

Supplemental Material

CBE—Life Sciences Education

Edwards et al.

Supplementary Materials:

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33 **Additional File 1: Copy of Survey Questions Analyzed:**

34 ***Religious Affiliation:***

35 I most closely identify as:

- 36 • Buddhist
- 37 • Christian (for example, Catholic, Protestant, Orthodox, CJD-LDS, nondenominational)
- 38 • Hindu
- 39 • Jewish
- 40 • Muslim
- 41 • I don't identify with a religion (for example, atheist or agnostic)
- 42 • Option not available, please describe _____
- 43 • Decline to state

44

45 If “Christian” is chosen:

46 With what denomination of Christianity do you most closely identify?

- 47 • Catholic
- 48 • Jehovah's Witness
- 49 • Orthodox
- 50 • Nondenominational
- 51 • Protestant (for example, Baptist, Methodist, Pentecostal, Lutheran, Presbyterian)
- 52 • The Church of Jesus Christ of Latter-day Saints
- 53 • Option not available, please describe _____
- 54 • Decline to state

55

56 ***Religiosity:***

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58 Please indicate how much you agree or disagree with the following statements:

59

60 I attend religious services regularly (when they are available).

- 61 • Strongly disagree
- 62 • Disagree
- 63 • Neutral
- 64 • Agree
- 65 • Strongly agree

66

67 I believe in God.

- 68 • Strongly disagree
- 69 • Disagree
- 70 • Neutral
- 71 • Agree

72 • Strongly agree

73

74 I consider myself a religious person.

75 • Strongly disagree

76 • Disagree

77 • Neutral

78 • Agree

79 • Strongly agree

80

81 I consider myself a spiritual person.

82 • Strongly disagree

83 • Disagree

84 • Neutral

85 • Agree

86 • Strongly agree

87

88 ***Year in School:***

89 What is your year in school?

90 • First/sophomore

91 • Junior/Senior

92 • Postgraduate

93 • Decline to state

94 ***Biology Major:***

95 Is your major in biology? (includes biomedical sciences, biology and society, conservation
96 biology, genetics, neurobiology/physiology/behavior, microbiology, medical microbiology,
97 molecular bioscience, neuroscience)

98 • Yes

99 • No

100 ***Intended Career:***

101 What is your intended career?

102 • Healthcare professionals (examples include Physician, Nurse, EMT). Please describe:

103 _____

104 • Research scientist (examples include Professor, Biologist, Chemist, Zoologist, Physicist,
105 Geologist): Please describe: _____

106 • Option not available. Please describe: _____

107 • Decline to state

108 ***Parent Education Level:***

109 What is your parents' highest completed level of education? If you have more than one parent
110 with differing levels of education, choose the higher of the two.

- 111 • Less than high school completed
- 112 • High school diploma or GED
- 113 • Some college but no degree
- 114 • Associate degree (for example: AA, AS)
- 115 • Bachelor's degree (for example: BA, AB, BS)
- 116 • Master's degree (for example: MA, MS, MEng, MEd, MSW, MBA)
- 117 • Higher than a Master's degree (for example: PhD, MD, JD)
- 118 • Decline to state

119 ***Gender:***

120 I most closely identify as:

- 121 • Woman
- 122 • Man
- 123 • Nonbinary
- 124 • Please describe your gender identity if the best option is not listed: _____
- 125 • Decline to state

126 ***Race:***

127 Choose the race/ethnicity with which you most closely identify:

- 128 • American Indian, Native American, or Alaskan Native
- 129 • Asian (Middle Eastern, East Asian, Southeast Asian, South Asian, West Asian)
- 130 • Black or African American
- 131 • Hispanic or Latinx
- 132 • Native Hawaiian or other Pacific Islander
- 133 • White
- 134 • Multiracial (please describe your multiple racial/ethnic identities) _____
- 135 • Option not available, please describe: _____
- 136 • Decline to state

137 ***Political Affiliation:***

138 Please indicate your political identity:

- 139 • Extremely Liberal
- 140 • Liberal
- 141 • Slightly Liberal
- 142 • Moderate
- 143 • Slightly Conservative

- 144 • Conservative
- 145 • Extremely Conservative
- 146 • Decline to state

147 ***View of Evolution:***

148 There are no right or wrong answers to this question. Please indicate which of the following
149 statements most closely represents your personal view, **based on your personal opinion:**

- 150 • All forms of life were first brought into being in their present form by God 6,000-10,000
151 years ago at the same time. (*Young Earth creationism*)
- 152 • All forms of life were first brought into being in their present form by God at different
153 times over billions of years. (*Old Earth creationism*)
- 154 • Some forms of life evolved from earlier forms, but God created groups of organisms such
155 as reptiles, birds, mammals, and humans separate from one another and organisms that
156 currently exist have evolved slowly from those first creations. (*Creationism with some
157 evolution*)
- 158 • Almost all forms of life evolved from earlier forms, but humans were created by God in
159 their present form separate from the rest of life. (*Humans only creationism*)
- 160 • All forms of life evolved from earlier forms, but God intervenes from time to time to
161 shape or override evolution. (*Interventionist evolution*)
- 162 • All forms of life evolved from earlier forms, but God set up evolution from the start in a
163 perfect way so that it would fulfill God's purpose and no subsequent intervention was
164 necessary. (*Theistic evolution*)
- 165 • All forms of life evolved from earlier forms, but life and evolution were first set in
166 motion by God without a specific purpose or plan. (*Deistic evolution*)
- 167 • All forms of life evolved from earlier forms, but I'm not sure whether any God was
168 involved in evolution. (*Agnostic evolution*)
- 169 • All forms of life evolved from earlier forms, but no God has ever played a role in
170 evolution. (*Atheistic evolution*)

171
172 **The italicized text in parentheses is the technical label of the evolution view that corresponds*
173 *with each statement. The italicized text was not included on the official survey, but it is included*
174 *here for readers' reference.*

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182 **Additional File 2: Copy of Interview Questions:**

- 183 1. Talk to me a bit about your religious identity.
- 184 2. When you are interacting with peers in your biology courses, are you ever reminded of
185 your religious identity?
- 186 3. Do you ever consider your religious identity when choosing who to sit by in class?
- 187 4. Talk to me about what you perceive are the potential benefits of being religious when
188 interacting your peers in your biology courses, particularly during peer discussion.
- 189 5. Talk to me about what you perceive are the potential disadvantages are of being religious
190 when interacting with your peers in your biology courses, particularly during peer
191 discussion.
- 192 6. To what extent do you reveal that you are religious to students in your biology courses?
- 193 7. Can you tell me about instances in your biology courses when you have had the chance to
194 reveal to your peers that you are religious, but decided not to?
- 195 8. Can you tell me about instances when you *have* revealed that you are religious to one of
196 your peers in your biology courses?
- 197 9. How do you decide whether or not to tell a peer in your biology courses that you are
198 religious?
- 199 10. Talk to me about the potential risks you see, if any, of revealing your religious identity to
200 other students in your biology classes.
- 201 11. Talk to me about the potential benefits you see, if any, of revealing your religious identity
202 to other students in your biology classes.
- 203 12. Compared to a traditional lecture course, do you feel like there are more opportunities to
204 reveal your religious identity in courses that incorporate peer discussion?
- 205 13. If you were to tell a peer in your biology courses that you are religious, would you worry
206 about what they would think about you? Why or why not?
- 207 14. Are there particular ways you talk about your religious identity with your peers to avoid
208 any negative perceptions?
- 209 15. Have any of your peers in your biology courses ever done anything that made you feel
210 like they did not value you as a person who is religious?
- 211 16. Have any of your peers in your biology courses ever done anything that made you think
212 they *did* value you as a person who is religious?
- 213 17. How would you feel if another student revealed to you that they were religious during a
214 discussion in your biology course?
- 215 a. Would your feelings depend on whether someone had the same religious identity
216 than you?
- 217 b. How do you think these feelings compare to how you would feel if another
218 student revealed that they are an Atheist?
- 219 18. How does your religious identity influence your comfort level when you are interacting
220 with your peers, particularly during peer discussion?

- 221 a. Are there any topics that you would feel less comfortable discussing because of
222 your religious identity?
223 i. Like what?

224 19. Logic question:

- 225 a. If they said they have revealed: To what extent do you feel
226 b. If they said they have not revealed: To what extent do you think you would feel
227 i. comfortable in a peer discussion where you have revealed that you are
228 religious to at least one other person?

229 20. Is there anything else you would like to talk about related to your experiences as a
230 religious student during peer discussions in your biology courses?

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261 **Additional File 3: Copy of Codebook Used for Qualitative Analysis:**

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263 **Saliency:**

264 a) **Specific topics:** Student explains that their religious identity is more salient when
265 they are discussing particular topics with their peers that may conflict with their
266 identity or topics for which their opinions are partially shaped by their religion such
267 as evolution, genetics, or bioethics topics.

268 b) **Differences among students:** Student explains that their religious identity is more
269 salient when they are interacting with their peers and are reminded that their views or
270 behaviors are different from their peers' due to their religious identity.

271 c) **Awe at creation:** Student says they are reminded of their religious identity when they
272 are discussing a science topic that they perceive to be incredibly intricate or
273 impressive because it reminds them that their creator made everything and is amazing

274 d) **Not reminded:** Student says their religious identity is never especially salient when
275 they are interacting with their peers.

276 I. **Silo religion and science:** Student says that when they are talking with their
277 peers, they keep science separate from their religion. Student may say they try
278 to think about the science itself rather than thinking about what their religion
279 would say about it.

280

281 **Benefits of being religious:**

282 b) **More open-minded:** Student states that one benefit of being religious is that they are
283 more open-minded, respectful, or empathetic when hearing their peers' views.

284 a) **Passion for Biology:** Student explains that one benefit of being religious is that their
285 religion increases their enthusiasm, appreciation, or passion for biology.

286 b) **Different perspective:** Student says that one benefit of being religious is that they
287 add unique perspectives to conversations in biology courses because of their religious
288 background.

289 c) **Already considered their views:** Student says that one benefit of being religious is
290 that, because of their religious identity, they have already deeply thought about their
291 views on many potentially controversial issues that come up in class and may know
292 what they think about those topics already. Student may also say that students who
293 are not religious may not have thought about their views on those topics until they
294 were brought up in class.

295

296 **Disadvantages of being religious:**

297 a) **Stereotypes:** Student says that one disadvantage of being religious is that if their
298 peers find out about their religious identities, they may make assumptions about the
299 student and associate them with stereotypes of religious people or judge them.

300 b) **Closed-minded peers:** Student says that one disadvantage of being religious is their
301 peers may be unwilling to listen to them, be closed-minded towards them, or be
302 confrontational if they find out they were religious.

- 303 c) **Difficulty relating to peers:** Student says that one disadvantage of being religious is
304 that because they are religious and they perceive most of their students are not, many
305 of their peers think or behave differently than they do, which can make it difficult to
306 connect with them.
- 307 d) **Making other students feel uncomfortable:** Student says that one disadvantage of
308 being religious is that their being religious may make other students in the class feel
309 uncomfortable. Student may mention that their peers' discomfort could stem from
310 their past personal experiences with religion/religious people or the assumptions that
311 they may make about religious people's attitudes or behaviors.

312

313 **Tendency to Reveal:**

- 314 a) **Never or rarely because of (anticipated stigma):** Student says that they rarely or
315 never reveal their religious identity to peers in their biology classes depending on the
316 person and situation because they have concerns about what their peer would think of
317 them if they were to reveal.
- 318 b) **Never or rarely because no opportunities:** Student says they never or rarely reveal
319 their religious identity in their biology class because there are not opportunities. The
320 student does not say that they would reveal if they could.
- 321 c) **Freely:** Student says that they freely reveal their religious identity to peers in their
322 biology classes any time it feels relevant or comes up in conversation.
- 323 I. **Reveals Frequently:** Student says that they frequently reveal their religious
324 identity in their biology classes.
- 325 II. **Reveals Rarely:** Student says that they rarely reveal their religious identity in
326 their biology classes because they do not have the opportunity to do so, but
327 they say that they would reveal if they did have the opportunity to.

328

329 **Reveal or conceal:**

- 330 a) **Open-mindedness of peer:** Student says that they would be willing to reveal if their
331 peer seems like they are open-minded or nice or would be willing to listen to or be
332 respectful of their perspective OR student says they would not be willing to reveal if
333 their peers seemed closed-minded or unwilling to respectfully listen to their
334 perspective.
- 335 b) **Relevance to discussion:** Student says that they would be willing to reveal if it
336 seemed relevant to the discussion they were having with their peers OR student says
337 that they would not be willing to reveal if doing so meant bringing their religious
338 identity up out of nowhere when it was not relevant to the conversation.
- 339 c) **Closeness with peer:** Student says that they would be willing to reveal if they knew
340 the peer or were friends with them OR student says they would not be willing to
341 reveal if they had just met the peer or hardly knew them.
- 342 d) **Other peer is religious:** Student says that they would reveal they were religious if
343 their peers revealed that they were religious first.
- 344 e) **Opportunity to evangelize:** Student says that they would reveal they were religious
345 because it may help others to become religious. Student may say it brings them joy or

346 helps them fulfill their duty as a Christian to talk about their religion with those who
347 are not religious. Student may also mention they could invite their peers to church or
348 answer any questions they have about religion if they reveal that they are religious.
349

350 **Anticipated Stigma:**

- 351 a) **Stereotypes:** Student says that if a peer knew they were religious, they may
352 stereotype, judge, or make false assumptions about them based on their religious
353 identity.
- 354 I. **Don't believe in science:** Student says that they think many individuals
355 would assume that they don't believe in science or some aspect of it, like
356 evolution.
 - 357 II. **Less scientifically capable:** Student says that they think many individuals
358 would discredit them or assume they are less of a scientist or less capable of
359 being a scientist than nonreligious individuals
 - 360 III. **No free will:** Student says that they think many individuals would assume that
361 they cannot make decisions for themselves or are required to do and say
362 things because of their religion.
 - 363 IV. **Judgmental or closed-minded:** Student says that they think many individuals
364 would assume that they are judgmental of other people or closed-minded
365 about the views of others.
 - 366 V. **Denomination specific stereotypes:** Student mentions that they think many
367 individuals would make assumptions about them based on their specific
368 denomination of Christianity. For example, a student who is LDS may say
369 they think that people assume they get have many children or that the men
370 have multiple wives, or a student who is Catholic may say they think people
371 might assume they are a bad person because of the views and behaviors
372 associated with the faith, like pedophilia or homophobia.
 - 373 VI. **Convert:** Student says that they think many individuals would assume that
374 they are always attempting to convert their peers or people they interact with.
 - 375 VII. **Naïve:** Student says that they think many individuals would assume they are
376 naïve because of their faith or turn a blind eye to fact and truth.
- 377 b) **Social repercussions:** Student says they may lose friends or be excluded from peer
378 groups or working groups because of their religious identity. Student may also say
379 their peers may dislike them or think less of them if they knew they were religious or
380 be less willing to interact with them.
- 381 c) **Confrontation:** Student says that if their peers knew they were religious, it could
382 lead to arguments, confrontation, or tension with them.
383
384

385 **Experienced Stigma:**

- 386 a) **Positive/neutral experience:** Student says that when they revealed they were
387 religious to a peer, the experience was positive or neutral.

- 388 b) **Assumed incompatibility of religion and science:** Student says that their peers
389 express shock or surprise at the idea that someone can be religious and accept
390 science.
- 391 c) **Jokes/negative comments about religious people:** Student says that peers in their
392 biology courses have made jokes or negative comments about religious people during
393 class.
- 394 d) **Mention anticipated stigma despite no experienced stigma:** Student explicitly
395 recognizes and mentions that they realize that they anticipate stigma from their peers
396 due to their religious identity even though they have never actually experienced
397 stigma.
- 398 e) **Never experienced stigma:** Student says that they have never experienced stigma
399 during discussions with their peers because of their religious identity.
400

401 **Impression management strategies:**

- 402 a) **Doesn't push religion on others:** Student says that when they reveal they are
403 religious, they will do so in a way that allows their peer to decide if they want to
404 continue the discussion or not, or they try not to bring their religion up in discussion
405 at all.
- 406 b) **Discusses casually:** Student says they discuss their religion in a casual way so it
407 doesn't seem like a big deal to their peers, or student says they will bring up the
408 commonly accepted ideals of their religion but not the more controversial ones. For
409 instance, students may say they go to church but not reveal more details about their
410 specific religious beliefs. Student may also say they will bring religion up in a relaxed
411 or simple way.
- 412 c) **Speak positively about religion:** Student says that they talk about their religion in a
413 positive way or highlights what they like about their religion to avoid negative
414 perceptions.
- 415 d) **Self-group distancing/assimilating:** Student reveals in a way that separates
416 themselves from the stereotypes typically associated with religious individuals.
- 417 I. **Accepts science:** Student reveals that they are religious but makes it clear that
418 they also accept science.
- 419 II. **Has individual thought:** Student reveals they are religious but discusses it
420 carefully to make it clear that they think deeply about their faith and have free
421 will regarding what they do and believe.
- 422 III. **Politics:** Student reveals that they are Christian but says that they are
423 politically liberal or progressive.
- 424 IV. **Different than their religion:** Student emphasize that they do not agree with
425 some of the sentiments and behavior of their church or religion, its leaders, or
426 its followers. Students may say they believe in foundational ideals like loving
427 one another but disagree with more controversial ideas typically associated
428 with the faith.
429
430

431 **Benefits of revealing:**

- 432 a) **Finding other religious students:** Student says that a benefit of revealing to their
433 peers is that they may find other students who are also religious because they feel
434 similar to them.
- 435 b) **Religion and science coexisting:** Student says that a benefit of revealing is that they
436 can show their peers, both those who are religious or nonreligious, that people can be
437 religious and believe in science.
- 438 c) **Others reveal:** Student says that a benefit of revealing is that their peers may also
439 feel comfortable enough to reveal their own religious identity.
- 440 d) **Increases closeness with peers:** Student says that a benefit of revealing is that their
441 peers can get to know them better and they may grow closer from the vulnerability of
442 revealing.

443

444 **Opportunities to reveal:**

- 445 a) **Yes:** Student says that they do think there are more opportunities to reveal their
446 religious identity in courses that incorporate peer discussion.
- 447 I. **Increased discussion:** Student says that they do think there are more
448 opportunities to reveal because with increased discussion with peers comes
449 increased opportunity for things like religious identity to come up or be
450 shared.
- 451 II. **Closer relationships:** Student says that they do think there are more
452 opportunities to reveal because increased discussion means students are more
453 likely to get close to each other, so they would be more likely to share
454 personal information like religion. Student may say this is especially the case
455 when they have discussions with the same peers throughout the semester.
- 456 III. **Small group:** Student says that they do think there are more opportunities to
457 reveal because they are in smaller groups so people may be more likely to
458 share that they are religious in those settings or may feel more comfortable
459 doing so.
- 460 b) **No, religion is not relevant:** Student says that they do not think there are more
461 opportunities to reveal their religious identity because even when students are talking
462 to each other, religion still is not relevant to the conversation, so it does not come up.

463 **Additional File 4: Participant Demographics Tables:**

464 Table S1. Each participant’s religious denomination, religiosity, view of evolution, year in school, race, and political identity.

Pseudonym	Christian Denomination	Religiosity	View of Evolution	Year in School	Race	Political Identity
Jamie	Nondenominational	3.5	Theistic evolution	Junior/Senior	White	Moderate
Molly	The Church of Jesus Christ of Latter-Day Saints	4.75	Interventionist evolution	Junior/Senior	White	Slightly conservative
Megan	Catholic	3.5	Agnostic evolution	First year/Sophomore	Hispanic or Latinx	Extremely liberal
Daniel	The Church of Jesus Christ of Latter-Day Saints	4.75	Theistic evolution	Junior/Senior	White	Conservative
Grace	The Church of Jesus Christ of Latter-Day Saints	5	Theistic evolution	Junior/Senior	White	Slightly liberal
Ira	Nondenominational	2.75	Interventionist evolution	First year/Sophomore	Asian	Liberal
Peter	Nondenominational	3.5	Old Earth Creationism	First year/Sophomore	Asian	Slightly conservative
Melody	Catholic	4.25	Agnostic evolution	Junior/Senior	Hispanic or Latinx	Liberal
Erin	Catholic	4.75	Theistic evolution	First year/Sophomore	Hispanic or Latinx	Slightly conservative
Sofia	Protestant	3.5	Human only creationism	First year/Sophomore	Hispanic or Latinx	Moderate
Maria	Nondenominational	4	Theistic evolution	Junior/Senior	Hispanic or Latinx	Extremely liberal
Connor	Nondenominational	4.5	Theistic evolution	First year/Sophomore	White	Moderate
Allan	The Church of Jesus Christ of Latter-Day Saints	5	Young Earth creationism	Junior/Senior	White	Conservative
Trinity	Nondenominational	4.5	Theistic evolution	First year/Sophomore	Asian	Slightly liberal

Lori	Nondenominational	5	Creationism with some evolution	Junior/Senior	Asian	Conservative
Brooke	Nondenominational	3.75	Theistic evolution	First year/Sophomore	White	Slightly liberal
Camila	Catholic	4.25	Deistic evolution	First year/Sophomore	White	Liberal
Brandon	Catholic	4	Creationism with some evolution	First year/Sophomore	Hispanic or Latinx	Liberal
Erica	Protestant	4	Deistic evolution	Junior/Senior	White	Slightly conservative
Javier	Catholic	4.5	Theistic evolution	Junior/Senior	Hispanic or Latinx	Liberal
Macie	Nondenominational	1	Human only creationism	First year/Sophomore	White	Slightly conservative
Iris	Nondenominational	4.75	Young Earth creationism	First year/Sophomore	Multiracial	Liberal
Julia	Catholic	4.5	Agnostic evolution	Junior/Senior	Hispanic or Latinx	Liberal
Levi	Protestant	4.5	Old Earth Creationism	First year/Sophomore	White	Conservative
Luke	The Church of Jesus Christ of Latter-Day Saints	5	Creationism with some evolution	Junior/Senior	White	Conservative
Diego	Catholic	5	Deistic evolution	Junior/Senior	Hispanic or Latinx	Moderate
Olivia	Nondenominational	4.5	Theistic evolution	First year/Sophomore	Hispanic or Latinx	Liberal
Gabby	The Church of Jesus Christ of Latter-Day Saints	3.75	Theistic evolution	First year/Sophomore	White	Moderate
Amie	The Church of Jesus Christ of Latter-Day Saints	4.25	Creationism with some evolution	Junior/Senior	White	Moderate
Kristin	The Church of Jesus Christ of Latter-Day Saints	5	Creationism with some evolution	Junior/Senior	White	Slightly liberal