

Post-Equating, Calibration, and Assessment Results for the Missouri End-of-Course (MO EOC) Assessments for the Summer 2014, Fall 2014, and Spring 2015 Administrations

Presented to the
Missouri Department of Education
by
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1. Introduction

This document presents the Spring 2015 post-equating process for the Missouri End-of-Course (EOC) Assessments in English II, Algebra I, Algebra II, and Physical Science. It also presents the assessment results for the Summer 2014, Fall 2014, and Spring 2015 administrations of the MO EOC Assessments in English II, Algebra I, Biology, English I, Algebra II, Geometry, Government, and American History, as well as the Spring 2015 results for Physical Science. This document will be presented to the Technical Advisory Committee (TAC) on August 20–21, 2015.

2. Post-Equating and Calibration

In Spring 2015, Questar Assessment, Inc. (Questar) performed post-equating with an anchor item stability check and free calibration for the MO EOC Assessments.

1. Post-equating with Item Stability Check

In order to ensure that test scores are comparable across years or test administrations, it is typical practice to check the item stability when equating is performed. Since post-equating is performed with anchor sets of items, it is necessary to check if those anchor sets behave differently from the last time they were used. If an item behaves differently, that item should not be used as an anchor item.

- a. English II, Algebra I, and Algebra II were post-equated with an item stability check. English II and Algebra I were newly created forms with multiple performance events (PEs) that led to the change of the total score, requiring new raw score to scale score (RSS) conversion tables. Algebra II was a newly created form as well but did not have PEs. However, Algebra II had items with missing item statistics (since Questar did not receive those item statistics from CTB, the previous vendor), so it was necessary to post-equate to estimate the item statistics in order to create the RSS table.

2. Free Calibration (no anchor set)

- a. The Physical Science form was newly created in Fall 2014. Therefore, no previous item statistics were available to be used as anchor items. As a result, free calibration (i.e., calibration without an anchor set) was performed. A small number of students took the Physical Science Assessment in Fall 2014, and cut scores were set through a standard setting meeting in February 2015. After the free calibration, the cut thetas established from Fall 2014 were used to create the RSS table.

2.1. *Post-equating with Item Stability Check: English II, Algebra I, and Algebra II*

In order to evaluate whether the item parameter estimates are stable from previous administrations to the Spring 2015 administration, the displacement criterion with $|\cdot|_{.30}$

logits¹ was initially adopted. The displacement measure indicates the size of difference, or drift, between the parameters of the anchored items, as well as the estimated parameters of the same items obtained with free calibration without constraint (Linacre, 2009). However, after the initial item stability check, Questar had to relax the displacement criterion to $|.50|$ because too many items had to be removed from the anchor sets that unbalanced the content of the assessments.

Winsteps 3.64 was used to estimate the displacement measurement statistic. The following steps describe the procedures used to estimate the displacement values for evaluating item parameter drift for multiple-choice (MC) items:

- Step 1: Calibrate with fixed item parameters for MC items.
- Step 2: Evaluate the displacement value. If the value of displacement is greater than 0.50 logits, the item will be removed from the anchor set.
- Step 3: After removing unstable items from the anchor set, re-calibrate.
- Step 4: Repeat Steps 1 through 3 until all unstable items are identified.
- Step 5: Use the survived MC items from the previous steps as anchor items to obtain item parameters for PEs.

Table 2.1 presents the results of item removal from the anchor set for English II, Algebra I, and Algebra II.

Table 2.1. Items Removed From the Anchor Set

Test	#Anchor Items (start)	#Items Removed	#Items Remaining
English II	35	3	32
Algebra I	36	7	29
Algebra II	25	8	17

2.2. Free Calibration: Physical Science

Physical Science was administered for the first time in Fall 2014. Therefore, it is necessary to establish a new scale for Physical Science. All items will be calibrated at the same time using Winsteps, and the appropriate slope and intercept will be determined to establish the RSS conversion table for the Spring 2015 form.

2.2.1 Slope and Intercept

To produce scale score ranges, linear transformation was applied to theta estimates and the scale score. The following formula was used to obtain the slope and intercept for the transformation function.

$$sc(y) = \left[\frac{sc(y_2) - sc(y_1)}{\theta_2 - \theta_1} \right] y + \left\{ sc(y_1) - \left[\frac{sc(y_2) - sc(y_1)}{\theta_2 - \theta_1} \right] \theta_1 \right\}$$

¹ This is the logit scale used in Rasch modeling.

where θ_2 and θ_1 are person parameter estimates that correspond to the cut score points, and $sc(y_2)$ and $sc(y_1)$ are scale score points. This formula was adopted from Kolen and Brennan (2004, p.337). $sc(y_1)$ was 200 and $sc(y_2)$ was 225.

Solving function with $sc(y_1)$ and $sc(y_2)$, 200 and 225 respectively, the new slope and intercept for Physical Science are 23.43 and 196.62, respectively. This slope and intercept will be applied to future administrations.

3. Assessment Results

Tables 3.1 through 3.18 show the achievement-level distributions and descriptive statistics for each MO EOC Assessment for the Summer 2014, Fall 2014, and Spring 2015 administrations. Figures 3.1 through 3.9 show graphs of the achievement-level distributions.

The Summer 2014 administration had the smallest number of students who took the MO EOC Assessments, so it is not recommended to compare the achievement-level distributions from Summer 2014 to the Fall 2014 and Spring 2015 administrations.

Table 3.1. Achievement-Level Distributions—English II

Achievement Level	Summer 2014		Fall 2014		Spring 2015	
	Freq.	%	Freq.	%	Freq.	%
Below Basic	46	12.7%	343	14.1%	3,129	5.0%
Basic	161	44.5%	734	30.2%	12,776	20.5%
Proficient	131	36.2%	1,083	44.5%	34,996	56.1%
Advanced	24	6.6%	274	11.3%	11,444	18.4%
Total	362	100.0%	2,434	100.0%	62,345	100.0%

Figure 3.1. Achievement-Level Distributions—English II

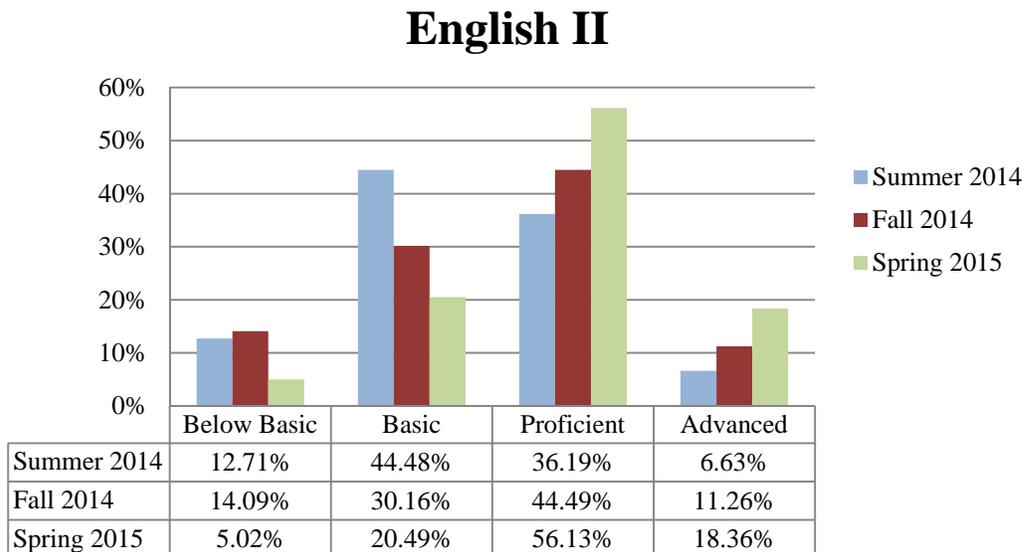


Table 3.2. Descriptive Statistics—English II

Test Period	Raw Score		Scale Score		Gender		Ethnicity*							Total
	Mean	SD	Mean	SD	Male	Female	0	1	2	3	4	5	6	
Summer 2014	21.90	7.15	196.50	16.25	221	141	2	10	--	166	25	156	3	362
Fall 2014	27.08	8.72	200.92	17.85	1,313	1,121	15	55	8	775	151	1,374	56	2,434
Spring 2015	31.37	6.74	208.15	16.16	31,378	30,967	296	1,217	119	9,108	2,861	47,514	1,230	62,345

*Ethnicity Codes:

- 0 = American Indian/Alaskan Native
- 1 = Asian
- 2 = Pacific Islander
- 3 = Black (Not Hispanic)
- 4 = Hispanic
- 5 = White (Not Hispanic)
- 6 = Multiracial (or multiple marks)

Table 3.3. Achievement-Level Distributions—Algebra I

Achievement Level	Summer 2014		Fall 2014		Spring 2015	
	Freq.	%	Freq.	%	Freq.	%
Below Basic	134	15.2%	1,211	23.6%	11,373	18.1%
Basic	361	41.1%	1,261	24.5%	11,955	19.0%
Proficient	267	30.4%	2,005	39.0%	27,444	43.7%
Advanced	117	13.3%	662	12.9%	12,001	19.1%
Total	879	100.0%	5,139	100.0%	62,773	100.0%

Figure 3.2. Achievement-Level Distributions—Algebra I

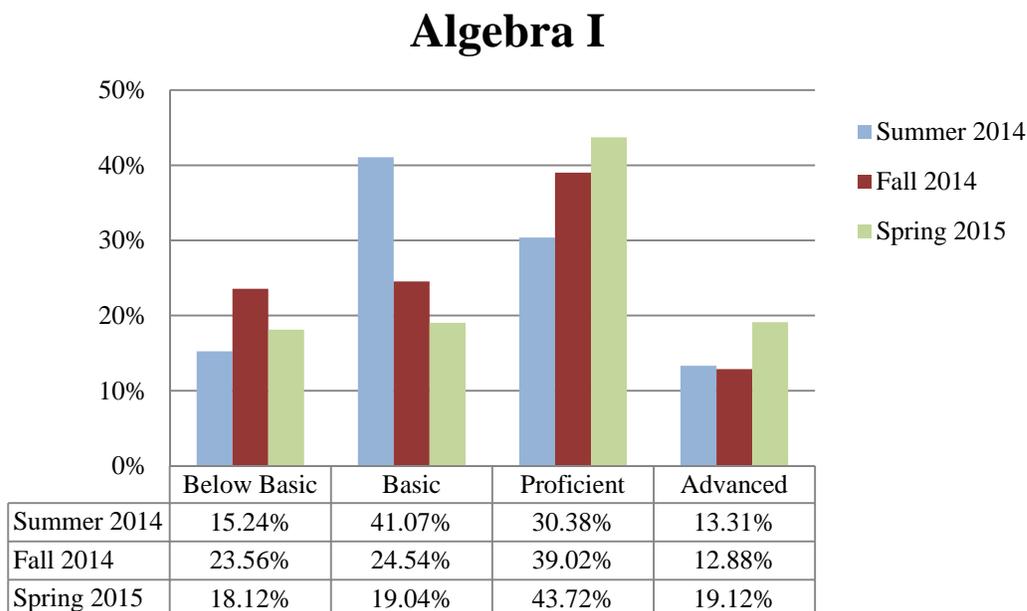


Table 3.4. Descriptive Statistics—Algebra I

Test Period	Raw Score		Scale Score		Gender		Ethnicity*							Total
	Mean	SD	Mean	SD	Male	Female	0	1	2	3	4	5	6	
Summer 2014	20.99	7.73	196.78	21.41	458	421	2	10	3	286	43	526	9	879
Fall 2014	19.99	9.05	201.24	19.43	2,573	2,566	31	116	10	1,046	252	3,603	81	5,139
Spring 2015	25.59	9.20	205.77	19.99	31,603	31,170	281	1,256	123	9,207	3,139	47,486	1,281	62,773

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Table 3.5. Achievement-Level Distributions—Biology

Achievement Level	Summer 2014		Fall 2014		Spring 2015	
	Freq.	%	Freq.	%	Freq.	%
Below Basic	69	21.3%	728	23.0%	1,878	3.0%
Basic	154	47.5%	1,052	33.2%	13,223	21.1%
Proficient	92	28.4%	938	29.6%	31,479	50.3%
Advanced	9	2.8%	451	14.2%	16,022	25.6%
Total	324	100.0%	3,169	100.0%	62,602	100.0%

Figure 3.3. Achievement-Level Distributions—Biology

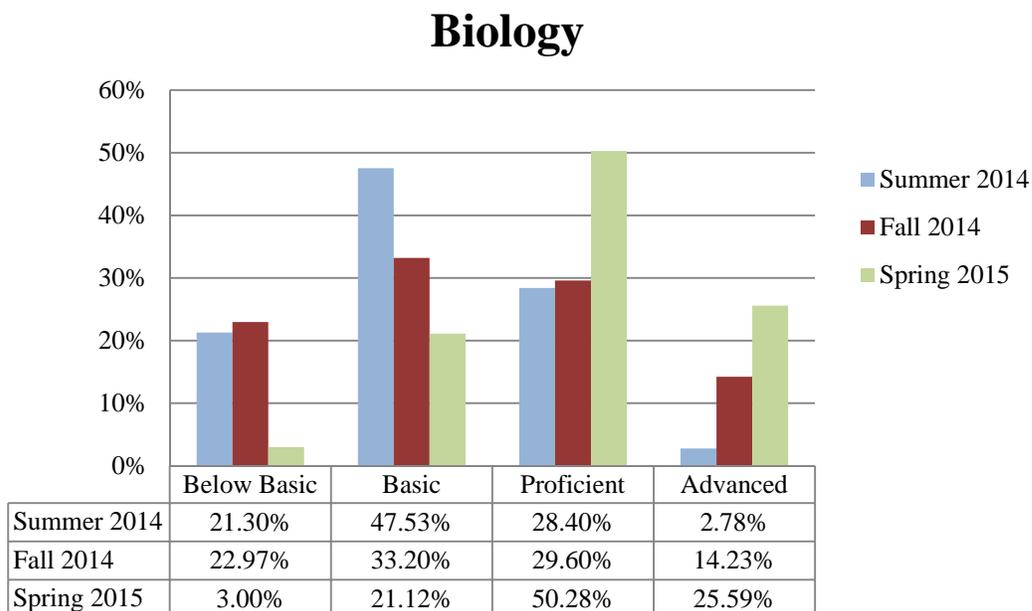


Table 3.6. Descriptive Statistics—Biology

Test Period	Raw Score		Scale Score		Gender		Ethnicity*						Total	
	Mean	SD	Mean	SD	Male	Female	0	1	2	3	4	5		6
Summer 2014	26.40	9.51	190.30	17.38	164	160	2	6	--	133	50	131	2	324
Fall 2014	29.10	12.57	195.93	24.15	1,664	1,505	23	89	11	787	189	2,000	70	3,169
Spring 2015	36.14	9.71	210.85	17.88	31,644	30,958	277	1,220	129	9,079	2,919	47,719	1,259	62,602

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Table 3.7. Achievement-Level Distributions—English I

Achievement Level	Summer 2014		Fall 2014		Spring 2015	
	Freq.	%	Freq.	%	Freq.	%
Below Basic	28	17.1%	53	8.5%	1,113	6.2%
Basic	57	34.8%	145	23.2%	4,776	26.6%
Proficient	57	34.8%	320	51.3%	10,083	56.3%
Advanced	22	13.4%	106	17.0%	1,952	10.9%
Total	164	100.0%	624	100.0%	17,924	100.0%

Figure 3.4. Achievement-Level Distributions—English I

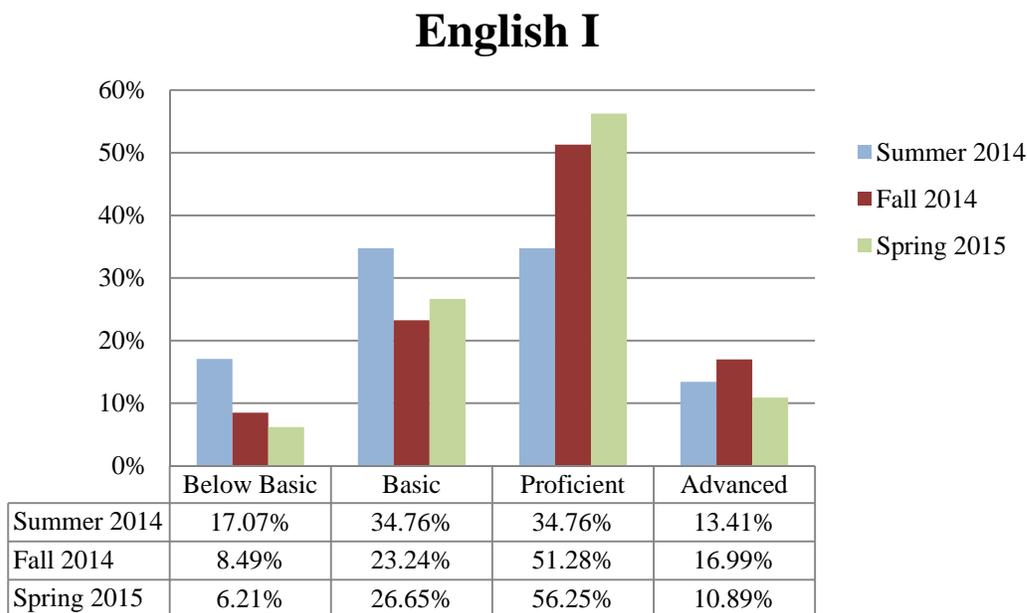


Table 3.8. Descriptive Statistics—English I

Test Period	Raw Score		Scale Score		Gender		Ethnicity*							Total
	Mean	SD	Mean	SD	Male	Female	0	1	2	3	4	5	6	
Summer 2014	22.68	7.84	197.44	22.79	87	77	1	2	--	31	36	90	4	164
Fall 2014	29.26	7.52	205.77	18.26	313	311	3	10	3	55	32	508	13	624
Spring 2015	28.87	6.57	204.57	15.74	8,944	8,980	98	221	35	1,463	677	15,134	296	17,924

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Table 3.9. Achievement-Level Distributions—Algebra II

Achievement Level	Summer 2014		Fall 2014		Spring 2015	
	Freq.	%	Freq.	%	Freq.	%
Below Basic	33	42.9%	136	17.7%	3,022	14.5%
Basic	33	42.9%	133	17.3%	4,031	19.3%
Proficient	9	11.7%	254	33.1%	7,897	37.8%
Advanced	2	2.6%	244	31.8%	5,936	28.4%
Total	77	100.0%	767	100.0%	20,886	100.0%

Figure 3.5. Achievement-Level Distributions—Algebra II

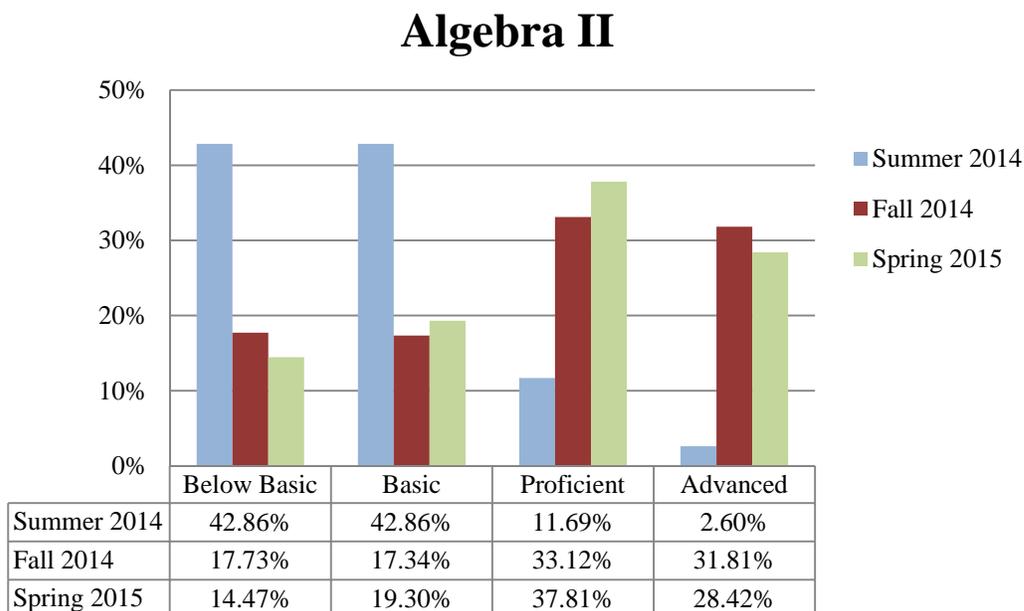


Table 3.10. Descriptive Statistics—Algebra II

Test Period	Raw Score		Scale Score		Gender		Ethnicity*						Total	
	Mean	SD	Mean	SD	Male	Female	0	1	2	3	4	5		6
Summer 2014	15.60	6.14	183.78	15.39	39	38	--	--	--	19	10	47	1	77
Fall 2014	24.06	7.97	208.82	24.46	365	402	1	33	2	73	42	595	21	767
Spring 2015	23.79	7.27	208.98	22.30	9,707	11,179	111	692	30	1,428	752	17,454	419	20,886

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Table 3.11. Achievement-Level Distributions—Geometry

Achievement Level	Summer 2014		Fall 2014		Spring 2015	
	Freq.	%	Freq.	%	Freq.	%
Below Basic	31	29.0%	104	13.6%	2,147	19.1%
Basic	35	32.7%	112	14.7%	2,059	18.3%
Proficient	32	29.9%	347	45.5%	5,191	46.1%
Advanced	9	8.4%	199	26.1%	1,861	16.5%
Total	107	100.0%	762	100.0%	11,258	100.0%

Figure 3.6. Achievement-Level Distributions—Geometry

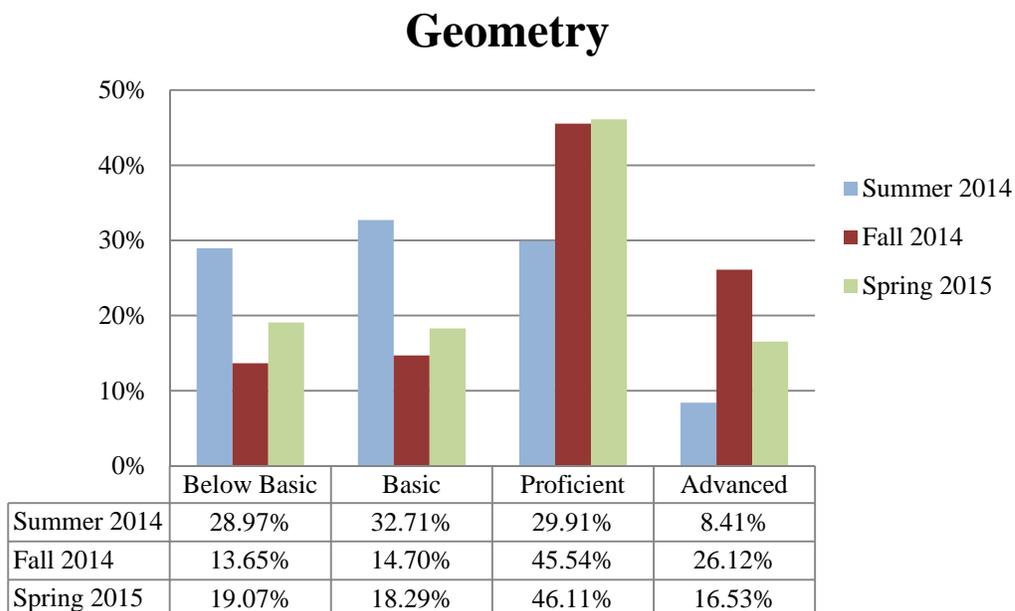


Table 3.12. Descriptive Statistics—Geometry

Test Period	Raw Score		Scale Score		Gender		Ethnicity*							Total
	Mean	SD	Mean	SD	Male	Female	0	1	2	3	4	5	6	
Summer 2014	20.29	7.37	192.36	20.35	52	55	2	--	1	38	11	54	1	107
Fall 2014	24.18	7.40	209.99	20.35	385	377	3	29	3	93	42	568	24	762
Spring 2015	22.13	7.03	204.33	18.91	5,359	5,899	56	232	13	706	437	9,677	137	11,258

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Table 3.13. Achievement-Level Distributions—Government

Achievement Level	Summer 2014		Fall 2014		Spring 2015	
	Freq.	%	Freq.	%	Freq.	%
Below Basic	117	13.7%	1,071	7.8%	3,183	7.0%
Basic	232	27.1%	4,696	34.0%	12,887	28.2%
Proficient	315	36.8%	5,593	40.5%	20,966	45.9%
Advanced	193	22.5%	2,459	17.8%	8,669	19.0%
Total	857	100.0%	13,819	100.0%	45,705	100.0%

Figure 3.7. Achievement-Level Distributions—Government

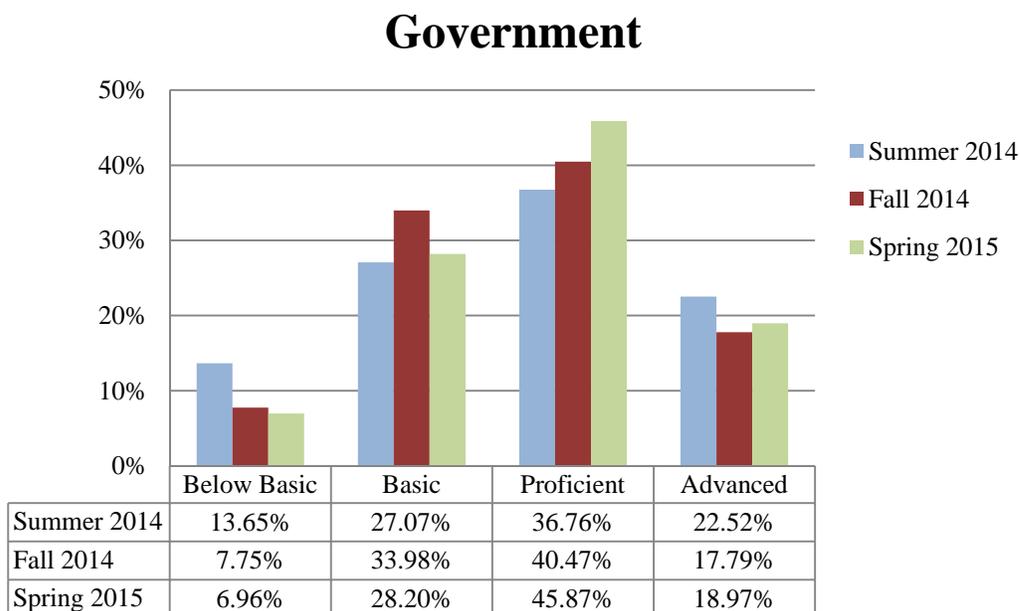


Table 3.14. Descriptive Statistics—Government

Test Period	Raw Score		Scale Score		Gender		Ethnicity*						Total	
	Mean	SD	Mean	SD	Male	Female	0	1	2	3	4	5		6
Summer 2014	25.93	8.41	203.55	22.90	413	444	5	44	5	155	62	573	13	857
Fall 2014	25.54	7.06	203.72	19.04	6,973	6,846	60	371	33	2,414	622	10,075	244	13,819
Spring 2015	25.86	6.95	205.00	19.14	23,139	22,566	219	834	99	6,712	1,979	35,001	861	45,705

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Table 3.15. Achievement-Level Distributions—American History

Achievement Level	Summer 2014		Fall 2014		Spring 2015	
	Freq.	%	Freq.	%	Freq.	%
Below Basic	56	32.2%	199	30.2%	2,832	25.0%
Basic	59	33.9%	141	21.4%	2,847	25.2%
Proficient	43	24.7%	191	28.9%	3,407	30.1%
Advanced	16	9.2%	129	19.5%	2,224	19.7%
Total	174	100.0%	660	100.0%	11,310	100.0%

Figure 3.8. Achievement-Level Distributions—American History

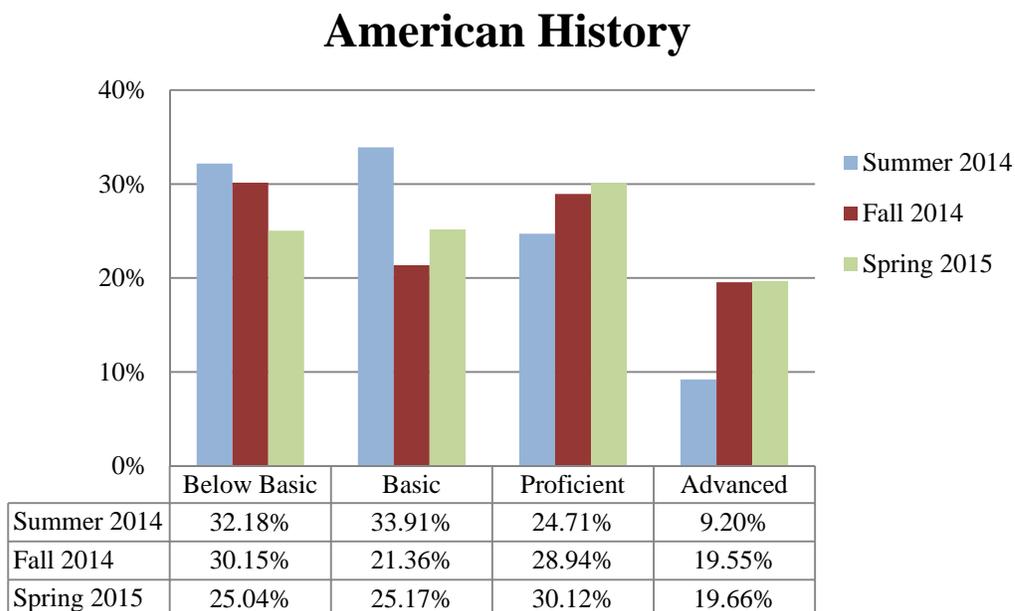


Table 3.16. Descriptive Statistics—American History

Test Period	Raw Score		Scale Score		Gender		Ethnicity*							Total
	Mean	SD	Mean	SD	Male	Female	0	1	2	3	4	5	6	
Summer 2014	20.82	6.43	190.73	21.08	72	102	1	5	--	24	38	104	2	174
Fall 2014	23.16	7.39	196.83	25.92	372	288	4	8	2	84	34	501	27	660
Spring 2015	23.26	7.53	198.67	25.18	5,737	5,573	61	120	11	645	340	9,957	176	11,310

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Table 3.17. Achievement-Level Distributions—Physical Science

Achievement Level	Summer 2014		Fall 2014		Spring 2015	
	Freq.	%	Freq.	%	Freq.	%
Below Basic	--	--	--	--	344	5.5%
Basic	--	--	--	--	4,175	67.2%
Proficient	--	--	--	--	1,443	23.2%
Advanced	--	--	--	--	250	4.0%
Total	--	--	--	--	6,212	100.0%

Figure 3.9. Achievement-Level Distributions—Physical Science

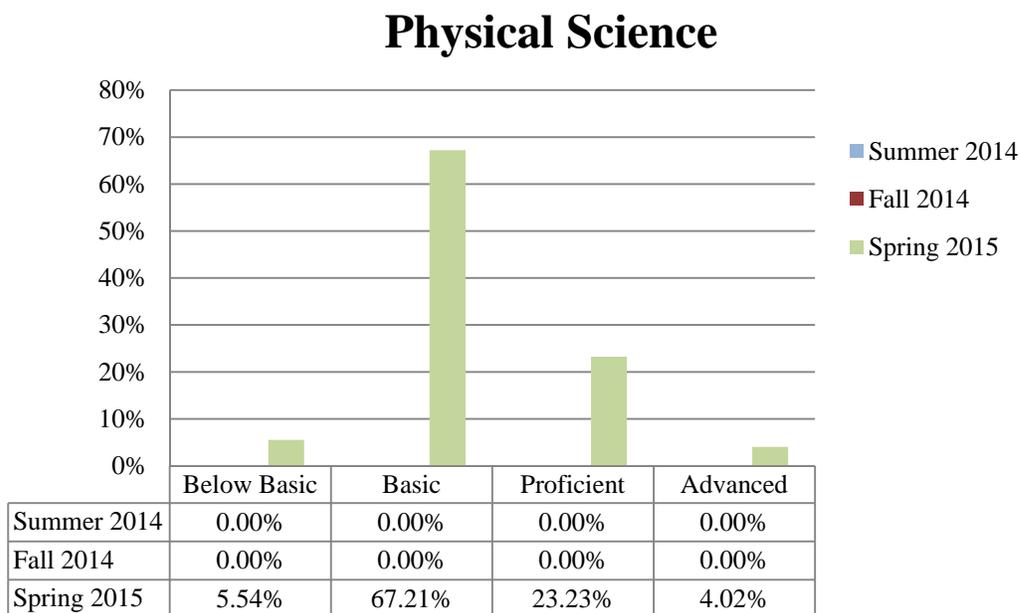


Table 3.18. Descriptive Statistics—Physical Science

Test Period	Raw Score		Scale Score		Gender		Ethnicity*						Total	
	Mean	SD	Mean	SD	Male	Female	0	1	2	3	4	5		6
Summer 2014	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fall 2014	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Spring 2015	20.20	6.19	190.20	16.83	3,200	3,012	27	45	6	278	193	5,581	82	6,212

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- 2 = Pacific Islander
- 3 = Black (Not Hispanic)
- 4 = Hispanic
- 5 = White (Not Hispanic)
- 6 = Multiracial (or multiple marks)

4. References

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Linacre, J. M. (2009). *A user's guide to WINSTEPS Rasch-model computer program*. Chicago: MESA Press.