Supplemental Material

CBE—Life Sciences Education

Wilton *et al.*

MCDB 1A - Belongingness Survey - F17

Start of Block: Section 1

1 This survey contains 8 sections and takes about 9 minutes to complete. Most of the statements in these sections focus on how you feel about your experiences as a student in **MCDB 1A lecture** at UCSB. The goal of the survey is to improve MCDB 1A by identifying areas of the course that are helpful, and parts of the course that can be improved. **Your honest feedback is greatly appreciated!** Your answers will not be graded in any way. You will receive **bonus course credit** for MCDB1AL for completing this survey. Although some of the statements may seem similar, there are differences between them and you should treat each one as a separate statement; *therefore, the best approach is to answer each question* fairly *quickly.* That is, for each statement just choose the response that is a reasonable estimate of how you feel about that statement honestly.

*

4 UCSB Perm# (UCSB digit ID number - Example: 112233445)

_____

*

Q34 UCSB Perm# (UCSB digit ID number - Example: 112233445)

_____

7 Which section of MCDB1A lecture are you currently enrolled in?

O Section 100 (Christoffersen - Feinstein - Clegg) @ Campbell Hall (1)

O Section 200 (Wilton - Gonzalez) @ Buchanan Hall (2)

O NA (3)

9 From the list, please select ALL the activities in which you have participated (MARK ALL THAT APPLY)

Biomentors (as Mentee) (1)

Research at a UCSB Lab (2)

Research at another institution (3)

L&S Health Honors program (4)

CLAS for MCDB 1A lecture (5)

13 Your data is confidential and will not be shared in connection with your name or your perm number. The goal of this survey is to improve MCDB1A by analyzing the results in aggregate (not individual responses).

However, if you would still like to opt-out of your responses being analyzed to improve this course, please click below.

(1)

Page Break

End of Block: Section 1

Start of Block: Section 2.1

Q39

Think about your experience with the lecture portion of MCDB 1A **Section 100 or 200**. Please indicate how true each statement is for you.

Rate the following items in terms of how true each one is for you, using this scale:

1-not at all true of me
2-somewhat true of me
3-more true than not of me
4-mostly true of me
5-completely true of me

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)
If I miss a MCDB1A class, I know students who I could get the notes from (1)	O	O	O	O	O
I discuss events which happen outside of class with my classmates (2)	O	O	O	O	O
I have developed personal relationships with other students in MCDB1A (3)	O	O	O	O	O
I feel comfortable volunteering ideas or opinions in MCDB1A (4)	O	O	O	O	O
I feel comfortable asking a question in MCDB1A lecture (5)	O	O	O	O	O

No one in MCDB1A knows anything personal about me (6)	O	O	O	O	O
I rarely talk to other students in MCDB1A (7)	O	O	O	O	O
I feel comfortable seeking help from my MCDB1A professors before or after class (8)	O	O	O	O	O
I feel comfortable asking my MCDB1A professor for help if I do not understand course-related material (9)	O	O	O	O	O
I feel comfortable asking my MCDB1A professor for help with a personal problem (10)	O	O	O	O	O
I feel that my MCDB1A professor would take the time to talk to me if I needed help (11)	O	O	O	O	O

I feel that my MCDB1A professor would be sensitive to my difficulties if I shared them (12)	O	O	O	O	O
I feel that I belong in this section of MCDB1A (13)	O	O	O	O	O

End of Block: Section 2.1

Start of Block: Section 2.2

Q16 During the **MCDB 1A lecture**, how many times have you gone to the professors' office hours? (ONDAS office hours, regularly scheduled office hours, appointments outside of office hours)

- O 0 times (1)
- O 1-2 times (2)
- O 2-4 times (3)
- O 5-10 times (4)
- O 11+ times (5)

Page Break

End of Block: Section 2.2

Start of Block: Section 3

Q41

Respond to the statements regarding the MCDB1A lecture using the scale outlined below.

Rate the following items in terms of how true each one is for you, using this scale:

1-not at all true of me
2-somewhat true of me
3-more true than not of me
4-mostly true of me
5-completely true of me

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)
When something bad happens, I feel that maybe I don't belong at UCSB (1)	O	O	O	O	O
I always feel that I belong at UCSB (2)	O	O	O	O	O
In MCDB1A, I sometimes worry that people will dislike me (3)	O	O	O	O	O
In MCDB1A, I worry that people will think I'm unintelligent if I do poorly (4)	O	O	O	O	O
I am usually confident that others will have a good impression of my ability in MCDB1A (5)	O	O	O	O	O
In MCDB1A, I often get nervous and worried when I talk to	O	O	O	O	O

people (6)

Page Break

End of Block: Section 3

Start of Block: Section 4

Q19 Respond to the statements for the MCDB1A lecture using the scale outlined below.

Rate the following items in terms of how true each one is for you, using this scale:

1-not at all true of me
2-somewhat true of me
3-more true than not of me
4-mostly true of me
5-completely true of me

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)
I believe that MCDB1A has prepared me to do well in my major (1)	O	O	O	O	O
I think that MCDB1A prepared me to earn a fair grade for the course (2)	O	O	O	O	O
I'm really looking forward to learning more about Biology (3)	O	O	O	O	O
Biology fascinates me (4)	O	O	O	O	O
I think the field of Biology is very interesting (5)	O	O	O	O	O
To be honest, I just don't find biology interesting (6)	O	O	O	O	O

End of Block: Section 4

Start of Block: Section 5

Q29 Respond to the statements using the scale outlined below for the **lecture section of MCDB1A**.

Rate the following items in terms of how true each one is for you, using this scale:

1-not at all true of me
2-somewhat true of me
3-more true than not of me
4-mostly true of me
5-completely true of me

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)
I think what we are learning in MCDB1A is important (1)	O	O	O	O	O
The material we are studying in MCDB1A is useful to know (2)	O	O	O	O	O
I enjoy coming to MCDB 1A lectures (3)	O	O	O	O	O
MCDB 1A lectures promote in-class collaboration with my peers (4)	O	O	O	O	O
MCDB 1A lecture provides opportunities to self-check my knowledge before the final exam (5)	O	O	O	O	O
In MCDB 1A lecture, I feel like I'm part of	O	O	O	O	O

a community
of biology
students (6)

Page Break

End of Block: Section 5

Start of Block: Section 6

Q43
Please indicate how much you agree with the following statements
1-strongly disagree
2-disagree
3-neither disagree or agree
4-agree
5-strongly agree

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)
You have a certain amount of intelligence, and you really can't do much to change it. (1)	O	O	O	O	O
Your intelligence is something about you that you can't change very much. (2)	O	O	O	O	O
You can learn new things, but you can't really change your basic intelligence. (3)	O	O	O	O	O
I feel encouraged by my MCDB 1A professor to learn how to succeed in the major (4)	O	O	O	O	O
My MCDB 1A professors are interested in my professional development as a scientist (5)	O	O	O	O	O

MCDB 1A is teaching me how to study for my subsequent biology courses (6)	O	O	O	O	O
MCDB 1A has helped me identify how I learn (7)	O	O	O	O	O

Page Break

End of Block: Section 6

Start of Block: Section 7

Q45 Respond to the statements using the scale outlined below.

For the following questions, we want to understand how you spent your time this quarter About how many hours do you spend in a typical 7-day week doing each of the following this quarter?
Scale: 0=0 hours per week; 1=1-5; 2=6-10; 3=11-15; 4=16-20; 5=21-25; 6=26-20; 7=31+

	0 (1)	1 (2)	2 (3)	3 (4)	4 (5)	5 (6)	6 (7)	7 (8)
Preparing for classes (studying, reading, writing, homework, lab work, etc (1)	O	O	O	O	O	O	O	O
Working for pay on campus (2)	O	O	O	O	O	O	O	O
Working for pay off campus (3)	O	O	O	O	O	O	O	O
Participating in co-curricular activities (organizations, campus publications, student government, fraternity or sorority, intercollegiate or intramural sports, etc.) (4)	O	O	O	O	O	O	O	O
Relaxing and socializing (5)	O	O	O	O	O	O	O	O
Providing care for dependents living with you (parents, children, spouse, etc.) (6)	O	O	O	O	O	O	O	O

Commuting to class (driving, walking, etc.) (7)	O	O	O	O	O	O	O	O

Q32 Please indicate how often you did the following activities this quarter. Consider all of your classes and activities, not just those for this course.

Scale:
0=Never, 1=Once a month, 2=Twice a month, 3=Every week

	0 (1)	1 (2)	2 (3)	3 (4)
Talk with a MCDB1A professor about academic matters, outside of class time (including e-mail) (1)	O	O	O	O
Meet with an academic advisor concerning academic plans (2)	O	O	O	O
Meet with a student mentor concerning academic plans (Cheadle Hall, peer mentor, etc.) (3)	O	O	O	O
Attend study groups outside of the classroom (4)	O	O	O	O
Have informal or social contacts with faculty members outside of classrooms and offices (5)	O	O	O	O

Page Break

End of Block: Section 7

Start of Block: Section 8

Q36 Have your experiences in **MCDB1A lecture** made you more sure or less sure of your major?

- O More Sure (1)
- O Less Sure (2)
- O No effect (3)

Q37 Please explain how this quarter has made you more sure or less sure

_____

Q38 Are you thinking of changing your major?

- O Yes (1)
- O No (2)

Q39 How likely are you to change majors within the next year?

- O Extremely likely (1)
- O Somewhat likely (2)
- O Neither likely nor unlikely (3)
- O Somewhat unlikely (4)
- O Extremely unlikely (5)

Q32 If you are thinking about changing majors, which major or majors are you considering switching to?

_____

Q33 If you are thinking about changing majors, what are the main reasons you would make the switch?

_____

Page Break

End of Block: Section 8

Output from Survey Data

Summary

Available scales

- Sense of belonging (α = 0.85)
    - Peer relationships subscale (α = 0.85)
    - Faculty relationships (α = 0.85)
    - Classroom comfort (α = 0.76)
- Interest in Biology (α = 0.90)
- Perceived utility of Biology (α = 0.90)
- Academic integration (individual items)
- Academic and social concerns (α = 0.67)
- Belonging uncertainty (α = 0.77)
- Growth mindset (α = 0.92)
- Course satisfaction (individual items)

Hypothesis testing

1. When limited to only Biology majors, **sense of belonging is greater** among students in the High Structure lecture section. This is also true for the following subscales of belonging:
    a. Peer relationships
    b. Faculty relationships
    c. Classroom comfort
2. These findings regarding sense of belonging are also significant when including all non-Bio majors
3. Students in the High Structure lecture section **did not have greater interest** in the subject of Biology
4. Students in the High Structure lecture section **did not have greater perceived utility** in the subject of Biology
5. When limited to Biology majors, **sense of belonging is greater** among students in the High Structure lecture section for minority groups
    a. EOP students
    b. URM students
        i. Although EOP and URM students both have higher belonging in the High Structure section, the difference is not more pronounced than the effect of being in the High Structure section for non-EOP and non-URM students

Scales & Alphas

Sense of belonging (with subscales)

Scale Name	Alpha (Items)	Items
Sense of Belonging	α = 0.85 (12 items)	All items in subscales below
Perceived peer support	α = 0.85 (5 items)	"I know students I could get notes from in MCDB1A" "I discuss outside events with classmates" "I have relationships with students in MCDB1A" "No one in MCDB1A knows me well personally" (reverse coded) "I rarely talk to others in MCDB1A" (reverse coded)
Perceived faculty support	α = 0.85 (5 items)	"I can seek help from MCDB1A profs before/after class" "I'm comfortable asking MCDB1A prof for help with course material" "I'm comfortable asking MCDB1A prof for help with a personal problem" "My MCDB1A prof would take time for me if I needed help" "My MCDB1A prof would be sensitive to my difficulties"
Perceived classroom comfort	α = 0.76 (2 items)	"I feel comfortable volunteering ideas in MCDB1A" "I'm comfortable asking a question in MCDB1A"
Response scale for all items: 1. Not at all true of me 2. Somewhat true of me 3. More true than not true of me 4. Mostly true of me 5. Completely true of me		

Note. Factor analysis produced a factor structure consistent with Tovar and Simon's (2010) most recent factor analysis of Hoffman et al.'s Sense of Belonging Scale (SOBS) (2003).

Interest in Biology

Items

1. "I'm looking forward to learning more about Biology"
2. "Biology fascinates me"
3. "The field of Biology is very interesting"
4. "I just don't find Biology that interesting" (reverse coded)

Response scale for all items:

1. Not at all true of me
2. Somewhat true of me
3. More true than not true of me
4. Mostly true of me
5. Completely true of me

Alpha: $\alpha = 0.90$

Perceived utility of Biology

Items

1. "MCDB1A material is important"
2. "MCDB1A material is useful"

Response scale for all items:

1. Not at all true of me
2. Somewhat true of me
3. More true than not true of me
4. Mostly true of me
5. Completely true of me

Alpha: $\alpha = 0.90$

Academic integration

Items

1. "Frequency talking with MCDB1A prof about academics outside class"
2. "Frequency meeting with academic advisor"
3. "Frequency meeting with a student mentor"
4. "Frequency attending study groups outside class"
5. "Frequency talking with faculty socially outside class"

Response scale for all items:

1. Never
2. Once a month
3. Twice a month
4. Every week

Alpha: None of these items are highly correlated. No combination of items produces a scale with an alpha higher than 0.55 (which indicates they are not measuring a common, higher-order construct). My subsequent recommendation is to only use single items of greatest interest in future analyses.

Academic and social concerns

Items

1. "Sometimes I worry people in MCDB1A will dislike me"
2. "I worry people in MCDB1A will think I'm unintelligent if I do poorly"
3. "I'm usually confident others in MCDB1A have good impression of my ability" (reverse coded)
4. "I often get worried when I talk to people in MCDB1A"

Response scale for all items:

1. Not at all true of me
2. Somewhat true of me
3. More true than not true of me
4. Mostly true of me
5. Completely true of me

Note. This response scale means that higher scores indicate *more* concerns/worry

Alpha: $\alpha = 0.67$ (this is not great, but acceptable)

Belonging uncertainty

Items

1. "Sometimes Ifeel I don't belong at UCSB when bad things happen"
2. "I always feel I belong at UCSB" (reverse coded)

Response scale for all items:

1. Not at all true of me
2. Somewhat true of me
3. More true than not true of me
4. Mostly true of me
5. Completely true of me

Note. This response scale means that higher scores indicate *more* belonging uncertainty

Alpha: $\alpha = 0.77$

Growth mindset

Items

1. "You have a certain amount of intelligence, and that can't be changed"
2. "Intelligence can't be changed very much"
3. "You can learn new things, but you can't change your basic intelligence"

Response scale for all items:

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly Agree

Note. This response scale means that *lower* scores indicate a growth mindset

Alpha: $\alpha = 0.92$ (This is very reliable. It is easy to see why. All items sound the same)

Course satisfaction

I can look at the following items individually if you'd like. I'd look at them individually because they are on various topics and likely wouldn't create good scales.

My impression is that these are the items you guys added because these questions capture your hypotheses about exactly what your section is better-suited to accomplish. They are not validated scales, like the ones above, but if these items better capture your hypothesized mechanisms for the impact of the course, then I would encourage you to take a look at these.

Items:

1. "MCDB1A prepared me to do well in my major"
2. "MCDB1A prepared me to earn fair grade for the course"
3. "I enjoy coming to MCDB1A lectures"
4. "MCDB1A lectures promote in-class peer collaboration"
5. "The MCDB1A lecture gives me help before final"
6. "I feel like a part of a Biology community in MCDB1A"
7. "I feel encouraged by my MCDB1A instructors to learn to succeed in major"
8. "My MCDB1A professors are interested in my professional development as a scientist"
9. "MCDB1A is teaching me how to study for future courses"
10. "MCDB1A helped me identify how I learn"

Hypothesis Testing

Note. All analyses below are limited to students who are Biology majors

	Large Lecture	Highly Structured
Non-Bio Majors	237	12
Bio Majors	162	171

Hypothesis 1: Students in the high structure lecture will have greater sense of belonging (to their MCDB 1A course) at the end of the course.

Figure 1. Distribution of Sense of Belonging (Full scale) by Section

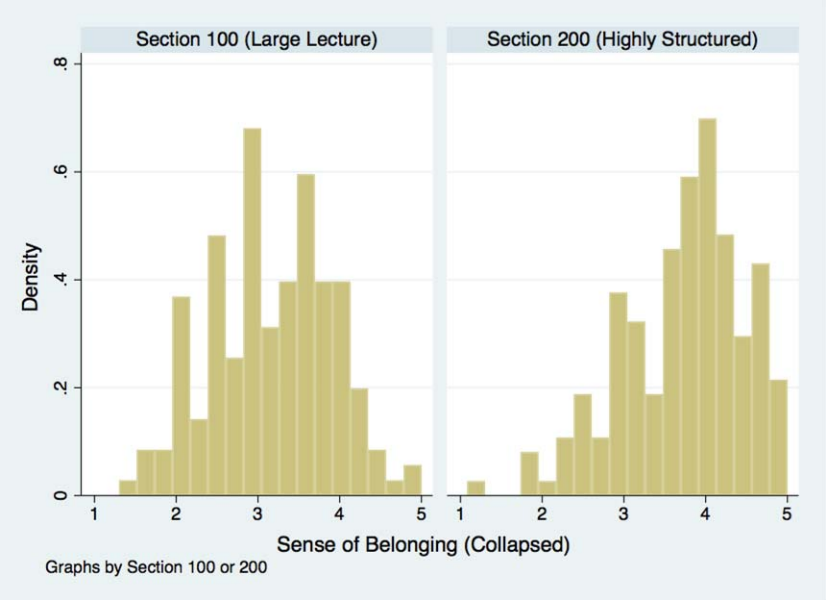


Table 1. t-test of Mean Difference – Sense of Belonging (Full scale) by Section

```
Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
 Section1|     162    3.158483    .0565815    .7201646    3.046745    3.270221
 Section2|     171    3.720273    .0573607    .7500882    3.607042    3.833504
---------+--------------------------------------------------------------------
combined |     333     3.44697    .0431035     .786565    3.362179     3.53176
---------+--------------------------------------------------------------------
    diff |           -.5617899    .0806601                -.720461   -.4031189
------------------------------------------------------------------------------
    diff = mean(Section) - mean(Section)                          t =  -6.9649
Ho: diff = 0                                     degrees of freedom =      331

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

Conclusion: Students in Section 200 have a significantly higher sense of belonging ($p<0.001$)

Table 1r. Regression of Sense of Belonging (Full scale and subscales) on Section, EOP status, and URM status (standardized)

Predicting Sense of Belonging and its Subcomponents by Section, EOP Status, and URM Status

	Sense of belonging (all)			Perceived Peer Support			Perceived Faculty Support			Classroom Comfort		
	model 1	model 2	model 3	model 1	model 2	model 3	model 1	model 2	model 3	model 1	model 2	model 3
High structured section	**0.33*** **	**0.36*** **	**0.30*** **	0.09	0.00	0.03	**0.40*** **	**0.46*** **	**0.36*** **	**0.27*** **	**0.27***	**0.31*** **
	(0.06)	(0.13)	(0.08)	(0.12)	(0.24)	(0.14)	(0.10)	(0.20)	(0.12)	(0.13)	(0.25)	(0.15)
Interactions												
Section x Race												
High structured section		-0.02			0.02			0.02			-0.05	
x Asian (vs. URM)		(0.16)			(0.31)			(0.26)			(0.32)	
High structured section		-0.04			0.15			-0.13			0.04	
x White (vs. URM)		(0.16)			(0.30)			(0.25)			(0.32)	
Section x Income												
High structured section			-0.07			-0.15			-0.10			0.09
x EOP status			(0.13)			(0.25)			(0.21)			(0.26)
Covariates												
Race												
Asian (vs. URM)	-0.03	-0.02	-0.03	-0.02	-0.04	-0.04	0.01	0.00	0.00	-0.13	-0.10	-0.12
	(0.09)	(0.12)	(0.09)	(0.16)	(0.22)	(0.16)	(0.13)	(0.19)	(0.14)	(0.17)	(0.24)	(0.17)
White (vs. URM)	-0.03	0.00	-0.03	-0.06	-0.16	-0.08	0.02	0.10	0.01	-0.06	-0.08	-0.05
	(0.09)	(0.12)	(0.09)	(0.16)	(0.23)	(0.16)	(0.14)	(0.19)	(0.14)	(0.17)	(0.24)	(0.17)
Income												
EOP Status	-0.05	-0.05	-0.01	-0.08	-0.09	0.01	-0.03	-0.03	0.03	0.02	0.02	-0.04
	(0.08)	(0.08)	(0.10)	(0.15)	(0.15)	(0.19)	(0.12)	(0.12)	(0.16)	(0.15)	(0.15)	(0.20)
Gender												
Female	-0.06	-0.05	-0.05	**0.14***	**0.14***	**0.15***	-0.08	-0.07	-0.07	**-0.14***	**-0.14** **	**-0.14** **
	(0.07)	(0.07)	(0.07)	(0.13)	(0.13)	(0.13)	(0.11)	(0.11)	(0.11)	(0.13)	(0.13)	(0.13)
N	317	317	317	317	317	317	317	317	317	317	317	317

Note. All sense of belonging variables on a scale from (1) low ... (5) high. All coefficients are in standard deviation units. Model 1 estimates main effect of section controlling for covariates. Model 2 includes an estimate of the interaction between section and race. Model 3 includes an estimate of the interaction. Reference category for high structured section is traditional large lecture. Reference category for race is URM, which includes Black and Hispanic students. Reference category for EOP status is non-EOP students. Reference category for female is male. status is non-EOP students. Reference category for female is male. All models additionally control for prior achievement (SAT scores and cumulative GPA in science). Standard errors in parentheses. *p<.05, **p<.01, ***p<.001

Conclusion. For this question, we look at model 1. After controlling for gender, ethnicity, and achievement (SAT scores and cumulative science GPA), Model 1 shows that being in the High Structure section is associated with a 0.33standard deviationincrease in sense of belonging.This effect seems to be driven by a significant effect on perceived faculty support and classroom comfort, while not affecting perceived peer support.

Figure 1a. Distribution of Sense of Belonging (Peer Relationshipssubscale) by Section

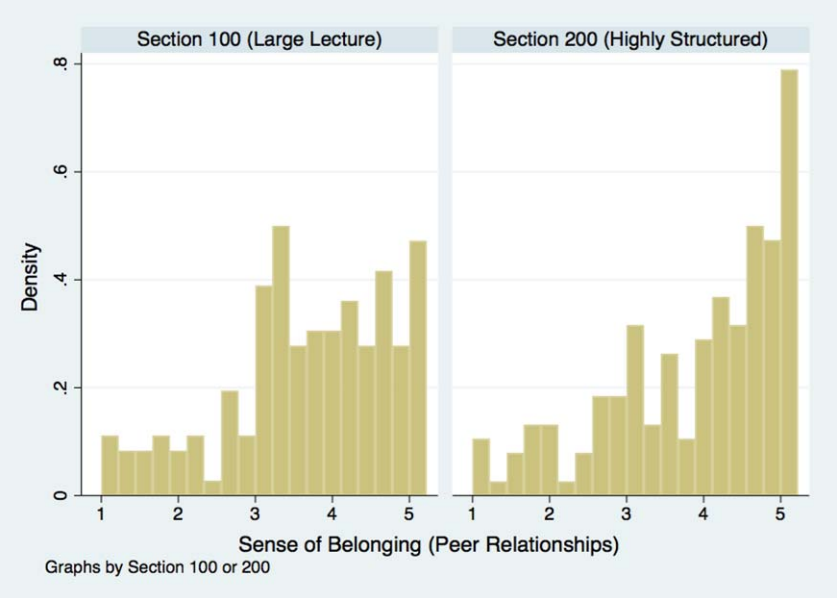


Table 1a. Equality of MediansTest– Sense of Belonging (Peer Relationshipssubscale) by Section

```
Median test

   Greater |
  than the |
median? | Section 1  Section 2 |     Total
-----------+----------------------+----------
        no |        97         78 |       175
       yes |        65         93 |       158
-----------+----------------------+----------
     Total |       162        171 |       333

          Pearson chi2(1) =   6.7866   Pr = 0.009

   Continuity corrected:
          Pearson chi2(1) =   6.2267   Pr = 0.013
```

Conclusion: Students in Section 200 have significantly stronger peer relationships ($p<0.01$)

Note. A t-test could not be run because it relies on the assumption that the data are Normally distributed. When this is not the case, I use a non-parametric test "equality of medians" test due to the non-Normality of the distributions. I will also use these for the other subscales. This test operates by finding the median of the distribution when the groups are *combined*. It then uses a Chi-squared test to see if cases in the two groups disproportionately fall on one side of the distribution. In the example above, more section 2 students fall above the median than below it, whereas the opposite is true for section 1 students. This suggests the groups are significantly different from each other.

Figure 1b. Distribution of Sense of Belonging (Faculty Relationshipssubscale) by Section

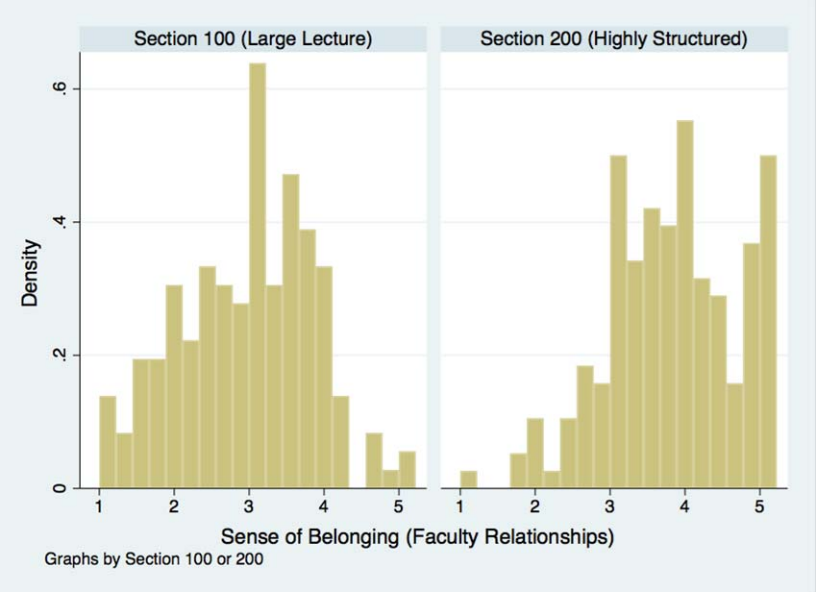


Table 1b. Equality of MediansTest– Sense of Belonging (Faculty Relationshipssubscale) by Section

```
Median test

   Greater |
  than the |  Section 100 or 200
median? | Section 1  Section 2 |     Total
-----------+----------------------+----------
        no |       125         73 |       198
       yes |        37         98 |       135
-----------+----------------------+----------
     Total |       162        171 |       333

          Pearson chi2(1) =  41.0062   Pr = 0.000

   Continuity corrected:
          Pearson chi2(1) =  39.5887   Pr = 0.000
```

Conclusion: Students in Section 200 have significantly stronger faculty relationships ($p<0.01$)

Figure 1c. Distribution of Sense of Belonging (Classroom comfortsubscale) by Section

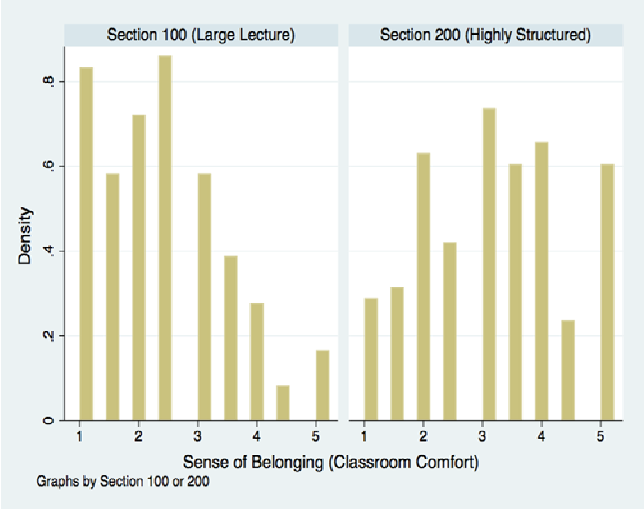


Table 1c. Equality of MediansTest– Sense of Belonging (Faculty Relationshipssubscale) by Section

Median test

Greater than the median?	Section 100 or 200 Section 1	Section 2	Total
no	108	**63**	171
yes	54	**108**	162
Total	162	171	333

Pearson chi2(1) = 29.6205 Pr = **0.000**

Continuity corrected:
Pearson chi2(1) = 28.4387 Pr = 0.000

Conclusion: Students in Section 200 perceive significantly greater classroom comfort (p<0.001)

*Note.*Hypothesis 2 incorporates all students regardless of major.

	Large Lecture	Highly Structured
Non-Bio Majors	237	12
Bio Majors	162	171
Total	399	183

Hypothesis 2: Students in the high structure lecture (all students) will have greater sense of belonging (to their MCDB 1A course) at the end of the course.

Figure 2. Distribution of Sense of Belonging (Full scale) by Section

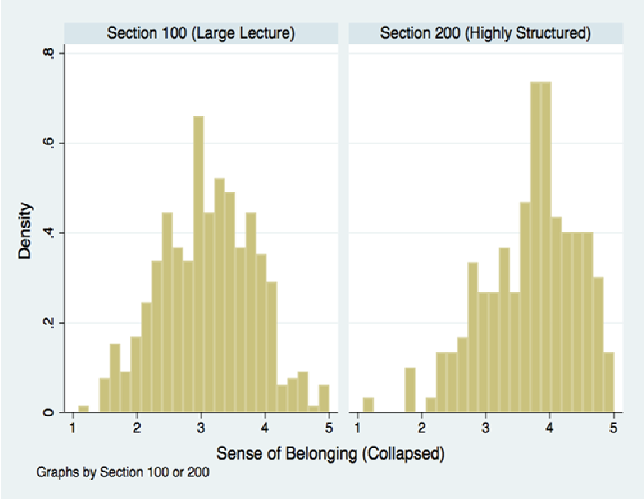


Table 2. t-test of Mean Difference – Sense of Belonging (Full scale) by Section

```
Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
 Section |     399    3.101561    .0373396    .7458577    3.028153    3.174968
 Section |     183    3.713115    .0548311     .741742    3.604928    3.821301
---------+--------------------------------------------------------------------
combined |     582    3.293853    .0330102    .7963592     3.22902    3.358687
---------+--------------------------------------------------------------------
    diff |            -.611554    .0664744               -.7421139   -.4809942
------------------------------------------------------------------------------
    diff = mean(Section) - mean(Section)                          t =  -9.1998
Ho: diff = 0                                     degrees of freedom =      580

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000Pr(T > t) = 1.0000
```

Conclusion: Students in Section 200 have a significantly higher sense of belonging ($p<0.001$)

Note. In section 1, the Bio majors don't have significantly different sense of belonging when compared to non-Bio majors. Therefore, the results from hypothesis 1 should also be significant among all majors.

Hypothesis 3: Students in the high structure lecture (all students) will have greater interest in the subject of Biology at the end of the course.

Figure 3. Distribution of Interest in Biology by Section

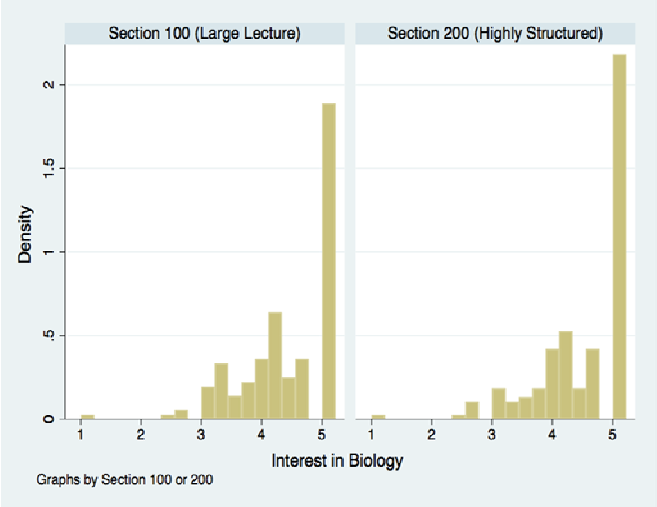


Table 3. Equality of MediansTest– Interest in Biology by Section

```
Median test

   Greater |
  than the |  Section 100 or 200
    median | Section 1  Section 2 |     Total
-----------+----------------------+----------
        no |        94         88 |       182
       yes |        68         83 |       151
-----------+----------------------+----------
     Total |       162        171 |       333

          Pearson chi2(1) =   1.4457   Pr = 0.229

   Continuity corrected:
          Pearson chi2(1) =   1.1930   Pr = 0.275
```

Conclusion: Students in Section 200 do not have a significantly differentinterest in Biology (p>0.05)

Hypothesis 4: Students in the high structure lecture (all students) will have greater perceived utility in the subject of Biology at the end of the course.

Figure 4. Distribution of Perceived Utility in Biology by Section

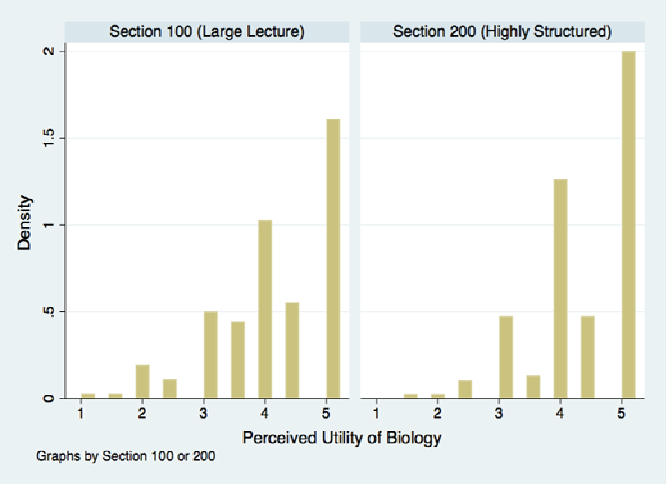


Table 3. Equality of MediansTest– Perceived Utility in Biology by Section

Median test

Greater than the median	Section 100 or 200 Section 1	Section 2	Total
no	104	**95**	199
yes	58	**76**	134
Total	162	171	333

Pearson chi2(1) = 2.5836 **Pr = 0.108**

Continuity corrected:
Pearson chi2(1) = 2.2367 Pr = 0.135

Conclusion: Students in Section 200 do not have a significantly different perceived utility value in Biology (p>0.05)

Hypothesis 5a:**EOPstudents** in the high structure lecture will have greater sense of belonging (to their MCDB 1A course) than EOP students in the large lectureat the end of the course.

Figure 5a. Distribution of Sense of Belonging (Full scale) by Section (EOP only)

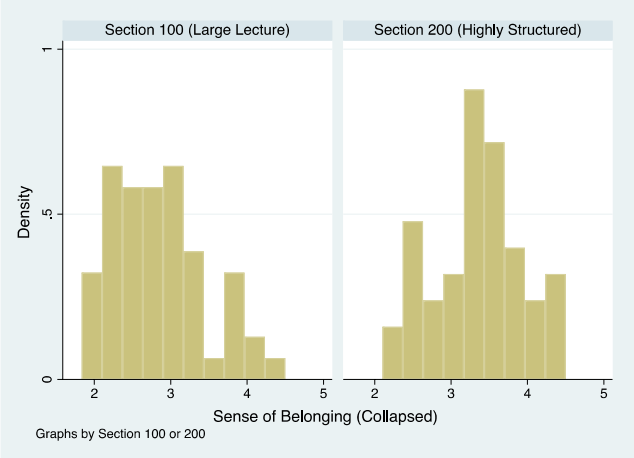


Table 5a. t-test of Mean Difference – Sense of Belonging (Full scale) by Section (EOP only)

```
Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
 Section1|      58    2.833333    .0799368    .6087808    2.673263    2.993404
 Section2|      47    3.347518    .0855517    .5865129    3.175311    3.519724
---------+--------------------------------------------------------------------
combined |     105    3.063492    .0633416    .6490587    2.937883    3.189101
---------+--------------------------------------------------------------------
    diff |           -.5141844    .1175476               -.7473123   -.2810565
------------------------------------------------------------------------------
    diff = mean(Section) - mean(Section)                          t =  -4.3743
Ho: diff = 0                                     degrees of freedom =      103

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

Conclusion: **EOP** students in Section 200 have a significantly higher sense of belonging (full scale)($p<0.001$) than EOP students in Section 100.

Figure 5ai. Distribution of Sense of Belonging (Peer Support subscale) by Section (EOP only)

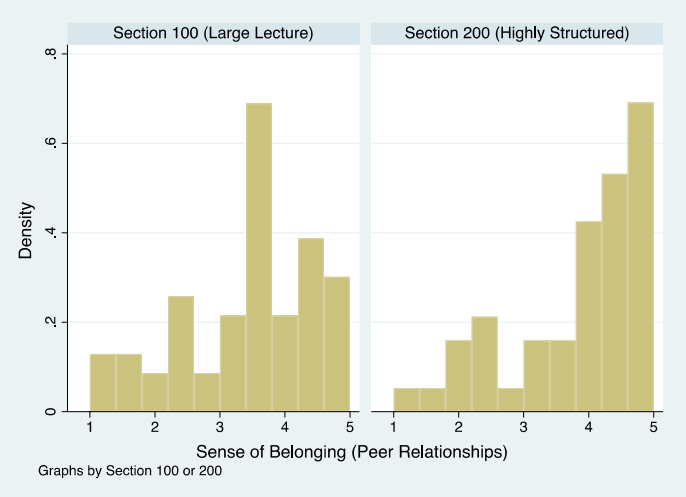


Table 5ai. Equality of MediansTest– Sense of Belonging (<u>Peer Support subscale</u>) by Section (EOP only)

Median test

Greater than the median	Section 100 or 200: Section 1	Section 2	Total
no	37	**16**	53
yes	21	**31**	52
Total	58	47	105

Pearson chi2(1) = 9.1923 **Pr = 0.002**

Continuity corrected:
Pearson chi2(1) = 8.0407 Pr = 0.005

Conclusion: **EOP** students in Section 200 have significantly <u>perceived peer support</u> ($p<0.01$) than EOP students in Section 100.

Figure 5aii. Distribution of Sense of Belonging (Faculty Support subscale) by Section (EOP only)

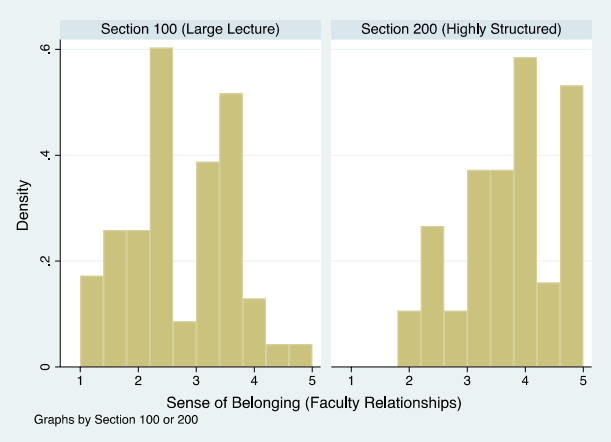


Table 5aii. Equality of MediansTest– Sense of Belonging (Faculty Support subscale) by Section (EOP only)

```
Median test

   Greater |
  than the |  Section 100 or 200
    median | Section 1  Section 2 |     Total
-----------+----------------------+----------
        no |        41         16 |        57
       yes |        17         31 |        48
-----------+----------------------+----------
     Total |        58         47 |       105

          Pearson chi2(1) =  14.0501   Pr = 0.000

   Continuity corrected:
          Pearson chi2(1) =  12.6121   Pr = 0.000
```

Conclusion: **EOP** students in Section 200 have a significantly higher perceived faculty support($p<0.001$) than EOP students in Section 100.

Figure 5aiii. Distribution of Sense of Belonging (Classroom Comfort subscale) by Section (EOP only)

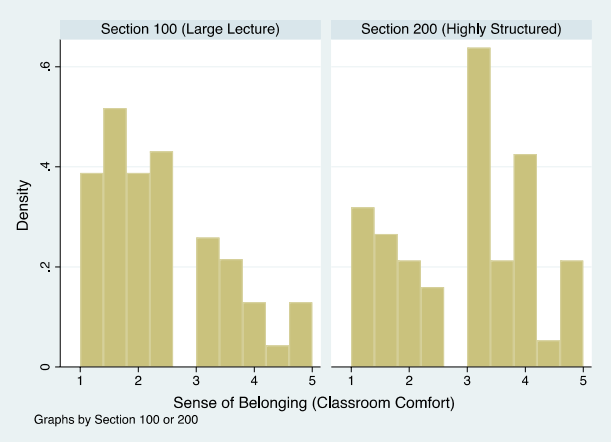


Table 5aiii. Equality of MediansTest– Sense of Belonging (Classroom Comfort subscale) by Section (EOP only)

Greater than the median	Section 100 or 200: Section 1	Section 2	Total
no	40	**18**	58
yes	18	**29**	47
Total	58	47	105

Pearson chi2(1) = 9.8753 **Pr = 0.002**

Continuity corrected:
Pearson chi2(1) = 8.6739 Pr = 0.003

Conclusion: **EOP** students in Section 200 have a significantly higher perceived classroom comfort($p<0.01$) than EOP students in Section 100.

Table 5ar. Regression of Sense of Belonging (Full scale and subscales) on Section, EOP status, and URM status (standardized)

Predicting Sense of Belonging and its Subcomponents by Section, EOP Status, and URM Status

	Sense of belonging (all)			Perceived Peer Support			Perceived Faculty Support			Classroom Comfort		
	model 1	model 2	model 3	model 1	model 2	model 3	model 1	model 2	model 3	model 1	model 2	model 3
High structured section	**0.33*** **	**0.36*** **	**0.30*** **	0.09	0.00	0.03	**0.40*** **	**0.46*** **	**0.36*** **	**0.27*** **	**0.27***	**0.31*** **
	(0.06)	(0.13)	(0.08)	(0.12)	(0.24)	(0.14)	(0.10)	(0.20)	(0.12)	(0.13)	(0.25)	(0.15)
Interactions												
Section x Race												
High structured section		-0.02			0.02			0.02			-0.05	
x Asian (vs. URM)		(0.16)			(0.31)			(0.26)			(0.32)	
High structured section		-0.04			0.15			-0.13			0.04	
x White (vs. URM)		(0.16)			(0.30)			(0.25)			(0.32)	
Section x Income												
High structured section			-0.07			-0.15			-0.10			0.09
x EOP status			(0.13)			(0.25)			(0.21)			(0.26)
Covariates												
Race												
Asian (vs. URM)	-0.03	-0.02	-0.03	-0.02	-0.04	-0.04	0.01	0.00	0.00	-0.13	-0.10	-0.12
	(0.09)	(0.12)	(0.09)	(0.16)	(0.22)	(0.16)	(0.13)	(0.19)	(0.14)	(0.17)	(0.24)	(0.17)
White (vs. URM)	-0.03	0.00	-0.03	-0.06	-0.16	-0.08	0.02	0.10	0.01	-0.06	-0.08	-0.05
	(0.09)	(0.12)	(0.09)	(0.16)	(0.23)	(0.16)	(0.14)	(0.19)	(0.14)	(0.17)	(0.24)	(0.17)
Income												
EOP Status	-0.05	-0.05	-0.01	-0.08	-0.09	0.01	-0.03	-0.03	0.03	0.02	0.02	-0.04
	(0.08)	(0.08)	(0.10)	(0.15)	(0.15)	(0.19)	(0.12)	(0.12)	(0.16)	(0.15)	(0.15)	(0.20)
Gender												
Female	-0.06	-0.05	-0.05	**0.14***	**0.14***	**0.15***	-0.08	-0.07	-0.07	**-0.14***	**-0.14****	**-0.14****
	(0.07)	(0.07)	(0.07)	(0.13)	(0.13)	(0.13)	(0.11)	(0.11)	(0.11)	(0.13)	(0.13)	(0.13)
N	317	317	317	317	317	317	317	317	317	317	317	317

Note. All sense of belonging variables on a scale from (1) low ... (5) high. All coefficients are in standard deviation units. Model 1 estimates main effect of section controlling for covariates. Model 2 includes an estimate of the interaction between section and race. Model 3 includes an estimate of the interaction. Reference category for high structured section is traditional large lecture. Reference category for race is URM, which includes Black and Hispanic students. Reference category for EOP status is non-EOP students. Reference category for female is male. status is non-EOP students. Reference category for female is male. All models additionally control for prior achievement (SAT scores and cumulative GPA in science). Standard errors in parentheses. *p<.05, **p<.01, ***p<.001

Conclusion. After controlling for gender, ethnicity, and achievement (SAT scores and cumulative science GPA), being in the High Structure section is **not significantly more associated** with belonging for **EOP students** than it is for non-EOP students.

Overall, the High Structure section is associated with higher belonging for EOP students (this is what we know from the equality of median tests above when limiting the comparison to only EOP students). However, the regression shows that the high structure section is not *more* beneficial for EOP students than non-EOP students (if it was, there would be a significant positive interaction term for High Structure x EOP, indicating EOP students get an additional boost to their sense of belonging).

Hypothesis 5b:**URMstudents** in the high structure lecture will have greater sense of belonging (to their MCDB 1A course) than URM students in the large lecture at the end of the course.

Figure 5b. Distribution of Sense of Belonging (Full scale) by Section (URM only)

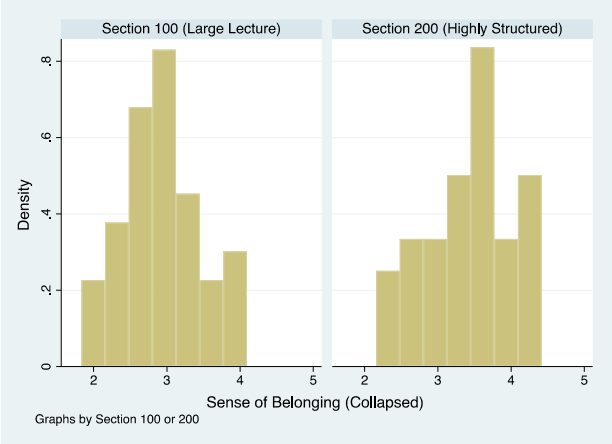


Table 5b. t-test of Mean Difference – Sense of Belonging (Full scale) by Section (URM only)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
Section1	41	**2.910569**	.0894782	.5729402	2.729727	3.091411
Section2	37	**3.43018**	.1003369	.6103257	3.226687	3.633673
combined	78	3.157051	.0727549	.6425538	3.012178	3.301925
diff		-.5196111	.1339988		-.7864928	-.2527293

diff = mean(Section) - mean(Section) **t = -3.8777**

Ho: diff = 0 degrees of freedom = 76

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = 0.0001 **Pr(|T| > |t|) = 0.0002** Pr(T > t) = 0.9999

Conclusion: **URM** students in Section 200 have a significantly higher sense of belonging (p=0.002) than URM students in Section 100.

Figure 5bi. Distribution of Sense of Belonging (<u>Peer Support subscale</u>) by Section (URM only)

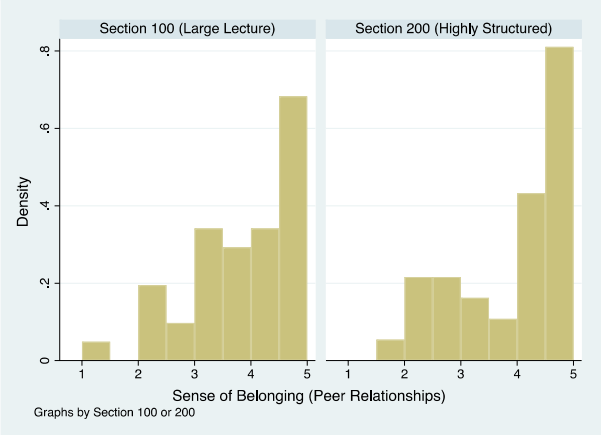


Table 5bi. Equality of MediansTest– Sense of Belonging (<u>Peer Support subscale</u>) by Section (URM only)

```
Median test

   Greater |
  than the |  Section 100 or 200
    median | Section 1  Section 2 |     Total
-----------+----------------------+----------
        no |        25         20 |        45
       yes |        16         17 |        33
-----------+----------------------+----------
     Total |        41         37 |        78

          Pearson chi2(1) =   0.3817   Pr = 0.537

   Continuity corrected:
          Pearson chi2(1) =   0.1508   Pr = 0.698
```

Conclusion: **URM** students in Section 200 **<u>do not</u>** have a significantly higher sense of belonging (p=0.537) than URM students in Section 100.

Figure 5bii. Distribution of Sense of Belonging (Faculty Support subscale) by Section (URM only)

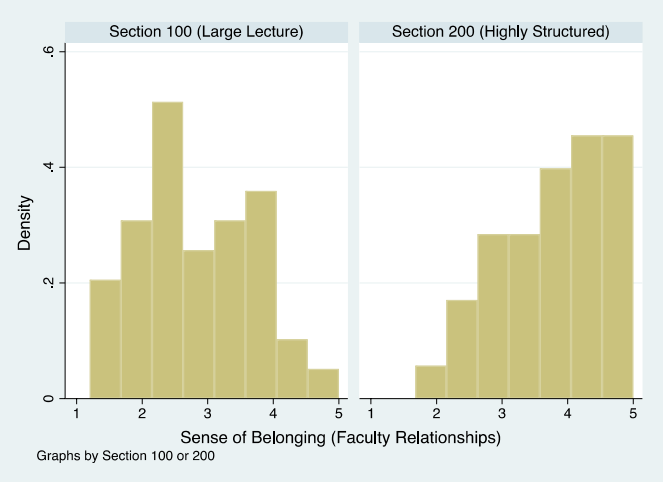


Table 5bii. Equality of MediansTest– Sense of Belonging (Faculty Support subscale) by Section (URM only)

```
Median test

   Greater |
  than the |  Section 100 or 200
    median | Section 1  Section 2 |     Total
-----------+----------------------+----------
        no |        29         12 |        41
       yes |        12         25 |        37
-----------+----------------------+----------
     Total |        41         37 |        78

          Pearson chi2(1) =  11.4413   Pr = 0.001

   Continuity corrected:
          Pearson chi2(1) =   9.9569   Pr = 0.002
```

Conclusion: **URM** students in Section 200 have a significantly higher sense of belonging ($p<0.01$) than URM students in Section 100.

Figure 5biii. Distribution of Sense of Belonging (<u>Classroom Comfort subscale</u>) by Section (URM only)

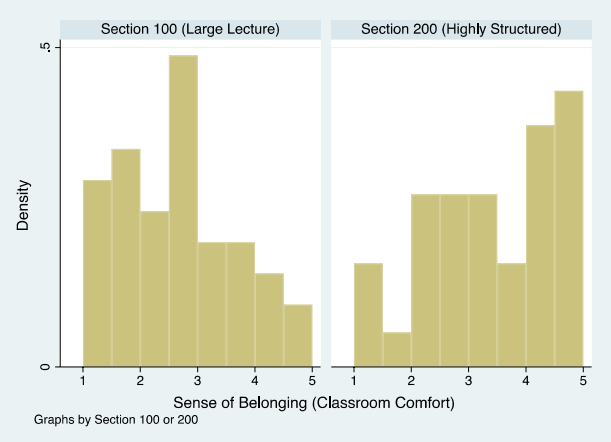


Table 5biii. Equality of MediansTest– Sense of Belonging (<u>Classroom Comfort subscale</u>) by Section (URM only)

```
Median test

   Greater |
  than the |  Section 100 or 200
    median | Section 1  Section 2 |     Total
-----------+----------------------+----------
        no |        28         14 |        42
       yes |        13         23 |        36
-----------+----------------------+----------
     Total |        41         37 |        78

          Pearson chi2(1) =   7.2584   Pr = 0.007

   Continuity corrected:
          Pearson chi2(1) =   6.0847   Pr = 0.014
```

Conclusion: **URM** students in Section 200 have a significantly higher sense of belonging ($p<0.01$) than URM students in Section 100.

Table 5br. Regression of Sense of Belonging (Full scale and subscales) on Section, EOP status, and URM status (standardized)

Predicting Sense of Belonging and its Subcomponents by Section, EOP Status, and URM Status

	Sense of belonging (all)			Perceived Peer Support			Perceived Faculty Support			Classroom Comfort		
	model 1	model 2	model 3	model 1	model 2	model 3	model 1	model 2	model 3	model 1	model 2	model 3
High structured section	**0.33*** **	**0.36*** **	**0.30*** **	0.09	0.00	0.03	**0.40*** **	**0.46*** **	**0.36*** **	**0.27*** **	**0.27***	**0.31*** **
	(0.06)	(0.13)	(0.08)	(0.12)	(0.24)	(0.14)	(0.10)	(0.20)	(0.12)	(0.13)	(0.25)	(0.15)
Interactions												
Section x Race												
High structured section		-0.02			0.02			0.02			-0.05	
x Asian (vs. URM)		(0.16)			(0.31)			(0.26)			(0.32)	
High structured section		-0.04			0.15			-0.13			0.04	
x White (vs. URM)		(0.16)			(0.30)			(0.25)			(0.32)	
Section x Income												
High structured section			-0.07			-0.15			-0.10			0.09
x EOP status			(0.13)			(0.25)			(0.21)			(0.26)
Covariates												
Race												
Asian (vs. URM)	-0.03	-0.02	-0.03	-0.02	-0.04	-0.04	0.01	0.00	0.00	-0.13	-0.10	-0.12
	(0.09)	(0.12)	(0.09)	(0.16)	(0.22)	(0.16)	(0.13)	(0.19)	(0.14)	(0.17)	(0.24)	(0.17)
White (vs. URM)	-0.03	0.00	-0.03	-0.06	-0.16	-0.08	0.02	0.10	0.01	-0.06	-0.08	-0.05
	(0.09)	(0.12)	(0.09)	(0.16)	(0.23)	(0.16)	(0.14)	(0.19)	(0.14)	(0.17)	(0.24)	(0.17)
Income												
EOP Status	-0.05	-0.05	-0.01	-0.08	-0.09	0.01	-0.03	-0.03	0.03	0.02	0.02	-0.04
	(0.08)	(0.08)	(0.10)	(0.15)	(0.15)	(0.19)	(0.12)	(0.12)	(0.16)	(0.15)	(0.15)	(0.20)
Gender												
Female	-0.06	-0.05	-0.05	**0.14***	**0.14***	**0.15***	-0.08	-0.07	-0.07	**-0.14***	**-0.14****	**-0.14****
	(0.07)	(0.07)	(0.07)	(0.13)	(0.13)	(0.13)	(0.11)	(0.11)	(0.11)	(0.13)	(0.13)	(0.13)
N	317	317	317	317	317	317	317	317	317	317	317	317

Note. All sense of belonging variables on a scale from (1) low ... (5) high. All coefficients are in standard deviation units. Model 1 estimates main effect of section controlling for covariates. Model 2 includes an estimate of the interaction between section and race. Model 3 includes an estimate of the interaction. Reference category for high structured section is traditional large lecture. Reference category for race is URM, which includes Black and Hispanic students. Reference category for EOP status is non-EOP students. Reference category for female is male. status is non-EOP students. Reference category for female is male. All models additionally control for prior achievement (SAT scores and cumulative GPA in science). Standard errors in parentheses. *p<.05, **p<.01, ***p<.001

Conclusion. After controlling for gender, income, and achievement (SAT scores and cumulative science GPA), being in the High Structure section is **not significantly more associated** with belonging for **URM students**(reference group) than it is for non-URM students (Asian, Caucasian).

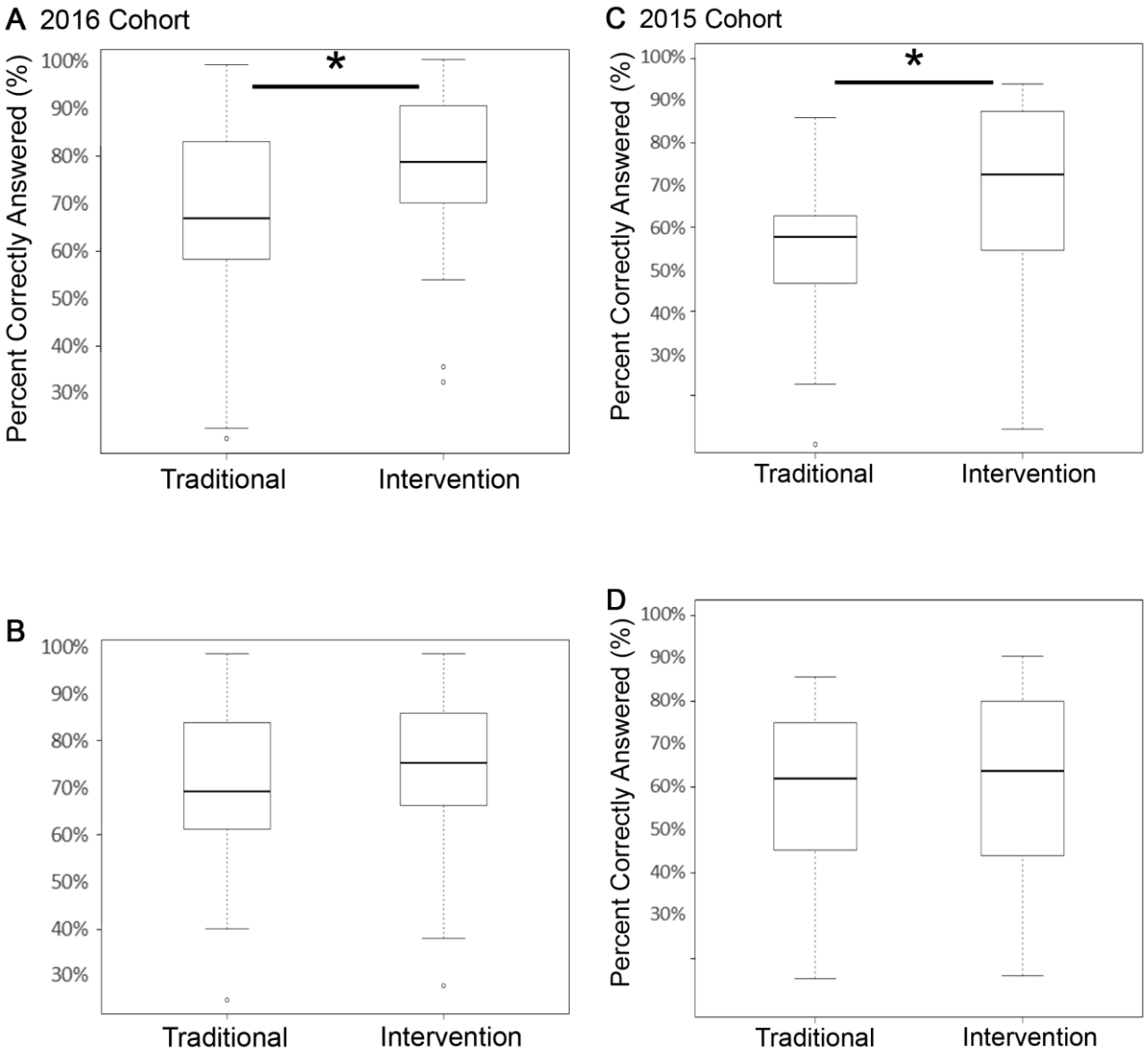
Overall, the High Structure section is associated with higher belonging for URM students (this is what we know from the equality of median tests above when limiting the comparison to only URM students). However, the regression shows that the high structure section is not *more* beneficial for URM students than non-URMstudents such as White and Asian students (if it was, there would be a significant positive interaction term for High Structure x White or High Structure x Asian, indicating White or Asian students in the High structure section get an additional boost or less of a boost to their sense of belonging when compared specifically to URM students).

References

Hoffman, M., Richmond, J., Morrow, J., & Salomone, K. (2003). Investigating "sense of belonging" in first-year college students. *Journal of College Student Retention*, *4*(3), 227–256.

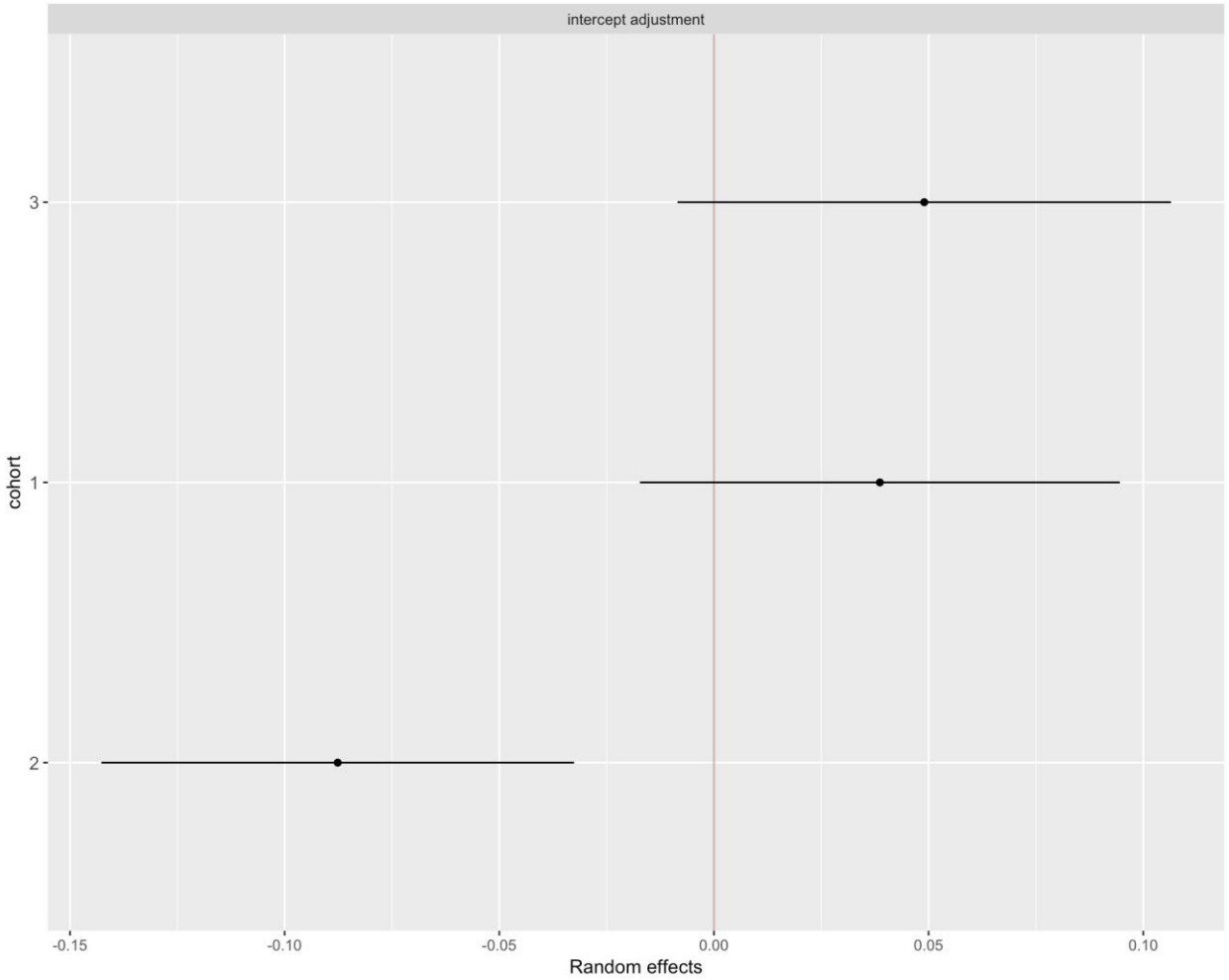
Tovar, E., & Simon, M. A. (2010). Factorial structure and invariance anaysis of the sense of belonging scales. *Measurement and Evaluation in Counseling and Development*, *43*(3), 199–217. http://doi.org/10.1177/0748175610384811

Supplemental Figure 1



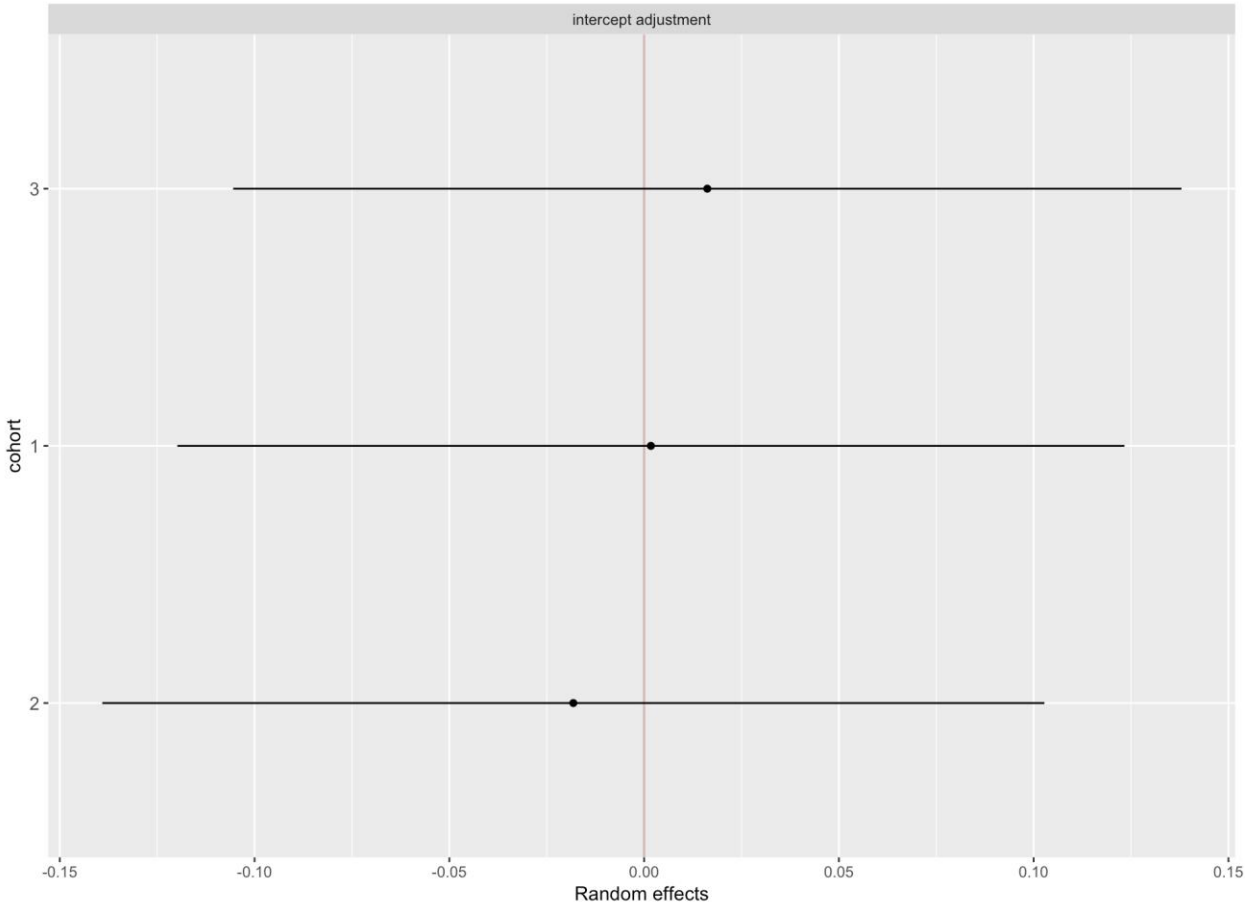
Supplemental Figure 1. The 2016 (A and B) and 2015 (C and D) intervention course outperforms traditional section on common exam questions. A comparison of academic performance in the intervention and traditional courses as measured by assessing percent correct answers on shared exam questions. Presented is the average number of correct responses per student on common exam question when content was delivered by active learning (A and C) or via lecture alone (B and D). Asterisks denote statistically significant differences between populations as determined by Welch two sample t-test. (A: p-value = 1.244e-8, B: p-value = 0.491, C: p-value = 4.116e-5, D: p-value = 0.5462).

Supplemental Figure 2.



Supplemental Figure 2. Random effect of cohort and year with confidence intervals of *Introductory Biology I* final grade. Caterpillar dotplots with confidence intervals of the size of the random intercept for each cohort and year (1 = 2016, 2 = 2015, 3 = 2017). The confidence intervals do not all overlap indicating that the model needs to include cohort and year as a random intercept. Further, we see that the random intercept increases with year, indicating that students got stronger each successive year.

Supplemental Figure 3.



Supplemental Figure 3. Random effect of cohort and year with confidence intervals of student retention in *Introductory Biology II*. Caterpillar dotplots with confidence intervals of the size of the random intercept for each cohort and year (1 = 2016, 2 = 2015, 3 = 2017). The confidence intervals overlap indicating that the model does not need to include cohort and year as a random intercept.

Supplemental Figure 4.
Covariates included in mediation analyses
Introductory Biology I final grade
Traditional/intervention course
Gender
Ethnicity
EOP status
Total SAT
Cumulative science GPA (first year)

Mediation package and code for R

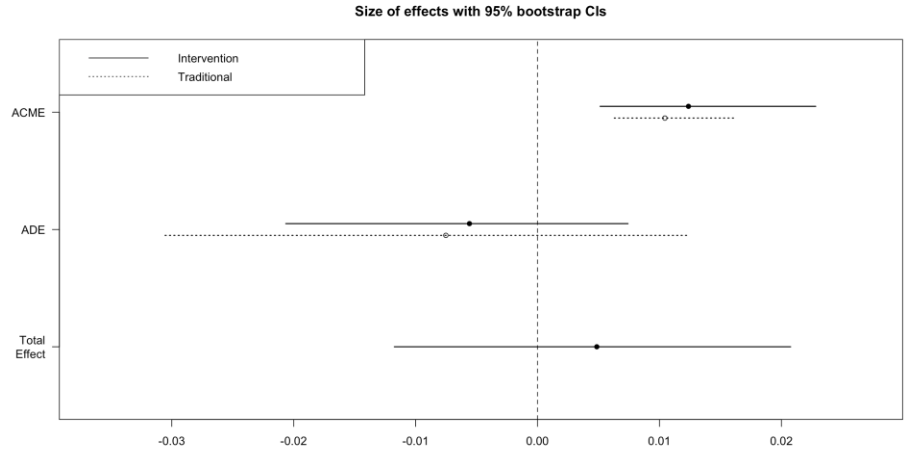
med.fit <- lm(Introductory Biology I final grade ~ traditional/intervention course + Gender x traditional/intervention course + ethnicity x traditional/intervention course + EOP x traditional/intervention course + Total SAT + cumulative science GPA (first year), data = dataframe)

out.fit <- glm(Introductory Biology II retention ~ traditional/intervention course + Gender x traditional/intervention course + ethnicity x traditional/intervention course + EOP x traditional/intervention course + Total SAT + cumulative science GPA (first year), data = dataframe)

med.out <- mediate(med.fit, out.fit, treat = " traditional/intervention course ", mediator = "Introductory Biology I final grade", sims = 2000, boot = TRUE)

summary(med.out)

plot(med.out, main = "Size of effects with 95% bootstrap CIs")
legend("topleft", c("Intervention", "Traditional"), lty = c(1,3))



Effect size of ACME (mediating effect of grade earned in *Introductory Biology I*), ADE (direct effect of *Introductory Biology I*), and Total Effect of intervention or traditional section of *Introductory Biology I* on retention of students into *Introductory Biology II*.

Supplemental Table 1.
Logistic Regression of Student Retention in Biology
Identified Model:
Retained BioMajor Spring Quarter Fourth Year ~ Gender + ethnicity + EOP + Cumulative Science GPA Spring Quarter First Year (4.0 scale) + Gender x Cumulative Science GPA Spring Quarter First Year + ethnicity x EOP

Table S1. Analysis of Biology Student RetentionLogistic Regression

Coefficients	**Estimate (β)**	**Standard Error**	***p***
Intercept	1.06062	0.29617	***
GenderMale	0.28896	0.21189	-
ethnicityCaucasian	**-0.73945**	**0.33783**	*****
ethnicityURM	-0.41164	0.41506	-
EOP	-0.53660	0.36987	-
ethnicityCaucasian x EOP	0.95839	0.55881	-
ethnicityUnknown x EOP	-14.813	476.501	-
ethnicityURM x EOP	0.05816	0.53350	-
Cumulative Science GPA Spring 1st Year	**0.95839**	**0.16051**	*******
GenderMale x Cumulative Sci GPA 1st Year	-0.33103	0.22605	-

2012 cohort of declared biology majors. Initial entry n = 1000. Asterisks denote significance levels, * = 0.05, *** = 0.

Deviance Residuals:

Min	1Q	Median	3Q	Max
-2.2183	-1.0079	0.6035	0.9196	2.1999

AIC: 591.62

Number of Fisher Scoring iterations: 13

Supplemental Table 2.
Multiple Linear Regression of First Year Student Cumulative Science GPA
Identified Model:
Cumulative Science GPA Spring 1st Year (4.0 scale) ~ Gender + ethnicity + EOP + Total SAT Score + Gender: Total SAT Score

AIC: 787.81
Residual standard error: 0.5178
Multiple R-squared: 0.2019,Adjusted R-squared: 0.1898
F-statistic: 16.75, p-value: < 2.2e-16

Residuals:

Table S2. Analysis of Biology Student Cumulative Science GPAMultipleLinear Regression

Coefficients	**Estimate (β)**	**Standard Error**	***p***
Intercept	1.0382818	0.3260121	**
GenderMale	0.6918737	0.4608804	-
EthnicityCaucasian	**0.1094359**	**0.0522205**	*****
EthnicityURM	**-0.1478364**	**0.0564669**	******
ethnicityInternational	0.3931096	0.2248618	-
ethnicityUnknown	-0.1622862	0.2146000	-
EOP	**-0.1116914**	**0.0506749**	*****
Total SAT	**0.0010189**	**0.0001683**	*******
GenderMale x Total SAT	-0.0003499	0.0002428	-

2012 cohort of declared biology majors. Initial entry n = 1000. Asterisks denote significance levels, * = 0.05, ** = 0.01, *** = 0.

Min	1Q	Median	3Q	Max
-1.37540	-0.37770	0.03386	0.41402	1.17068

Supplemental Table 3.
Multilevel Logistic Regression of Student Enrollment in Two Courses of *Introductory Biology I*
Identified Model:

Table 3. Estimated regression coefficients frommultilevellogistic regressionof student demographics across *Introductory Biology I* courses

Coefficients	**Estimate (β)**	**Standard Error**	**z-value**	***p***
Intercept	-0.55130	0.38463	-1.433	-
GenderMale	-0.25751	0.11465	-2.246	-
EthnicityCaucasian	-0.16739	0.13262	-1.262	-
EthnicityURM	0.01686	0.15387	0.110	-
Ethnicity International	-0.37932	0.45814	-0.828	-
Ethnicity Unknown	-0.56601	0.44291	-1.363	-
EOP	0.25673	0.13983	1.836	-
Total SAT	**0.29474**	**0.08036**	4.209	*******
Cumulative Science GPA Spring 1st Year	0.13815	0.10350	1.243	-

Traditional section of the course is the reference group. Combined 2015-2017 cohorts of declared biology majors in *Introductory Biology I*. n = 1602. Asterisks denote significance levels, * = 0.05, ** = 0.01, *** = 0.

Supplemental Table 4.
ANOVA table with significance of random effects variable of cohort year

Table S4. ANOVA table for logistic regression analysis of student demographics between Traditional and Intervention course with significance of random effects variable of cohort year

Model	**df**	**AIC**	***p***
Logistic Regression	9	2072.8	-
Multilevel Logistic Regression + Cohort Year	10	1963.5	< 2.2e-16

Combined 2015-2017 cohort data of declared Biology Majors students. n = 1612.

Supplemental Table 5.
ANOVA table with significance of random effects variable of cohort year

Table S5. ANOVA table for multiple linear regression analysis of earned *Introductory Biology I* final grade with significance of random effects variable of cohort year

Model	**df**	**AIC**	***p***
Multiple Linear Regression	17	3459.6	-
Multilevel Linear Regression + Cohort Year	18	3453.5	0.004438

Combined 2015-2017 cohort data of declared Biology Majors students. n = 1612.

Table S6A. Predicting Sense of Belonging (Full scale) with all covariates and interaction terms (standardized)

Table A

Regressions of sense of belonging on section

	Sense of belonging (all)					
	m1	m2	m3	m4	m5	m6
Intervention Course	**0.33*** **	**0.35*** **	**0.30*** **	**0.31*** **	0.06	0.42
	(0.06)	(0.13)	(0.08)	(0.11)	(0.34)	(0.68)
Interactions						
Section x race						
Intervention Course		-0.02				
x Asian (vs. URM)		(0.16)				
Intervention Course		-0.03				
x White (vs. URM)		(0.16)				
Section x income						
Intervention Course			0.07			
x EOP status			(0.13)			
Section x gender						
Intervention Course				0.03		
x Female				(0.13)		
Section x prior achievement						
Intervention Course					0.28	
x Science GPA					(0.11)	
Intervention Course						-0.10
x SAT score						(0.00)
Covariates						
Race						
Asian (vs. URM)	-0.05	-0.04	-0.06	-0.05	-0.05	-0.05
	(0.09)	(0.12)	(0.09)	(0.09)	(0.09)	(0.09)
White (vs. URM)	-0.04	-0.02	-0.04	-0.04	-0.04	-0.04
	(0.09)	(0.12)	(0.09)	(0.09)	(0.09)	(0.09)
Income						
EOP status	-0.05	-0.04	0.00	-0.05	-0.05	-0.05
	(0.08)	(0.08)	(0.10)	(0.08)	(0.08)	(0.08)
Gender						
Female	-0.04	-0.04	-0.04	-0.06	-0.03	-0.04
	(0.07)	(0.07)	(0.07)	(0.09)	(0.07)	(0.07)
Prior achievement						
Science GPA	**0.16** **	**0.16** **	**0.16** **	**0.16** **	0.12	**0.16** **
	(0.06)	(0.06)	(0.06)	(0.06)	(0.08)	(0.06)
SAT score	0.07	0.07	0.07	0.07	0.08	0.08
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	317	317	317	317	317	317

Note. All sense of belonging variables on a scale from (1) low ... (5) high. All coefficients are in standard deviation units. Standard errors in parentheses. *p<.05, **p<.01, ***p<.001. Model 1 estimates main effect of theIntervention Course controlling for covariates. The remaining models include an estimate of the interaction. Reference category for Intervention Course is Traditional Course. Reference category for race is URM, which includes Black and Hispanic students.Reference for EOP status is non-EOP.

Table S6B. Predicting Sense of Belonging (Perceived peer support subscale) with all covariates and interaction terms (standardized)

Table B

Regressions of perceived peer support on section

	Sense of belonging (Perceived peer support)					
	m1	m2	m3	m4	m5	m6
Intervention Course	0.08	-0.01	0.02	-0.08	-0.15	-0.14
	(0.12)	(0.24)	(0.14)	(0.20)	(0.64)	(1.28)
Interactions						
Section x race						
Intervention Course		0.03				
x Asian (vs. URM)		(0.31)				
Intervention Course		0.16				
x White (vs. URM)		(0.30)				
Section x income						
Intervention Course			0.15			
x EOP status			(0.25)			
Section x gender						
Intervention Course				**0.24***		
x Female				(0.25)		
Section x prior achievement						
Intervention Course					0.25	
x Science GPA					(0.21)	
Intervention Course						0.23
x SAT score						(0.00)
Covariates						
Race						
Asian (vs. URM)	-0.04	-0.06	-0.05	-0.03	-0.04	-0.04
	(0.16)	(0.23)	(0.16)	(0.16)	(0.16)	(0.16)
White (vs. URM)	-0.07	-0.17	-0.08	-0.08	-0.08	-0.07
	(0.16)	(0.23)	(0.16)	(0.16)	(0.17)	(0.17)
Income						
EOP status	-0.07	-0.08	0.02	-0.07	-0.07	-0.07
	(0.15)	(0.15)	(0.19)	(0.15)	(0.15)	(0.15)
Gender						
Female	**0.15****	**0.14***	**0.16****	0.03	**0.16****	**0.15****
	(0.12)	(0.13)	(0.12)	(0.18)	(0.13)	(0.13)
Prior achievement						
Science GPA	0.11	0.10	0.11	0.13	0.07	0.11
	(0.11)	(0.11)	(0.11)	(0.11)	(0.14)	(0.11)
SAT score	-0.01	-0.01	-0.02	-0.03	-0.01	-0.03
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	317	317	317	317	317	317

Note. All sense of belonging variables on a scale from (1) low ... (5) high. All coefficients are in standard deviation units. Standard errors in parentheses. *p<.05, **p<.01, ***p<.001. Model 1 estimates main effect of the Intervention Course controlling for covariates. The remaining models include an estimate of the interaction. Reference category for Intervention Course is Traditional Course. Reference category for race is URM, which includes Black and Hispanic students.Reference for EOP status is non-EOP.

Table S6C. Predicting Sense of Belonging (Perceived faculty support subscale) with all covariates and interaction terms (standardized)

Table C

Regressions of perceived faculty support on section

	Sense of belonging (Perceived faculty support)					
	m1	m2	m3	m4	m5	m6
Intervention Course	0.40***	0.45***	0.36***	0.40***	0.22	0.90
	(0.10)	(0.20)	(0.12)	(0.17)	(0.54)	(1.06)
Interactions						
Section x race						
Intervention Course		0.01				
x Asian (vs. URM)		(0.26)				
Intervention Course		-0.12				
x White (vs. URM)		(0.25)				
Section x income						
Intervention Course			0.10			
x EOP status			(0.21)			
Section x gender						
Intervention Course				0.00		
x Female				(0.21)		
Section x prior achievement						
Intervention Course					0.19	
x Science GPA					(0.17)	
Intervention Course						-0.51
x SAT score						(0.00)
Covariates						
Race						
Asian (vs. URM)	-0.01	-0.02	-0.02	-0.01	-0.01	-0.01
	(0.13)	(0.19)	(0.13)	(0.13)	(0.13)	(0.13)
White (vs. URM)	0.00	0.08	0.00	0.00	0.00	0.00
	(0.14)	(0.19)	(0.14)	(0.14)	(0.14)	(0.14)
Income						
EOP status	-0.02	-0.02	0.04	-0.02	-0.02	-0.02
	(0.12)	(0.12)	(0.16)	(0.12)	(0.12)	(0.12)
Gender						
Female	-0.06	-0.05	-0.06	-0.06	-0.06	-0.06
	(0.10)	(0.10)	(0.10)	(0.15)	(0.10)	(0.10)
Prior achievement						
Science GPA	0.11	**0.12***	0.11	0.11	0.08	0.11
	(0.10)	(0.10)	(0.09)	(0.10)	(0.12)	(0.10)
SAT score	0.05	0.05	0.05	0.05	0.05	0.09
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	317	317	317	317	317	317

Note. All sense of belonging variables on a scale from (1) low ... (5) high. All coefficients are in standard deviation units. Standard errors in parentheses. *p<.05, **p<.01, ***p<.001. Model 1 estimates main effect of the Intervention Course controlling for covariates. The remaining models include an estimate of the interaction. Reference category for Intervention Course is Traditional Course. Reference category for race is URM, which includes Black and Hispanic students.Reference for EOP status is non-EOP.

Table S6D. Predicting Sense of Belonging (Classroom comfort subscale) with all covariates and interaction terms (standardized)

Table D

Regressions of perceived faculty support on section

	Sense of belonging (Perceived classroom comfort)					
	m1	m2	m3	m4	m5	m6
Intervention Course	**0.27*** **	**0.28** **	**0.31*** **	**0.24** **	-0.20	0.18
	(0.13)	(0.25)	(0.15)	(0.21)	(0.67)	(1.34)
Interactions						
Section x race						
Intervention Course		-0.05				
x Asian (vs. URM)		(0.32)				
Intervention Course		0.03				
x White (vs. URM)		(0.32)				
Section x income						
Intervention Course			-0.08			
x EOP status			(0.26)			
Section x gender						
Intervention Course				0.05		
x Female				(0.26)		
Section x prior achievement						
Intervention Course					0.51	
x Science GPA					(0.22)	
Intervention Course						0.10
x SAT score						(0.00)
Covariates						
Race						
Asian (vs. URM)	**-0.14***	-0.11	-0.13	-0.14	**-0.14***	**-0.14***
	(0.17)	(0.24)	(0.17)	(0.17)	(0.17)	(0.17)
White (vs. URM)	-0.06	-0.08	-0.05	-0.06	-0.07	-0.06
	(0.17)	(0.24)	(0.17)	(0.17)	(0.17)	(0.17)
Income						
EOP status	0.02	0.02	-0.04	0.01	0.01	0.02
	(0.15)	(0.16)	(0.20)	(0.15)	(0.15)	(0.15)
Gender						
Female	**-0.13***	**-0.14***	**-0.13***	**-0.15***	**-0.12***	**-0.13***
	(0.13)	(0.13)	(0.13)	(0.19)	(0.13)	(0.13)
Prior achievement						
Science GPA	**0.18** **	**0.17** **	**0.18** **	**0.18** **	0.10	**0.18** **
	(0.12)	(0.12)	(0.12)	(0.12)	(0.15)	(0.12)
SAT score	0.074	0.076	0.078	0.07	0.079	0.067
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	317	317	317	317	317	317

Note. All sense of belonging variables on a scale from (1) low ... (5) high. All coefficients are in standard deviation units. Standard errors in parentheses. *p<.05, **p<.01, ***p<.001. Model 1 estimates main effect of the Intervention Course controlling for covariates. The remaining models include an estimate of the interaction. Reference category for Intervention Course is Traditional Course. Reference category for race is URM, which includes Black and Hispanic students. Reference for EOP status is non-EOP.

Supplemental Table 7.
ANOVA table with significance of random effects variable of cohort year

Table S7. ANOVA table for multiple logistic regression analysis of student retention in *Introductory Biology II* in the subsequent quarter with random effects variable of cohort year

Model	**df**	**AIC**	***p***
Multiple Logistic Regression	17	350.72	-
Multilevel Logistic Regression + Cohort Year	18	352.58	0.7008

Combined 2015-2017 cohort data of declared Biology Majors students. n = 1612.