Appendix A

Questions Used in Survey

Question
What gender do you identify as? (Male, Female, Prefer not to say)
Is English your first language? (Yes, No)
When I read the primary scientific literature (1. I only read specific
parts, 2. I skim to collect the information I need, 3. I read all the way
through but not in a thorough manner, 4. I read carefully and try to
understand it as much as possible.)
How often do you read primary scientific literature? (1. More than 3 days
a week, 2. 1-3 days a week, 3. 1-3 days a month, 4. Less than one day a
month, 5. Almost never.)
Likert questions: Strongly disagree, Disagree, Neutral, Agree, Strongly
agree.
Reading primary scientific literature is an important part of studying
science (van Lacum et al., 2012).
Reading primary scientific literature is time-consuming (Smith, 2001).
NEG

Q7	Reading primary scientific literature is challenging (Hoskins, Lopatto, &
	Stevens, 2011). NEG
Q8	Reading primary scientific literature improves my critical thinking (Coil
	et al., 2010; Gottesman & Hoskins, 2013).
Q9	I read primary scientific literature because I think it is important for my
	study (van Lacum et al., 2012; Smith, 2001).
Q10	I only read primary scientific literature because the assignments ask me to
	do so (Brownell, Price, & Steinman, 2013). NEG
Q11	I only read primary scientific literature because my teachers require me to
	do so (Coil et al., 2010). NEG
Q12	Besides the recommended list for my studies I also read other primary
	scientific papers (Gottesman & Hoskins, 2013).
Q13	I can understand the scientific language in primary scientific literature
	(Hoskins et al., 2011; Willard & Brasier, 2014).
Q14	I can understand the method(s) used in primary scientific literature
	(Gottesman & Hoskins, 2013).
Q15	I can understand the controls of the experiments in primary scientific
	literature (Gottesman & Hoskins, 2013; Hoskins et al., 2011).
Q16	After I read primary scientific literature, I can accurately paraphrase those
	articles in my written tasks (Brownell et al., 2013).
Q17	I do not learn from reading primary scientific literature (Smith, 2001).
	NEG
Q18	I am now less intimidated by reading primary scientific literature than
	when I was in first year (Smith, 2001).
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Q19	I am now more comfortable interpreting graphs, figures and tables than I
	was in first year (Smith, 2001).
Q20	The primary scientific literature helps me understand lecture material
	better (Smith, 2001).
Q21	I have difficulty understanding why a particular experiment was performed
	in a primary scientific paper (Brownell et al., 2013). NEG
Q22	I do not feel confident in my ability to understand the main
	findings/conclusions of a primary scientific paper (Brownell et al., 2013).
	NEG
Q23	Reading primary research papers is often a stressful experience for me
	(Round & Campbell, 2013). NEG
Q24	I tend to get frustrated when trying to understand primary research papers
	(Round & Campbell, 2013). NEG
Q25	I feel confident in my ability to communicate the results of the experiment
	after reading primary scientific literature (Brownell et al., 2013; Hoskins
	et al., 2011).
Q26	I feel confident in my ability to read and evaluate primary literature
	(Hoskins et al., 2011).

Note. NEG indicates negatively phrased questions.

Appendix B

Means and Standard Deviation of Student Answers According to Gender and English as a First Language (EFL) o Second Language (ENFL), With *T*
Test Results

Q	Male		Female	p, t-test	EFL	ENFL	p, t-test
	n = 37		n = 98	n = 135	n = 113	n=24	<i>n</i> = 137
5	4.16	±	4.23 ± 0.78	0.67	4.19 ± 0.85	4.29 ± 0.75	0.54
	0.90		4.23 ± 0.76	0.07	4.17 ± 0.03	T.27 ± 0.73	0.54
6	4.32	±	4.43 ± 0.80	0.5	4.47 ± 0.70	4.08 ± 1.10	0.11
	0.78		4.43 ± 0.60	0.5	4.4/±0./0	4.06 ± 1.10	0.11
7	3.92	±	4.11 ± 0.77	0.22	4.03 ± 0.82	4.25 ± 0.61	0.13
	0.83		4.11 ± 0.77	0.22	4.03 ± 0.62	4.23 ± 0.01	0.13
8	4.08	±	4.01 ± 0.86	0.65	4.02 ± 0.83	4.13 ± 0.85	0.58
	0.80		4.01 ± 0.80	0.03	4.02 ± 0.65	4.13 ± 0.03	0.38
9	3.65	±	3.54 ± 1.11	0.58	3.51 ± 1.05	3.88 ± 1.08	0.14
	0.95		3.34 ± 1.11	0.38	3.31 ± 1.03	3.88 ± 1.08	0.14
10	3.84	±	4.21 ± 0.98	0.1	4.09 ± 1.07	4.21 ± 1.02	0.61
	1.24		4.21 ± 0.76	0.1	4.07 ± 1.07	7.21 ± 1.02	0.01
11	3.38	±	3.89 ± 1.08	0.04 *	3.74 ± 1.16	3.79 ± 1.14	0.85
	1.30		3.69 ± 1.06	0.04	3./4 ± 1.10	J./ J ± 1.14	0.83
12	3.14	±	2.69 ± 1.34	0.08	2.73 ± 1.34	3.25 ± 1.26	0.08
	1.29		2.09 ± 1.34	0.00	2.13 ± 1.34	J.23 ± 1.20	0.00
13	3.86	±	3.67 ± 0.91	0.27	3.70 ± 0.91	3.83 ± 0.87	0.5
	0.89		J.07 ± 0.71	0.27	J./U ± 0./1	J.03 ± 0.07	0.5

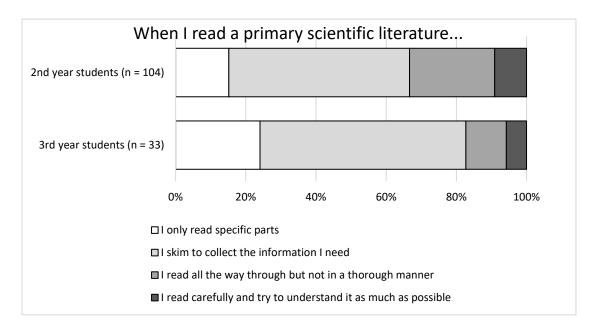
14	3.62	±	3.56 ± 0.99	0.7	3.55 ± 0.95	3.67 ± 0.82	0.54
	0.72		3.30 ± 0.77	0.7	3.33 ± 0.73	3.07 ± 0.02	0.54
15	3.89	±	3.95 ± 0.84	0.69	3.95 ± 0.80	3.88 ± 0.80	0.69
	0.70		3.73 ± 0.0 4	0.07	3.75 ± 0.60	3.88 ± 0.80	0.07
16	3.57	±	3.60 ± 0.93	0.84	3.59 ± 0.90	3.58 ± 0.88	0.96
	0.84		3.00 ± 0.73	0.01	3.57 ± 0.70	3.30 ± 0.00	0.70
17	1.81	±	2.20 ± 1.02	0.02 *	2.09 ± 0.98	2.17 ± 0.92	0.71
	0.78		2.20 - 1.02	0.02	2.05 = 0.50	2.17 = 0.72	0.71
18	4.05	Н	3.91 ± 1.03	0.47	3.93 ± 1.05	4.08 ± 0.93	0.48
	1.05			011,			0110
19	4.19	Н	3.80 ± 0.98	0.01 *	3.88 ± 0.93	4.00 ± 0.93	0.59
	0.74			0.01			0.03
20	3.54	\pm	3.53 ± 1.09	0.96	3.46 ± 1.12	3.92 ± 0.78	0.02 *
	1.07						
21	2.97	±	2.89 ± 0.94	0.62	2.88 ± 0.94	2.96 ± 0.81	0.7
	0.87						
22	2.49	±	2.83 ± 1.09	0.08	2.67 ± 1.06	2.96 ± 1.04	0.23
	0.93						
23	2.73	±	3.43 ± 1.07	0.001 **	3.19 ± 1.11	3.38 ± 1.14	0.48
	1.10						
24	2.92	±	3.51 ± 1.02	0.006 **	3.33 ± 1.10	3.46 ± 0.88	0.53
	1.09						
25	3.38	\pm	3.34 ± 0.92	0.83	3.38 ± 0.91	3.21 ± 0.93	0.41
	0.92						

26	3.620.95	土	3.56 ± 0.99	0.73	3.58 ± 1.00	3.54 ± 0.83	0.84
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Note. Means and standard deviation of student answers according to gender and according to English as a first language (EFL) or second language (ENFL), with *t*-test results.

Appendix C

Differences Between Cohorts of Students in Responses to Q3



Note. Q3: "When I read primary scientific literature..."; chi-square test (d.f. = 3, n = 137, p = 0.229).

Appendix D

Differences in Means of Answers by Student Years (Mean +/- Standard Deviation)

	V2	Year 3	4 44
Q	Year 2	Year 3	p, t-test
			n = 137
5	4.07 ±	4.64 ± 0.65	<0.001 ***
	0.84	4.04 ± 0.03	~0.001
6	4.38 ±	4.48 ± 0.76	0.48
	0.80	4.40 ± 0.70	0.40
7	4.08 ±	4.03 ± 0.81	0.77
	0.78	4.05 ± 0.01	0.77
8	3.90 ±	4.45 ± 0.67	<0.001 ***
	0.84	1.15 ± 0.07	·0.001
9	3.43 ±	4.03 ± 0.81	0.001 **
	1.09	4.03 ± 0.01	0.001
10	4.24 ±	3.70 ± 1.2	0.02 *
	0.97	3.70 ± 1.2	0.02
11	3.87 ±	3.39 ± 1.20	0.05 *
	1.12	3.33 = 1.20	0.00
12	2.65 ±	3.36 ± 1.32	0.01 *
	1.31	3.30 ± 1.32	0.01
13	3.66 ±	3.91 ± 0.77	0.13
	0.93	0.71 - 0.77	0.10
14	3.60 ±	3.48 ± 0.83	0.52
	0.95	3.10 ± 0.03	0.52

15	3.94 ±	3.91 ± 0.63	0.81
	0.85	3.71 = 0.03	0.01
16	3.52 ±	3.82 ± 0.77	0.07
	0.92	3.02 ± 0.77	0.07
17	2.27 ±	1.58 ± 0.66	<0.001 ***
	0.99	1.20 - 0.00	0.001
18	3.74 ±	4.64 ± 0.78	<0.001 ***
	1.05	1.01 = 0.70	.0.001
19	3.71 ±	4.52 ± 0.67	<0.001 ***
	0.92		0.001
20	3.40 ±	3.97 ± 0.98	0.01 *
	1.08	3.57 = 0.50	0.01
21	2.83 ±	3.12 ± 1.05	0.15
	0.86	1.00	0.10
22	2.85 ±	2.33 ± 1.02	0.02 *
	1.04	1.02	0.02
23	3.33 ±	2.91 ± 1.13	0.07
	1.09	2.91	
24	3.43 ±	3.09 ± 1.07	0.12
	1.05	2.07 = 1.07	0.12
25	3.30 ±	3.52 ± 0.97	0.27
	0.90	0.02 = 0.07	
26	3.48 ±	3.88 ± 0.89	0.03 *
	0.98	2.00 = 0.03	
			· · · · · · · · · · · · · · · · · · ·

Appendix E

Correlations Between Students' Answers to Each Question Using Spearman's Rank-Order Correlation Test

	Q5	Q6	Q 7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26
Q	.177	.071	.001	.173	.152	11	09	.188	01	.136	.120	.222	18	.152	.049	.166	.017	10	04	07	.091	.138
3	*	0.40	0.98		0.07	9	7		4	0.11	0.16		2*	0.07	0.56	0.05	0.84	9	9	1	0.29	0.11
	0.03	8	8	0.04	7	0.16	0.25	0.28	0.87	4	2	0.00	0.03	6	9	3	5	0.20	0.57	0.41	4	0
	46	.060	.120	41	49	397	.454	33	20	16	17	23	.476	42	33	43	.134	.296	.292	.188	15	30
Q_4	0**	0.48	0.16	7**	9**	**	**	33 1**	20 1*	10 4	0*	23 9**	.4/U **	8**	0**	2**	0.11	.290 **	.292 **	*	2	1**
-	< 0.0	9	3	<0.0	<0.0	< 0.0	< 0.0	<0.0	0.01	0.05	0.47	0.00	< 0.0	<0.0	<0.0	<0.0	8	< 0.0	0.00	0.02	0.07	<0.0
	01			01	01	01	01	01	9	5		5	01	01	01	01		01	1	8	7	01
Q		0.04	0.13	0.47	0.43	-	-	0.36	0.12	0.02	0.02	0.24	-	.351	.302	.416	03	25	14	07	.072	.260
5		5	4	7	1	0.29	0.25	8	9	9	8	8	0.44	**	**	**	2	6**	9	3	0.40	0.002
		0.59	0.11	<0.0	<0.0	5	0.00	< 0.0	0.13	0.73	0.74	0.00	3	<0.0	0.00	<0.0	0.70	0.00	0.08	0.39	7	0.002
		8	8	01	01	<0.0 01	3	01	2	6	8	4	<0.0 01	01	1	01	8	3	3	7		
Q			0.3	0	1	.17	.24	1	2	1	1	.02	.10	0	0	1	.06	.20	.34	.37	1	1
6			85	91	17	4*	9**	03	50*	82*	00	9	8	11	10	10	6	3*	6**	7**	67	24
			<0.	0.2	0.1	0.0	0.0	0.2	*	0.0	0.2	0.7	0.2	0.8	0.0	0.2	0.4	0.0	<0.	<0.	0.0	0.1
			00	91	75	42	03	30	0.0	33	46	35	08	97	94	03	45	17	00	00	52	50
			1						03										1	1		
Q				0	1	.24	.20	1	3	2	2	1	.18	1	2	0	.12	.24	.30	.46	2	2
7				05	04	2**	3*	12	30*	91* *	15*	13	9*	25	00*	97	7	4**	8**	2**	49* *	31*
				0.9 50	0.2	0.0	0.0	0.1 93	<0.	0.0	0.0 12	0.1 89	0.0 27	0.1 45	0.0	0.2 59	0.1 38	0.0	<0. 001	<0. 00	0.0	0.0
				30	23	04	1 /	93	00	0.0	12	09	21	43	19	39	30	04	001	1	0.0	0.0
									1	01										1	03	07
Q					.29	2	2	.29	.21	.18	.17	.23	4	.49	.31	.45	.00	2	2	1	.21	.30
8					0**	74*	05*	5**	3*	2*	9*	9**	66*	5**	2**	6**	5	82*	21*	74*	0*	7**
					0.0	*	0.0	<0.	0.0	0.0	0.0	0.0	*	<0.	<0.	<0.	0.9	*	*	0.0	0.0	<0.
					01	0.0	16	00	12	34	36	05	<0.	00	00	00	51	0.0	0.0	43	14	00
						01		1					00	I	I	I		01	09			1
													1									

Q 9			2 50* 0.0 03	2 58* 0.0 02	.47 9** <0. 00 1	.22 9** 0.0 07	.17 6* 0.0 40	.08 2 0.3 43	.25 7** 0.0 02	2 71* 0.0 01	.20 9* 0.0 14	.13 0 0.1 31	.44 7** <0. 00 1	1 00 0.2 47	2 27* * 0.0 08	2 24* 0.0 08	1 69* 0.0 48	.27 3** 0.0 01	.21 8* 0.0 11
Q 1 0				.71 1** <0. 00 1	4 10* <0. 00 1	1 55 0.0 71	1 92* 0.0 24	2 24* 0.0 08	0 52 0.5 50	.30 2** <0. 00 1	2 36* *0. 00 5	2 51* *0. 00 3	4 26* * <0. 00	.10 8 0.2 11	.34 7** <0. 00 1	.31 6** <0. 00 1	.22 6** 0.0 08	1 98* 0.0 21	1 91* 0.0 26
Q 1 1					4 33* <0. 00 1	1 45 0.0 90	1 33 0.1 21	2 67* 0.0 02	.01 7 0.8 43	.41 5** <0. 00 1	1 58 0.0 65	2 70* * 0.0 01	3 59* <0. 00	.17 1* 0.0 46	.30 6** <0. 00 1	.29 8** <0. 00 1	.26 5** 0.0 02	2 09* 0.0 15	1 88* 0.0 29
Q 1 2						.30 4** <0. 00 1	.20 5* 0.0 16	.21 6* 0.0 11	.22 5** 0.0 08	4 46* * <0. 00 1	.25 9** 0.0 02	.33 1** <0. 00 1	.46 5** <0. 00 1	1 23 0.1 51	3 49* <0. 00 1	3 13* <0. 00 1	3 27* * <0. 00 1	.30 6** <0. 00 1	.23 8** 0.0 05
Q 1 3							.51 3** <0. 00 1	.35 1** <0. 00 1	.22 1** 0.0 09	2 90* * 0.0 01	.18 5* 0.0 31	.14 1 0.0 99	.09 9 0.2 48	1 52 0.0 75	3 60* * <0. 00	3 68* 0.0 01	3 95* * <0. 00 1	.37 8** <0. 00 1	.37 7** <0. 00 1
Q 1 4								.51 0** <0. 00 1	.26 9** 0.0 01	1 88* 0.0 28	.15 8 0.0 66	.09 9 0.2 49	.10 8 0.2 11	1 91* 0.0 25	2 86* 0.0 01	1 43 0.0 96	2 58* 0.0 02	.28 5** 0.0 01	.26 8** 0.0 02
Q 1 5									.23 8**	3 04*	.18 5*	.17 2*	.20 8*	1 80*	3 17*	0 77	2 66*	.23 6**	.17 1*

						0.0 05	<0. 00	0.0	0.0	0.0	0.0 35	<0. 00	0.3 72	0.0 02	0.0	0.0 47
Q 1							31 9**	.335	.275	.189	03 3	31 5**	18 6*	21 9*	.381	.374
6							<0.0 01	<0.0	0.00	0.02	0.70 0	<0.0	0.03	0.01	<0.0	<0.0 01
Q 1								47 9**	47 5**	36 5**	.258	.489 **<0	.396	.415	27 7**	39 1**
7								< 0.0	< 0.0	< 0.0	0.00	.001	<0.0	<0.0	< 0.0	< 0.0
Q								01	.571	.347	07	37	17	26	.214	.283
1									**	**	4	7**	3*	0**	*	**
8									<0.0 01	0.00	0.38 9	<0.0 01	0.04	0.00	0.01	0.00
Q 1										.477 **	13 50.1	40 3**	25 4**	41 5**	.265	.204
9										<0.0	15	< 0.0	0.00	< 0.0	0.00	0.01
Q										01	08	26	316	23	.265	.289
2 0											6 0.31	3** 0.00	9* 0.04	7** 0.00	0.00	0.00
											8	2	8	5	2	1
Q 2												.360	.371	.226	02 2	02 0
1												<0.0	<0.0	0.00	0.79 6	0.81
Q												01	.525	.463	35	37
2 2													<	**<0 .001	3** <0.0	1** <0.0
													0.00		01	01
Q													1	.598	27	28
2 3														** <0.0	7** 0.00	6** 0.00
3														0.0	1	1

Q 2 4										39 4** <0.0 01	37 2** <0.0 01
Q 2 5											.537 *** <0.0 01

Note. Correlations between students' answers to each question using the Spearman's Rank-Order Correlation test.