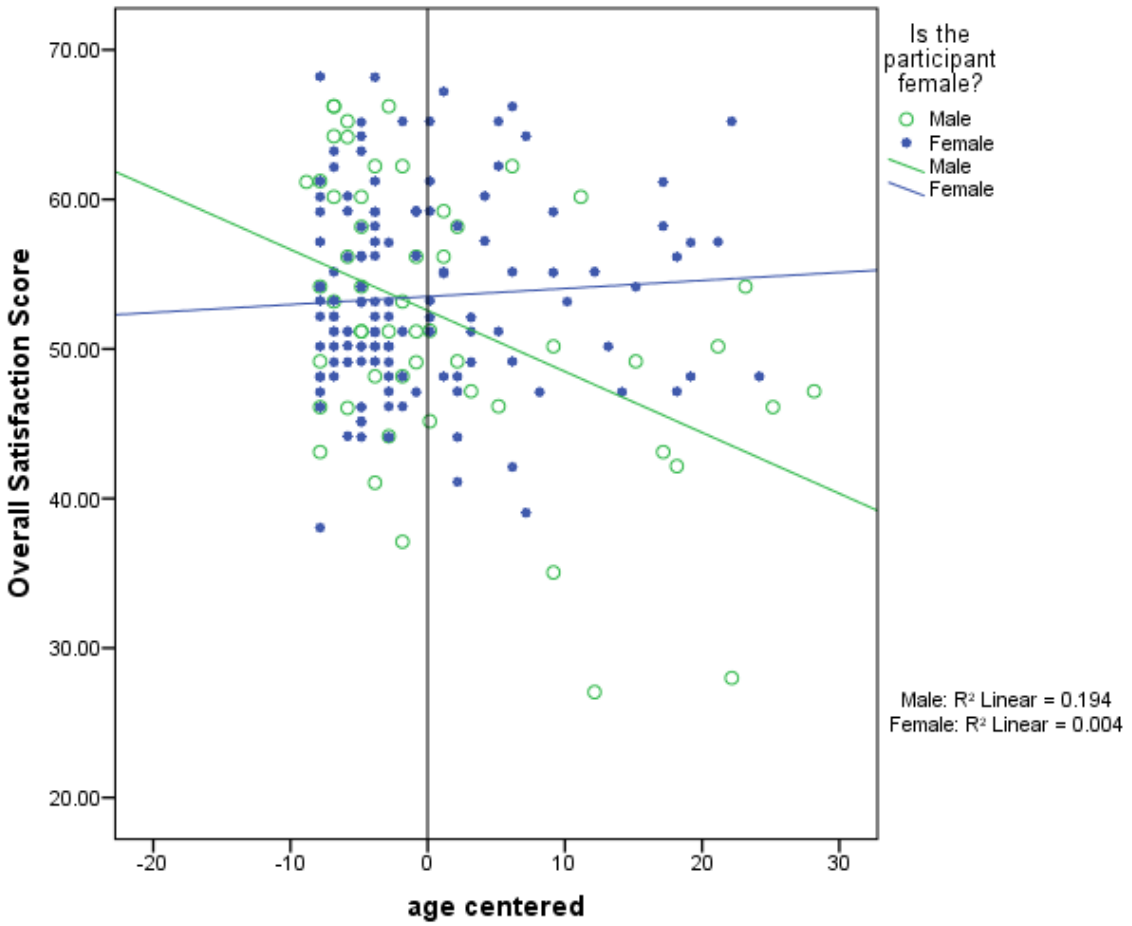
```
**To get the same main effect of Gender information using regression
coefficients, center Age at its mean and rerun the model.
*Age_Centered = Age - 25.84.
```

Tests of Between-Subjects Effects

Dependent Variable:OverallSATScore Overall Satisfaction Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	959.408[a]	3	319.803	6.669	.000
Intercept	428101.047	1	428101.047	8927.009	.000
Female	33.622	1	33.622	.701	.403
AGE_Centered	382.985	1	382.985	7.986	.005
Female * AGE_Centered	649.895	1	649.895	13.552	.000
Error	8919.761	186	47.956		
Total	544791.179	190			
Corrected Total	9879.170	189			

a. R Squared = .097 (Adjusted R Squared = .083)



Parameter Estimates

Dependent Variable:OverallSATScore Overall Satisfaction Score

Parameter	B	Std. Error	t	Sig.
Intercept	53.509	.596	89.799	.000
[Female=.00]	-.940	1.123	-.837	.403
[Female=1.00]	0[a]	.	.	.
AGE_Centered	.054	.080	.671	.503
[Female=.00] * AGE_Centered	-.462	.125	-3.681	.000
[Female=1.00] * AGE_Centered	0[a]	.	.	.

a. This parameter is set to zero because it is redundant.

E(Satisfaction) = 53.509 -.940Female + .054(Age – 25.84) - .462Female*(Age – 25.84)

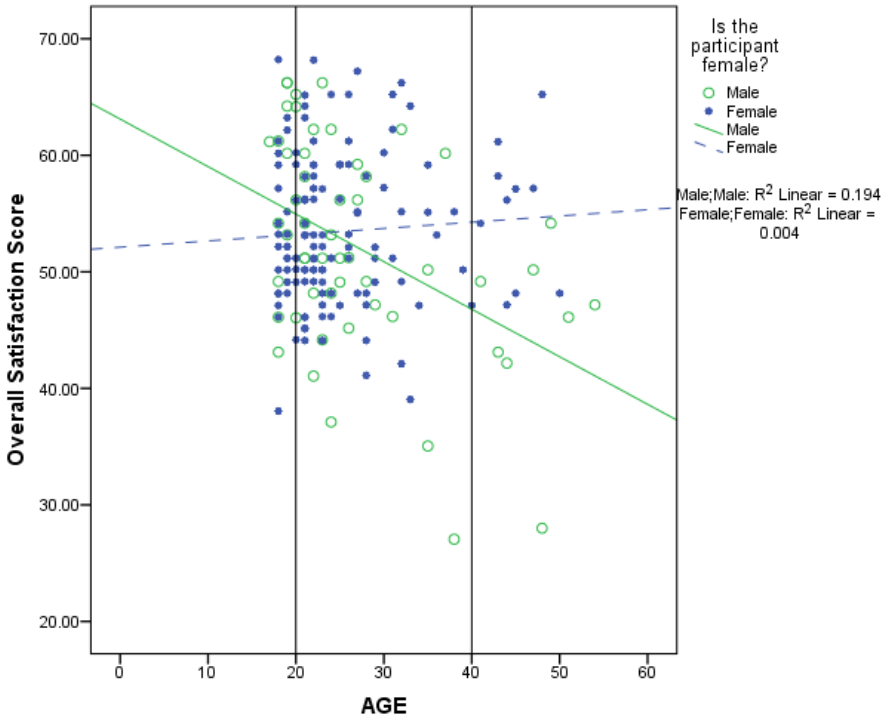
Is the participant female?

Dependent Variable:OverallSATScore Overall Satisfaction Score

Is the participant female?	Mean	Std. Error
.00 Male	52.591[a]	.952
1.00 Female	53.506[a]	.596

a. Covariates appearing in the model are evaluated at the following values: AGE_Centered age centered = -.0558.

```
**Spotlight Analysis.
**Interpretation 5c: Instead of focusing on difference in slopes of Age
between genders, focus on the mean difference between genders at specific
values of Age.
```



3. Is the participant female?

Dependent Variable:OverallSATScore Overall Satisfaction Score

Is the participant female?	Mean	Std. Error
.00 Male	54.951[a]	1.171
1.00 Female	53.196[a]	.726

a. Covariates appearing in the model are evaluated at the following values: Age AGE = 20.

Pairwise Comparisons

Dependent Variable:OverallSATScore Overall Satisfaction Score

(I) Is the participant female?	(J) Is the participant female?	Mean Difference (I-J)	Std. Error	Sig.[a]
.00 Male	1.00 Female	1.755	1.378	.204
1.00 Female	.00 Male	-1.755	1.378	.204

Based on estimated marginal means

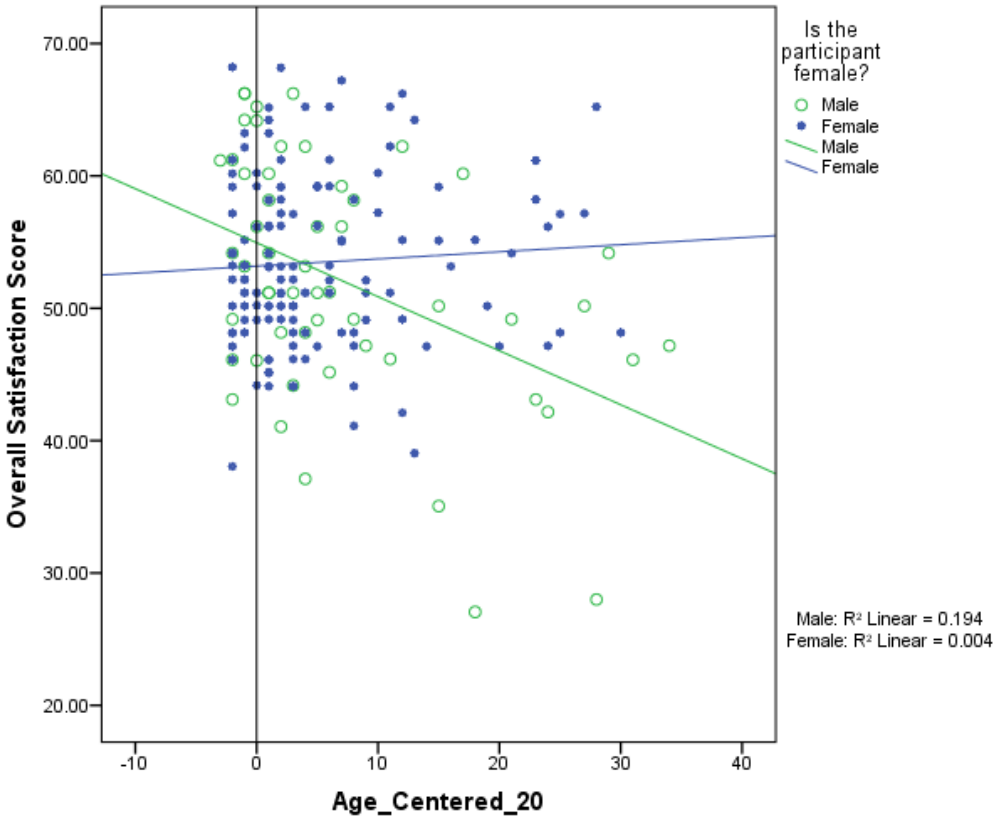
a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Parameter Estimates

Dependent Variable:OverallSATScore Overall Satisfaction Score

Parameter	B	Std. Error	t	Sig.
Intercept	53.196	.726	73.301	.000
[Female=.00]	1.755	1.378	1.274	.204
[Female=1.00]	0[a]	.	.	.
Age_Centered_20	.054	.080	.671	.503
[Female=.00] * Age_Centered_20	-.462	.125	-3.681	.000
[Female=1.00] * Age_Centered_20	0[a]	.	.	.

a. This parameter is set to zero because it is redundant.



From the model using original Age variable.

4. Is the participant female?

Dependent Variable:OverallSATScore Overall Satisfaction Score

Is the participant female?	Mean	Std. Error
.00 Male	46.793[a]	1.554
1.00 Female	54.268[a]	1.322

a. Covariates appearing in the model are evaluated at the following values: Age AGE = 40.

Pairwise Comparisons

Dependent Variable:OverallSATScore Overall Satisfaction Score

(I) Is the participant female?	(J) Is the participant female?	Mean Difference (I-J)	Std. Error	Sig.[a]
.00 Male	1.00 Female	-7.475*	2.041	.000
1.00 Female	.00 Male	7.475*	2.041	.000

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

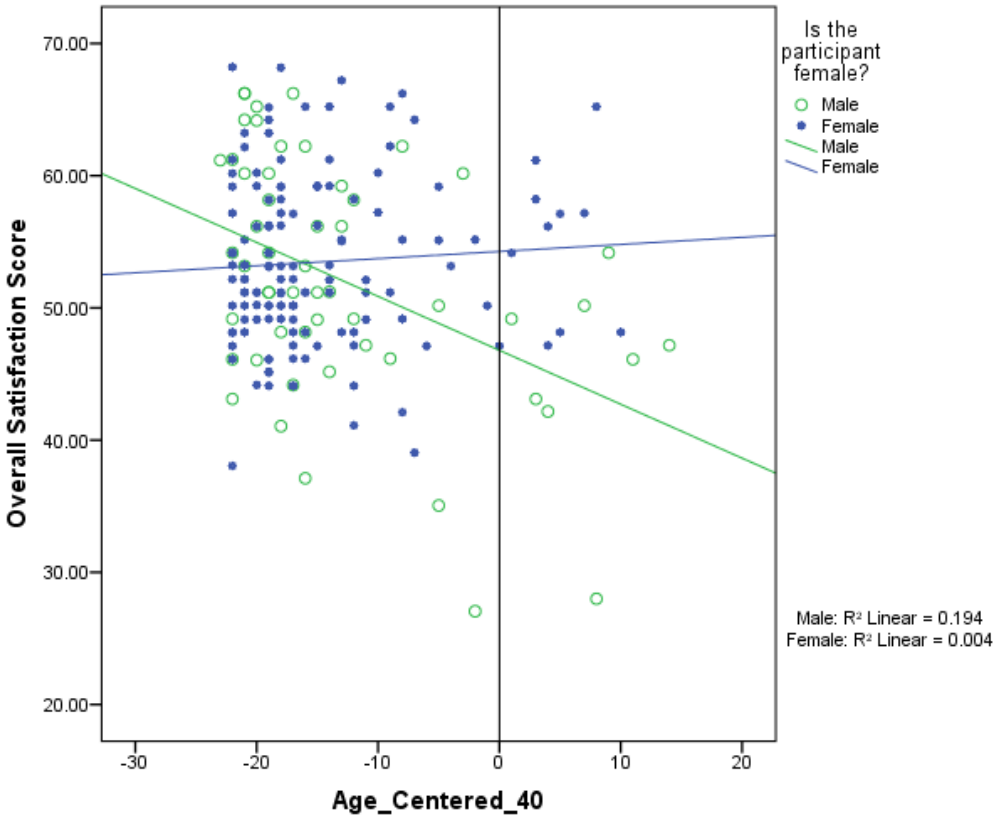
Parameter Estimates

Dependent Variable:OverallSATScore Overall Satisfaction Score

Parameter	B	Std. Error	t	Sig.
Intercept	54.268	1.322	41.052	.000
[Female=.00]	-7.475	2.041	-3.663	.000
[Female=1.00]	0[a]	.	.	.
Age_Centered_40	.054	.080	.671	.503
[Female=.00] * Age_Centered_40	-.462	.125	-3.681	.000
[Female=1.00] * Age_Centered_40	0[a]	.	.	.

a. This parameter is set to zero because it is redundant.

When Age is centered at 40, the coefficient for Gender is the mean difference for Males vs. Females at Age 40.



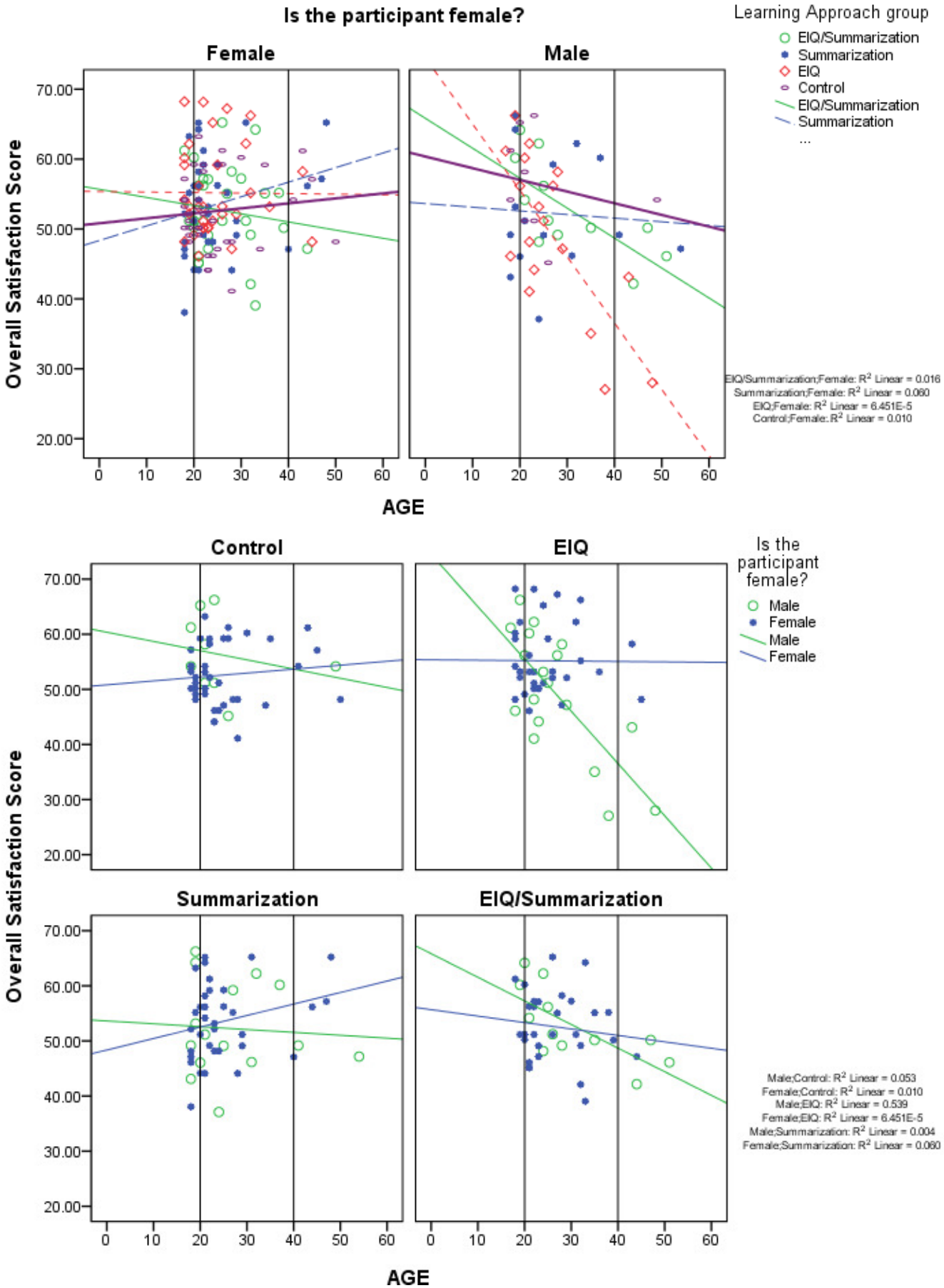
Model 6: 3 Way Interactions

Parameter Estimates

Dependent Variable:OverallSATScore Overall Satisfaction Score

Parameter	B	Std. Error	t	Sig.
Intercept	50.819	3.557	14.286	.000
[group=1.00]	4.861	6.156	.790	.431
[group=2.00]	-2.462	5.140	-.479	.633
[group=3.00]	4.542	5.660	.802	.423
[group=4.00]	0[a]	.	.	.
[Female=.00]	9.544	7.303	1.307	.193
[Female=1.00]	0[a]	.	.	.
[group=1.00] * [Female=.00]	.610	10.591	.058	.954
[group=1.00] * [Female=1.00]	0[a]	.	.	.
[group=2.00] * [Female=.00]	-4.265	9.561	-.446	.656
[group=2.00] * [Female=1.00]	0[a]	.	.	.
[group=3.00] * [Female=.00]	9.593	9.962	.963	.337
[group=3.00] * [Female=1.00]	0[a]	.	.	.
[group=4.00] * [Female=.00]	0[a]	.	.	.
[group=4.00] * [Female=1.00]	0[a]	.	.	.
[group=1.00] * Age	-.117	.183	-.637	.525
[group=2.00] * Age	.209	.142	1.470	.143
[group=3.00] * Age	-.008	.173	-.044	.965
[group=4.00] * Age	.071	.135	.526	.600
[Female=.00] * Age	-.238	.281	-.849	.397
[Female=1.00] * Age	0[a]	.	.	.
[group=1.00] * [Female=.00] * Age	-.073	.381	-.193	.847
[group=1.00] * [Female=1.00] * Age	0[a]	.	.	.
[group=2.00] * [Female=.00] * Age	-.022	.358	-.062	.950
[group=2.00] * [Female=1.00] * Age	0[a]	.	.	.
[group=3.00] * [Female=.00] * Age	-.703	.377	-1.864	.064
[group=3.00] * [Female=1.00] * Age	0[a]	.	.	.
[group=4.00] * [Female=.00] * Age	0[a]	.	.	.
[group=4.00] * [Female=1.00] * Age	0[a]	.	.	.

a. This parameter is set to zero because it is redundant.


Is the participant female?
Female
Male
Learning Approach group
EIQ/Summarization
Summarization
EIQ
Control
EIQ/Summarization
Summarization
...
Overall Satisfaction Score
70.00
60.00
50.00
40.00
30.00
20.00
0
10
20
30
40
50
60
AGE
EIQ/Summarization;Female: R² Linear = 0.016
Summarization;Female: R² Linear = 0.080
EIQ;Female: R² Linear = 6.451E-5
Control;Female: R² Linear = 0.010
Control
EIQ
Summarization
EIQ/Summarization
Is the participant female?
Male
Female
Male
Female
Male;Control: R² Linear = 0.053
Female;Control: R² Linear = 0.010
Male;EIQ: R² Linear = 0.539
Female;EIQ: R² Linear = 6.451E-5
Male;Summarization: R² Linear = 0.004
Female;Summarization: R² Linear = 0.080

1. Learning Approach group * Is the participant female?

Dependent Variable:OverallSATScore Overall Satisfaction Score

Learning Approach group	Is the participant female?	Mean	Std. Error
1.00 EIQ/Summarization	.00 Male	57.265[a]	2.678
	1.00 Female	53.344[a]	1.725
2.00 Summarization	.00 Male	52.594[a]	2.097
	1.00 Female	52.528[a]	1.337
3.00 EIQ	.00 Male	55.518[a]	1.998
	1.00 Female	55.207[a]	1.394
4.00 Control	.00 Male	57.020[a]	2.464
	1.00 Female	52.243[a]	1.268

a. Covariates appearing in the model are evaluated at the following values: Age AGE = 20.

2. Learning Approach group * Is the participant female?

Dependent Variable:OverallSATScore Overall Satisfaction Score

Learning Approach group	Is the participant female?	Mean	Std. Error
1.00 EIQ/Summarization	.00 Male	48.696[a]	2.596
	1.00 Female	51.008[a]	2.760
2.00 Summarization	.00 Male	51.553[a]	2.812
	1.00 Female	56.698[a]	2.431
3.00 EIQ	.00 Male	36.538[a]	2.899
	1.00 Female	55.054[a]	2.892
4.00 Control	.00 Male	53.678[a]	4.445
	1.00 Female	53.667[a]	2.289

a. Covariates appearing in the model are evaluated at the following values: Age AGE = 40.