Demographic Factors Influence on Scientific Versus Creationist Evolutionary Belief Systems Within Denver East High School

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ABSTRACT

Despite legal precedents affirming the dominance of evolutionary theory in public school curricula, the compartmentalization of scientific and religious viewpoints remains a significant aspect of students' cognitive processes. This research project investigates the intersection of scientific and religious beliefs among high school students, focusing on factors influencing their perspectives on evolution. The study is based on existing research on creationist versus scientific evolutionary belief patterns, emphasizing the impact of religious upbringing, educational approaches, and socio-cultural factors on students' perspectives. The study addresses a critical gap in the literature by examining the Denver East high school community's unique dynamics, aiming to uncover localized influences on students' views. The research design employs a survey methodology to collect both quantitative and qualitative data, exploring the effects of demographics on cognitive evolutionary belief systems. Preliminary findings highlight the multifaceted nature of factors influencing evolution acceptance, challenging assumptions about the conflict between science and religion. The study contributes to the broader understanding of students' beliefs and has potential implications for refining scientific teaching strategies.

Introduction

Despite efforts in several American states and municipalities to prohibit the teaching of evolution in public schools or to teach alternatives to evolution, courts have routinely rejected public school curriculum that deviate from evolutionary theory in recent decades. In Edwards v. Aguillard (1987), for example, the United States Supreme Court decided that a Louisiana statute requiring public school students to understand both evolution and creationism (the concept that the universe and living beings are the result of specific acts of divine creation) violated the prohibition on the establishment of religion in the United States Constitution (Pew Research Center). So how are students and young adults developing their own beliefs about creationism?

In the sphere of science education, the compartmentalization, the mental process of segregating or separating one's beliefs or ideas (in this case, separating scientific and religious viewpoints on evolution) of scientific and religious evolutionary ideas among high school students has attracted a lot of attention (Scientific evolution refers to the well-established scientific understanding of the process by which living organisms have developed and changed over time through natural selection and genetic variation). Numerous research has been conducted to investigate the factors (In this study, factors included social, cultural, educational, or other aspects that impact students' beliefs) that influence these beliefs, with the goal of providing insights into the complicated interaction between science education and religious convictions.

Literature Review

Search Strategies

To guarantee credibility, sources were identified solely using peer-reviewed sources from various academic databases. Keywords were: Cognitive Apartheid, Religiosity, Evolution and Science versus Religion. All sources utilized in the literature review and research are available in the reference section of the academic paper.

Pre-Existing Research on the Intersectionality of Creationist Versus Scientific Evolutionary Belief Patterns

The intersection of science and religion refers to the point at which scientific knowledge and religious beliefs interact or overlap, particularly in discussions related to topics like evolution. It involves exploring how individuals reconcile or integrate scientific and religious perspectives. The role of religious upbringing and community influence is one significant factor that has been studied in a lot of research. Researchers discovered that students from close-knit religious communities were more likely to hold creationist beliefs, whereas those from more diverse religious backgrounds were more likely to embrace scientific explanations for evolution. Furthermore, it has been discovered that a student's family's level of religiosity played a substantial effect in forming their perspective on evolution (Johnson 2019). Another area of study has been the impact of scientific education curriculum and methods of instruction. Anderson and Brown (2019) and Ramirez et al. (2020) conducted studies that emphasized the significance of inclusive and balanced science education approaches that respect multiple belief systems. They contended that a more nuanced approach to evolution education can generate a more inclusive learning environment in which students feel comfortable examining both scientific and religious perspectives.

A study done on high school students in Italy and Brazil suggests that those who follow the same religion (Catholic) in different countries (Brazil and Italy) have more significant differences in evolution acceptance than people brought up in the same socio-cultural environment but following different religious teachings. This implies that wider sociocultural factors may have a more significant influence on evolution acceptance than religious affiliation alone (Bizzo 2022). Similar findings are found in other studies that explore the relationship between religious affiliation, levels of religiosity, and their influence on individuals' scientific beliefs in the United States, delving into how religious factors can shape perspectives on scientific concepts.(Jensen 2019)

A common assumption is that increased religiousness leads to an increased sense of conflict between science and religion. Researchers Kyle C Longest and Christian Smith surveyed across the nation with their findings especially reflective of the emerging youth and how their surroundings affect their views. They challenge the widespread assumption that increased religiousness leads to a stronger perception of conflict between religion and science. Instead, they proposed to examine this assumption using data from the National Study of Youth and Religion (NSYR) through four distinct questions. The conclusions drawn from the study suggest that there isn't a simple conflict-compatibility continuum when it comes to the relationship between religion and science. Instead, there are various viewpoints and configurations of beliefs. The findings indicate that increased religiousness among emerging adults is associated with a stronger agreement in the compatibility of science and religion, rather than conflict. Additionally, they note that incorporating different spiritual traditions and adherence to fundamentalist Christian doctrine can lead to complex configurations of beliefs on this topic. The study's findings challenge conventional assumptions about how religious experiences influence beliefs, emphasizing the influence of social factors, which may vary across different stages in life or generations. (most importantly younger generations) (Longest et. 2011)

A study conducted by Ronald S. Hermann, an Associate Professor of Science Education at Towson University, explores how high school students reconcile their religious beliefs with scientific concepts, particularly in the context of evolution and the big bang theory, aiming to understand the phenomenon of compartmentalization or cognitive apartheid in science education. It identifies a subset of students who may resist learning evolution due to perceived conflicts with their religious beliefs. The study aims to investigate students who can demonstrate a sophisticated understanding of evolution despite their stated disbelief. It introduces the concept of compartmentalization as a potential explanation for how students may hold both scientific understandings and religious beliefs. The study concluded that students might compartmentalize scientific knowledge based on imprecise rules, which are frequently reliant on the degree of belief. It implies that dialogues regarding science and religion concerns may assist students in developing a more sophisticated model integrating beliefs and understandings, hence minimizing the requirement for compartmentalization. The findings support the notion that students may successfully compartmentalize scientific knowledge, but they also suggest that this can be an unpleasant cognitive strain.(Hermann 2012) This suggests that intuitive cognitions and feelings of certainty are influential in belief formation.(Ha 2011) This finding is supported through studies introducing new measures such as PCoRE, which assesses students' perceived conflict between evolution and religion, similarly suggesting that perceived conflict may be a significant factor in shaping acceptance of evolution.(Barnes, et al. 2021) However this emphasizes the necessity for standardized measurement tools, illustrating how inconsistencies in measurement might contribute to conflicting findings in understanding the impact of community factors on evolutionary beliefs. The variability in measurement tools affects comprehension of evolution acceptance, emphasizing the need for consistency in measurement for more accurate comparisons across various studies.(Barnes 2019) Highlighting how despite recent progress, it is crucial to acknowledge the comparative limitation of research on measuring knowledge, skills, and attitudes crucial to evolution education compared to other educational aspects.(Nehm, et al. 2021)

Understanding students' conceptions is vital for addressing potential conflicts between scientific and evolutionary beliefs.(Bishop 1990) For example, take a 2015 study that explores how third-graders' understanding of the origin of species is influenced by formal instruction, specifically regarding evolution and natural selection. It involves interviewing the same group of 8 to 9-year-old children before and after a curriculum about these topics. The study found that creationist answers were rare, and there was a significant increase in evolutionist answers after the instruction. However, the children's grasp of evolution was fragmented, limited to some animals, and they made errors when placing vertebrate classes on a timeline. Additionally, only a minority understood evolutionary mechanisms, attributing differences to mutations but not mentioning differential survival. Despite increased evolutionist answers post-instruction, children might still exhibit fragmented or incomplete comprehension of evolutionary concepts due to limitations in the learning process, highlighting the nuances in children's understanding of evolution post-instruction, emphasizing the importance of comprehensive and effective educational strategies to shape students' beliefs about evolution accurately. (Berti, et al. 2015) But these findings don't just apply to young children, a study done on 667 students from a first-semester biology course and 74 students from an evolutionary biology course illustrates how there was a significant change in students' understanding of macroevolution and acceptance of evolution after completing the one-semester evolutionary biology course. These findings are essential as they shed light on the interconnectedness between students' acceptance of evolution and their understanding of macroevolution. Moreover, the study demonstrates the potential impact of an evolutionary biology course on students' perspectives and comprehension of macroevolution and acceptance of evolution, reinforcing the importance of educational coursework in influencing students' acceptance and understanding of evolution. (Nadelson et al. 2012) These sources emphasize the significance of a comprehensive and sensitive approach to teaching evolution. They underline the importance of considering diverse perspectives and beliefs among students while ensuring the accurate presentation of scientific concepts, contributing to a more inclusive and effective evolution education strategy. (Smith 2007)

Within a study that explores the multifactorial aspects of acceptance of evolution, researchers delve into the persistence of public acceptance of biological evolution in the US over the past 35 years despite various education reform endeavors. Aiming to quantitatively model how factors such as evolutionary content knowledge, religiosity, epistemological sophistication, and understanding the nature of science collectively predict an individual's acceptance or rejection of evolution. The study population exhibited a high acceptance of evolution, as indicated by an average score of 77.17 on the Measure of Acceptance of the Theory of Evolution (MATE) instrument. The findings highlighted that understanding the nature of science explained the most variation in evolution acceptance, surpassing the impact of evolutionary knowledge. Elucidating the multifaceted nature of factors influencing individuals' acceptance of evolution and emphasizing the significance of understanding the nature of science in shaping acceptance or rejection of evolution. Highlighting the pivotal role of comprehending the nature of science in impacting evolution acceptance, suggesting that educational efforts should prioritize enhancing this understanding alongside direct evolutionary instruction. (Dunk 2017) However, on the opposite end of the spectrum, studies conducted by Pew Research Center suggest that highly religious individuals might feel conflicted about acknowledging human evolution without clarifying their beliefs about God's involvement in the process, showcasing the impact of belief systems on how individuals perceive and respond to questions about evolution. Depicting the complexity of interpreting individuals' beliefs about evolution and the role of God in the process, emphasizing the need to consider belief systems when studying evolutionary beliefs within communities.(Funk 2019)

Gap in the Research

Despite these substantial advances, there is still a significant gap in the literature concerning the specific dynamics inside the Denver East high school community. While larger studies have looked at nationwide patterns, the distinctive cultural and demographic makeup of Denver and its neighboring areas introduced distinct factors impacting students' attitudes. This study aimed to fill the gap by performing a focused inquiry into the Denver East high school community, with the goal of uncovering localized influences on the formation of views among its students.

Summary

In conclusion, while existing research provides useful insights into the elements influencing students' beliefs in scientific and religious evolution, this study sought to add to this body of information by giving a detailed understanding of the Denver high school community's distinctive contextual influences on these beliefs, with potential implications (the potential consequences, effects, or significance of a particular finding or observation. In this study, pertaining to the broader societal, educational, or philosophical consequences of students' beliefs in scientific and religious evolution) for scientific teaching on a larger scale.

Research Design and Methodology

Study Design

This study explored the effects of demographics on cognitive evolutionary belief systems. The goal was to draw conclusions about direct connections between demographics and belief systems. This was important because it can identify factors that may be stifling or encouraging uninfluenced beliefs.

The study employed a survey methodology to investigate the impact of demographic characteristics on religious and scientific belief patterns among students aged 14-18 at Denver East High School. This allowed

for both qualitative and quantitative data collection. Using a combination of qualitative and quantitative data can improve an evaluation by ensuring that the limitations of one type of data are balanced by the strengths of another. This will ensure that understanding is improved by integrating different ways of knowing (Rainbow Framework). The survey, distributed anonymously and optionally, included multiple choice and linear scale questions on demographics, religiousness, and comfortability in schools as well as an open-ended response question about intersectionality of religious standpoints. As shown in the Literature review, the study of evolutionary beliefs is prevalent but pre-existing research does not cover the specific area or factors this study does. The survey consisted of four sections, with the first two focusing on demographic information and religious beliefs, providing a thorough analysis of participants' perspectives.
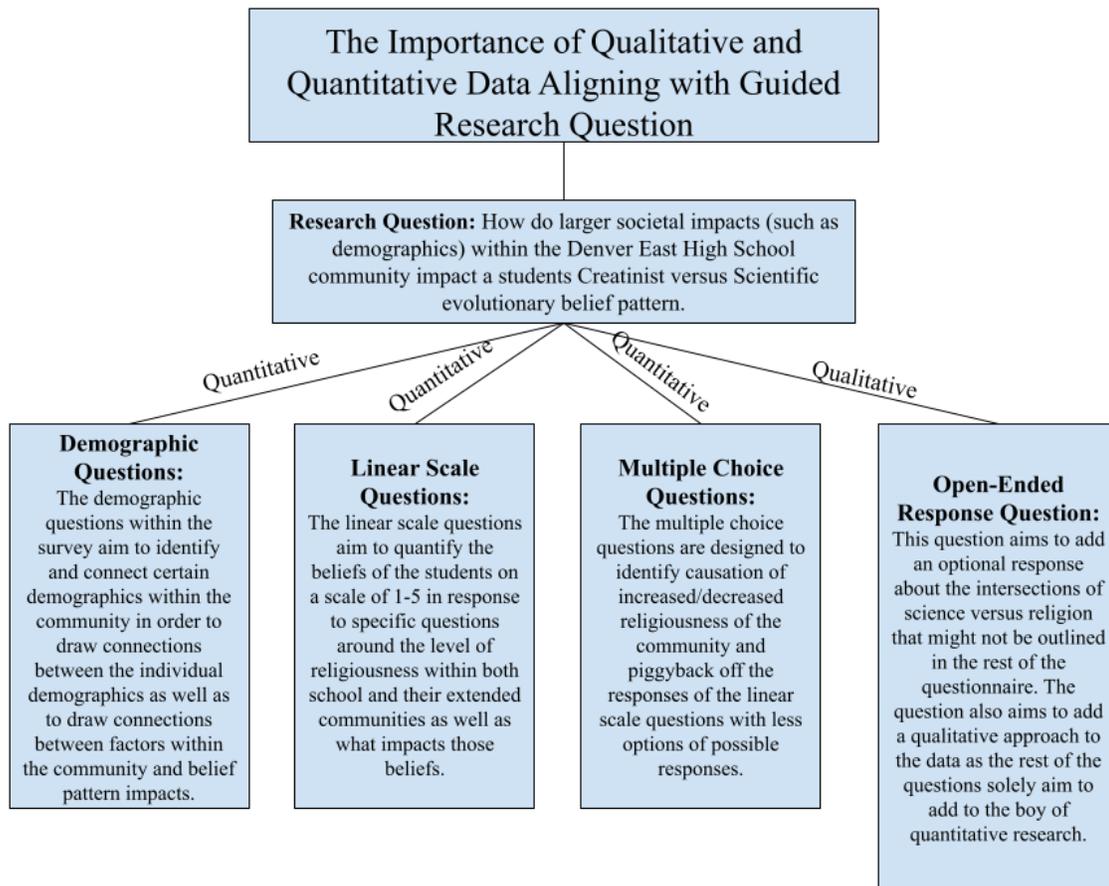
Figure 1. The 4-part Method Design in Alignment with the Research Question

Subjects

With a target population of 365-400 respondents evenly distributed across four grades, the survey's design allowed for a comprehensive understanding of the entire school's perspective. Using random sampling of classes throughout the school, the survey was able to gather an unbiased and more accurate pool of information. In order to participate in the survey, subjects were required to be a student actively enrolled in Denver East High

School, and had to answer all required questions. The subjects were and should be from any demographic background including but not limited to gender, ethnicity, age and religious affiliation.

Research Instruments

The study only employed one research instrument (the survey) which did not need any permissions as it was designed and distributed solely for use in this study. The final responses from the survey were converted into a spreadsheet and analyzed in tables. All survey questions are included in Appendix A.

Procedures

After the final revisions of the survey, it was distributed to teachers of all grade levels to distribute amongst their students. This process was then repeated until all of the necessary responses were compiled. The survey was not distributed directly from me to students to prevent bias.

The survey's distribution through teachers across all grades enhances randomness and comprehensiveness in participant selection (all emails sent included in appendix B). Ethical considerations are addressed through the survey's voluntary and anonymous nature, securing participants' consent for their responses to be used in the final study. The research aims to explore how demographic changes influence increased religiousness or the development of evolutionary ideology. Post-collection, the data was analyzed to measure the impact of each demographic variable on the identified factors. Using coded pivot tables, the data from the survey was filtered into spreadsheets and analyzed based on demographic effect on religiousness, the qualitative data was also filtered through and responses reflecting the best understanding and interpretation of perspective were cited in the results. In order to do this all of the data from the survey was be copied into a spreadsheet then each demographic factor included in the survey was compared against each question (ie. how many females identified themselves as highly involved in their religious community?). Then I tried to draw connections between each demographic and their responses (ie. Would a christian male or an atheist female be more inclined to criticize the evolutionary teaching protocol at East?). Finally all of that data was be pooled together to find the strongest connection between demographic and sociocultural factors and cognitive patterns considering evolution. The data from the open-ended response question, "In your opinion, what are the areas where science and religion might intersect or complement each other?" (Note that an answer to the question was not required and thus less qualitative data was procured) was analyzed and sorted into themes from six categories, balance, contradiction, creation, death/life, did not know an answer, and ideology. A count of the amount of times each theme was referenced or directly mentioned was then counted and tallied and then converted into percentage to quantify the qualitative data. Additionally, responses that seemed particularly important or illuminating were also made note of and analyzed for themes and conclusions in the results section.

Delimitations

It is acknowledged that limitations arose from the age group and emotional maturity of respondents, affecting the reliability and seriousness of the results. However, answers to the open-ended response question that were determined to be unreliable were promptly invalidated and removed from the response pool. The survey underwent rigorous critique and revision by experts, ensuring its validity. To mitigate potential biases, the inclusion of linear scale questions and more inclusive demographic criteria was emphasized during the revision process.

Defense of Research Method

The decision to use a survey was justified by its efficiency in quantifying a large group and obtaining diverse evidence. This proves crucial with adolescents, considering attention span limitations and the need for a swift data collection process. A survey was the most effective and reliable method due to my limited timeframe, as a mass survey reached the largest population and gathered the most accurate, serious, and reliable results. Due to the age demographic of my chosen population, data can be inaccurate or lead to sarcastic or satirical results, a survey provided the best method of weeding out these responses to gather an accurate body of knowledge. With the size of the total population as well, interviews or smaller surveys just wouldn't have been able to get an accurate read of the group, and would have led to biased results as every combination of demographic and personal beliefs leads to a different response.

Results

The survey (Appendix C) was completed by 382 members of the student body. The survey began collecting responses on February 1, 2024 and concluded March 4, 2024. The results were filtered based on factors of meeting the criteria for the study as well as meeting the necessary requirements for seriousness of data collection, if a response suggested an unserious answer, it was removed from the pool of data to encourage a complete understanding. The use of the survey was justified by its efficiency and reliability in the collection process as the survey was able to exceed its quota of responses.

Quantitative Results

Note that highlighting has been done on all of the following tables to emphasize key points and make them easier to read, only tables with significant data comparisons are shown but all survey results can be found in Appendix C, tables may cut of certain parts of the question but a full explanation of what is being compared in the graph can be found directly above each graph.

Demographic Overview

The collection of data provided a relatively even collection of age demographics based on the school demographics received from staff (Appendix D) (Table 1).

Table 1. Age and grade demographics for Denver East High School based on survey responses from a sample group of 382 pipils.

What is your age/grade?	COUNTA of What is your age/grade?
Freshman - 14/15	18.59%
Junior - 16/17	23.56%
Senior - 17/18	20.42%
Sophomore - 15/16	37.43%
Grand Total	100.00%

The results of the gender demographics (Table 2) were precise with no more than 2% deviation from the school demographics.

Table 2. Gender demographics for Denver East High School based on survey responses from a sample group of 382 pupils.

What is your gender iden	COUNTA of What is your gender identity
Female	50.52%
Gender Nonconforming (g	4.19%
Male	45.03%
Other	0.26%
Grand Total	**100.00%**

There were some limitations present in the race and ethnicity demographics (Table 3) received from the survey, compared to the grander school demographics, the Latino/a/x, Hispanic, and Chicano/a community was significantly underrepresented. There was a 10% deviation from the school demographics which inhibited my ability to get an accurate read of that population. Besides that one data point however, the race demographics of my sample size had no more than a 1% deviation.

Table 3. Race and ethnicity demographics for Denver East High School based on survey responses from a sample group of 382 pupils.

What is your ethnic or cu	COUNTA of What is your ethnic or cultur
Asian or Pacific Islander	3.66%
Black	15.18%
Latino/a/x, Hispanic, Chic	11.78%
Mixed Race	11.26%
Native/Indigenous	1.05%
Other	1.57%
White/Caucasian	55.50%
Grand Total	**100.00%**

The school had no prior data on the religion demographics of the whole population but the largest population identified as Christian followed by Atheist/Agnostic, Spiritual and Other.

Table 4. Religious affliation demographics for Denver East High School based on survey responses from a sample group of 382 pupils.

What is your religious aff.	COUNTA of What is your religious affilia
Atheist/Agnostic	27.75%
Buddhist	1.31%
Christian	40.58%
Hindu	0.26%
Jewish	4.97%
Muslim	1.83%
Other	10.99%
Spiritual (believe in highe	12.30%
Grand Total	**100.00%**

The demographic tables highlight the diversity within the sample population and illustrate a semi-accurate reflection of the whole population of the school with a 20% sample size.

Evolutionary Beliefs

Students who identified themselves as Atheists or Agnostic and claimed they had a very knowledgeable understanding of evolutionary theory were the least likely to claim that "Yes, absolutely" science and religion can coexist peacefully in explaining the origin of life. They had a 6.25% acceptance rate whereas the next lowest rate was 33.33%. (Table 5).

Table 5. Survey questions: Do you believe science and religion con coexist peacefully in explaining the origin of life? Compared against how would you describe your understanding of the theory of evolution? And what is your religious affiliation, if any?

5	Atheist/Agnostic	15.63%	34.38%	21.88%	21.88%	6.25%
	Buddhist					100.00%
	Christian	3.85%	3.85%	46.15%	3.85%	42.31%
	Jewish			16.67%	33.33%	50.00%
	Muslim		50.00%			50.00%
	Other	22.22%	33.33%		11.11%	33.33%
	Spiritual (believe	27.27%	9.09%	9.09%	18.18%	36.36%
5 Total		12.50%	19.32%	23.86%	14.77%	29.55%

Those who ranked themselves a one or two on belief in scientific theory were more inclined to say they cant co exist whereas those who ranked themselves a four or five were more inclined to say they cant co-exist. (Table 6)

Table 6. Survey questions: Do you believe science and religion can coexist peacefully in explaining the origin of life? Compared against do you believe in the scientific theory of evolution? (eg. Darwin's theory of evolution)

Do you believe ir	1	2	3	4	5
1	22.73%	22.73%	27.27%	9.09%	18.18%
2	11.11%	17.78%	37.78%	20.00%	13.33%
3	4.55%	10.61%	40.91%	25.76%	18.18%
4	2.53%	12.66%	21.52%	27.85%	35.44%
5	6.47%	14.71%	25.88%	21.76%	31.18%
Grand Total	6.81%	14.40%	29.06%	22.77%	26.96%

Impact of Religious Upbringing

Students who said that they don't let their religion impact their beliefs also are most likely to say that it's because evolution is not discussed (66.67%) whereas most people who said their religious community highly impacts their beliefs say that the teachings in their religious community were only supportive of one perspective (46.67) (Table 7).

Table 7. Survey questions: How does your religious community influence your views on evolution? Compared against have there been discussions or teachings about evolution within your religious community?

How does your religious community	No, evolution is not discussed	Yes, and it encourages critical thinking	Yes, but it supports only one perspective
1	66.67%	22.64%	10.69%
2	35.29%	39.71%	25.00%
3	39.06%	26.56%	34.38%
4	26.67%	30.00%	43.33%
5	6.67%	46.67%	46.67%

Females were more influenced than any other gender identity by their families beliefs, claiming that their upbringing impacts their beliefs a great deal 7.77% of the time compared to 5 or 6% of gender non-conforming or male respondents saying the same thing.(Table 8)

Table 8. Survey questions: What is your gender identity? Compared against how much influence do your family's beliefs have on your understanding of evolution?

What is your gender identity?	1	2	3	4	5
Female	27.98%	20.73%	26.42%	17.10%	7.77%
Gender Nonconforming (gender fluid	62.50%	12.50%	6.25%	12.50%	6.25%
Male	31.40%	21.51%	27.91%	13.37%	5.81%
Other			100.00%		

Additionally, of those who claimed that their upbringing impacts their beliefs a great deal, those who identified themselves as White/Caucasian were the least likely to identify that way, with a 3.77% rate compared to a 15.52% rate from the Black identifying respondents.

Table 9. Survey questions: What is your ethnic or cultural background? Compared against how much influence do your family's beliefs have on your understanding of evolution?

Asian or Pacific Islander	28.57%	21.43%	28.57%	21.43%	
Black	22.41%	18.97%	27.59%	15.52%	15.52%
Latino/a/x, Hispanic, Chicano/a	22.22%	24.44%	24.44%	17.78%	11.11%
Mixed Race	27.91%	18.60%	30.23%	16.28%	6.98%
Native/Indigenous		25.00%	50.00%	25.00%	
Other	16.67%	50.00%	16.67%		16.67%
White/Caucasian	36.79%	19.81%	25.47%	14.15%	3.77%

Finally, Christians were the most likely to claim that their upbringing impacts their beliefs a great deal, nearly doubling the rates of the other religions.

Table 10. Survey questions: What is your religion affiliation, if any? Compared against how much influence do your family's beliefs have on your understanding of evolution?

What is your religious affiliation, if a	1	2	3	4	5
Atheist/Agnostic	43.40%	18.87%	19.81%	12.26%	5.66%
Buddhist	40.00%		60.00%		
Christian	21.29%	18.71%	31.61%	18.06%	10.32%
Hindu				100.00%	
Jewish	42.11%	21.05%	21.05%	15.79%	
Muslim		42.86%	42.86%	14.29%	
Other	30.95%	26.19%	19.05%	19.05%	4.76%
Spiritual (believe in higher power but	34.04%	25.53%	27.66%	8.51%	4.26%

Educational Influences

Table 11 depicts how those who said it was slightly important to teach evolution alongside other theories of creation also said the teaching at our school is biased towards certain beliefs whereas those who said it was very important also said that the teaching was already balanced and informative.

Table 11. Survey questions: How important do you think it is for schools to teach evolution alongside other theories of creation? Compared to how you perceive the teaching of evolution in your school?

How important do you t	Balanced and informative	Biased towards certain beliefs	Not addressed adequately
1	47.06%	23.53%	29.41%
2	34.00%	44.00%	22.00%
3	50.00%	26.39%	23.61%
4	54.84%	23.66%	21.51%
5	63.64%	14.39%	21.97%

Furthermore, those who said they were the most comfortable discussing religious beliefs and evolution in your classes also said they had the least conflicts between their religious beliefs and scientific teachings in school. (Table 12)

Table 12. Survey questions: Do you feel comfortable discussing religious and evolution in your classes? Compared to have you experienced conflicts between your religious beliefs and science teaching in schools?

Do you feel comfortabl	1	2	3	4	5
1	46.15%	15.38%	15.38%	23.08%	
2	25.71%	31.43%	25.71%	14.29%	2.86%
3	53.68%	22.11%	13.68%	4.21%	6.32%
4	56.96%	21.52%	10.13%	5.06%	6.33%
5	66.90%	20.42%	4.93%	3.52%	4.23%

In addition, Table 13 depicts that of the total responses from students, the least amount of people said that encountering different beliefs in their community had a positive effect, most people said that regardless of teacher influence on stifling beliefs, the different viewpoints in their community don't impact their beliefs.

Table 13. Survey questions: Do you feel like your teachers stifle your understanding and belifs about evolution? Compared to have you encountered different viewpoints on evolution within your school community?

Do you feel like your te	No, there's only one viewpoint	Yes, and it positively influences my beliefs	Yes, but it does not affect my beliefs
No, I dont feel like my	23.16%	8.09%	68.75%
Yes, they prevent learn	16.36%	20.00%	63.64%
Yes, they prevent learn	13.64%	22.73%	63.64%
Grand Total	**21.49%**	**10.89%**	**67.62%**

Sociocultural Factors

Out of those who said their religious beliefs do not influence their understanding of science, Latino/a/x, Hispanic, Chicano/a identifying students were most likely to say they don't find conflicts between scientific versus religious evolution. Whereas out of those who said their religious beliefs do impact their understanding, Black students were the most likely to say they find the conflicts between the two challenging and that they try to find common ground between the two or that they haven't found a solution. (Table 14 & 15)

Table 14. Survey questions: How do your religious beliefs or lack of influence your understanding of scientific theories, such as evolution? Compared to how do you reconcile any conflicts between scientific explanations and religious beliefs in your life? And what is your ethnic or cultural background?

How do your relig	What is your ethi	I am not religious	I don't find any c	I try to find comr	It's challenging;
1	Asian or Pacific Islander		80.00%	20.00%	
	Black	26.67%	46.67%	20.00%	6.67%
	Latino/a/x, Hispa	21.43%	57.14%	14.29%	7.14%
	Mixed Race	33.33%	40.00%	20.00%	6.67%
	Native/Indigenou	100.00%			
	Other	25.00%	75.00%		
	White/Caucasian	37.38%	41.12%	16.82%	4.67%
1 Total		33.54%	44.72%	16.77%	4.97%

Table 15. Survey questions: How do your religious beliefs or lack of influence your understanding of scientific theories, such as evolution? Compared to how do you reconcile any conflicts between scientific explanations and religious beliefs in your life? And what is your ethnic or cultural background?

–	5	Black		28.57%	42.86%	28.57%
		Latino/a/x, Hispanic, Chicano/a			100.00%	
		Mixed Race	40.00%	40.00%		20.00%
		Other			100.00%	
		White/Caucasian	37.50%	37.50%	12.50%	12.50%
Total				20.83%	29.17%	33.33%	16.67%

Freshman who said their beliefs had little to no influence on their understanding also said they don't find conflicts, and out of those who said their religious beliefs do not influence their understanding of science, Christians were most likely to say they don't find conflicts (Table 16 & 17).

Table 16. Survey questions: How do your religious beliefs or lack of influence your understanding of scientific theories, such as evolution? Compared to how do you reconcile any conflicts between scientific expla-nations and religious beliefs in your life? And what is your age/grade?

How do your relig		What is your age	I am not religious	I don't find any c	I try to find comr	It's challenging;
–	1	Freshman - 14/1	21.21%	54.55%	18.18%	6.06%
		Junior - 16/17	33.33%	38.46%	25.64%	2.56%
		Senior - 17/18	39.39%	48.48%	9.09%	3.03%
		Sophomore - 15/	37.50%	41.07%	14.29%	7.14%

Table 17. Survey questions: How do your religious beliefs or lack of influence your understanding of scientific theories, such as evolution? Compared to how do you reconcile any conflicts between scientific explanations and religious beliefs in your life? And what is your religious affiliation, if any?

How do your relig	What is your relig	I am not religious	I don't find any c	I try to find comr	It's challenging;
1 Atheist/Agnostic		55.93%	27.12%	11.86%	5.08%
Buddhist			50.00%	50.00%	
Christian		7.14%	61.90%	23.81%	7.14%
Hindu			100.00%		
Jewish		10.00%	60.00%	20.00%	10.00%
Muslim			25.00%	50.00%	25.00%
Other		42.11%	57.89%		
Spiritual (believe		37.50%	41.67%	20.83%	

Compartmentalization and Strain

The final connections drawn were around cognitive apartheid, a field of study discussed in the literature review, Table 18 supports the conclusion that Males who identify as highly religious have the highest cognitive strain and sense of conflict over Females with a nearly 10% deviation.

Table 18. Survey questions: What is your gender identity? Compared to how involved are you in religious activities within your community? And have you experienced conflicts between your religious beliefs and scientific teachings in school?

What is your gen	How involved are you in religiou		1	2	3	4	5
Female		1	74.39%	14.63%	7.32%	1.22%	2.44%
		2	55.26%	26.32%	13.16%	5.26%	
		3	33.33%	27.27%	21.21%	9.09%	9.09%
		4	46.43%	35.71%	14.29%		3.57%
		5	25.00%		25.00%	16.67%	33.33%
Female Total			56.48%	21.24%	12.95%	4.15%	5.18%
Male		1	77.33%	14.67%	4.00%	4.00%	
		2	52.63%	28.95%	10.53%	7.89%	
		3	31.43%	34.29%	14.29%	20.00%	
		4	17.65%	35.29%	29.41%		17.65%
		5	14.29%	14.29%	28.57%		42.86%

In addition, those who identified as highly religious white people saw far less conflict than those of other races (Table 19)

Table 19. Survey questions: What is your ethnic or cultural background? Compared to how involved are you in religious activities within your community? And have you experienced conflicts between your religious beliefs and scientific teachings in school?

Race	Response	1	2	3	4	5
Black	1	66.67%	13.33%	13.33%		6.67%
	2	47.06%	17.65%	23.53%	11.76%	
	3	28.57%	35.71%	21.43%	7.14%	7.14%
	4	40.00%	40.00%	20.00%		
	5	14.29%		28.57%	14.29%	42.86%
Black Total		43.10%	20.69%	20.69%	6.90%	8.62%
Latino/a/x, H	1	78.57%	7.14%	7.14%	7.14%	
	2	42.86%	14.29%		42.86%	
	3	23.53%	5.88%	29.41%	35.29%	5.88%
	4	60.00%	40.00%			
	5	50.00%				50.00%
Latino/a/x, Hispanic, Chicano/a Total		48.89%	11.11%	13.33%	22.22%	4.44%
Mixed Race	1	81.25%	12.50%		6.25%	
	2	60.00%	20.00%	10.00%		10.00%
	3	57.14%	28.57%	14.29%		
	4	33.33%	33.33%	33.33%		
	5				25.00%	75.00%
Mixed Race Total		58.14%	18.60%	9.30%	4.65%	9.30%
Native/Indige	1	66.67%	33.33%			
	3					100.00%
Native/Indigenous Total		50.00%	25.00%			25.00%
Other	1		50.00%			50.00%
	2		100.00%			
	3			100.00%		
	4			100.00%		
Other Total			50.00%	33.33%		16.67%
White/Cauca	1	77.68%	15.18%	5.36%	1.79%	
	2	59.52%	30.95%	9.52%		
	3	37.50%	41.67%	12.50%	8.33%	
	4	37.93%	34.48%	13.79%		13.79%
	5	40.00%		40.00%		20.00%

Those who said they were more involved in their religious community also claimed they had the highest understanding of the theory of evolution (Table 20). Those who were most involved in their religious community had the least belief of scientific theory (Table 21). Of those responses, Highly religious females had far more difficulty understanding scientific theory than highly religious males. (Table 22)

Table 20. Survey questions: How involved are you in religious activities within your community? And how would you describe your understanding of the theory of evolution?

How involved are	1	2	3	4	5
1	1.81%	9.64%	18.07%	42.17%	28.31%
2	3.75%	12.50%	26.25%	47.50%	10.00%
3	1.45%	13.04%	28.99%	42.03%	14.49%
4	2.13%	8.51%	36.17%	25.53%	27.66%
5			20.00%	30.00%	50.00%

Table 21. Survey questions: How involved are you in religious activities within your community? Do you believe in the scientific theory of evolution? (eg. Darwin's theory of evolution)

How involved are	1	2	3	4	5
1	3.61%	4.82%	12.65%	19.28%	59.64%
2	6.25%	10.00%	23.75%	22.50%	37.50%
3	5.80%	20.29%	26.09%	20.29%	27.54%
4	6.38%	21.28%	8.51%	27.66%	36.17%
5	20.00%	25.00%	20.00%	10.00%	25.00%

Table 22. Survey questions: How involved are you in religious activities within your community? Do you believe in the scientific theory of evolution? (eg. Darwin's theory of evolution)

5 Female	25.00%	25.00%	25.00%	8.33%	16.67%
Gender Nonconforming (gender fluid, non binary, trans,...)					100.00%
Male	14.29%	28.57%	14.29%	14.29%	28.57%

Those that described themselves as actively very involved in their religious community had an increased sense of conflict compared to those who described themselves not involved at all on the same scale (Table 18 & 19)

Qualitative Results

Quantitative Theme Analysis

Table 23 depicts the theme analysis done on the open ended response question in order to quantify my qualitative data, the results showed that themes of creation were the most profound, respondents mentioned or referenced that religion and science intersect the most at the point of creation and evolution with 47.37% of tallied responses mentioning themes of creation. Additionally, a sufficient number of respondents also referenced themes of balance or contradiction between the two concepts with a 14-15% theme reference rate. Respondents noted themes of ideology and death/life processes as well but not in sufficient amounts. It is also noted that about 14% of respondents claimed that they did not know a point religion and science did intercept.

Table 23. Qualitative results quantified by theme in table.

Theme	SUM of # of times mentioned	SUM of # of time
Balance	17	14.91%
Contradiction	16	14.04%
Creation	54	47.37%
Death/Life	4	3.51%
Did not know an	16	14.04%
Ideology	7	6.14%
Grand Total	**114**	**100.00%**

Open-Ended Response Insightful Answers

Of the 138 responses analyzed, a few particularly illuminating responses included themes of arguments for the betterment of the world with one side of the conflict being in more power than the other, religious arguments around plausibility of the random configuration of the world, and arguments for fair balance between the two.
Student One shared,

"There is a balance and understanding that can be reached between science and religion, and they can build off one another, but there is also a lot of conflict between the two presently that is preventing that."

with another student adding on that,

"Religion doesn't have to be a spiritual belief in a higher power and that the teachings of religion can coexist with scientific advancement."

but that,

"Science can't teach morals."

Discussing the interconnectedness of science and religion, a third student shared,

"I think science and religion are inherently linked. When you think about the most important scientific discoveries in human history, a lot of the most notable people were religious. They were passionate about science because they were inspired by their religious beliefs, and I think there are plentiful examples of this. For example, Einstein rejected a conflict between science and religion, and held that cosmic religion was necessary for science."

Expressing a nuanced perspective, a different student mentioned,

"Science and religion intercent when it comes to the questions of the validity of a religious argument. Empirical evidence often refutes the teachings of religion, but religion and faith can also be evidence for societies and the ideas of sociology and the development as a human species."

Regarding the evolving role of religion, a respondent stated,

"Religion works well as a temporary substitute to explain what science cannot yet explain, but as technology and the knowledge of our surroundings grows and adapts, religion should too."

Another student with a similar perspective also expressed,

"Religion was our ancestors' answer to questions of science."

A final student also said that,

"I believe that science and its research is the driving factor of understanding our past. While I do not think that many parts of the Bible, for example, are applicable or true, it is still an important part of history, making it worth diving deep into."

Many students also made note of the plausibility of creation, a student suggested,

"Maybe when discussing the random probability of life, it can also be seen as a miracle, due to how unlikely it was to happen."

Finally, comparing the methodologies, a student observed,

"Mostly they are separate domains and use different approaches to understand the world. Science has rules, religion just makes up its own rules. Science has a process and a transparency that religion does not. Religion can serve psychological and spiritual needs, but cannot create vaccines and the like."

Acknowledging the potential synergy, another respondent remarked,

"There are a lot of things that we can't answer with science, and religion maybe can help bridge the gap. Religious evolution is not part of the science standards, so teachers are not supposed to teach it. However, they don't necessarily prevent anyone from learning religious stories about how things came to be."

Summing up the diverse perspectives, a final student concluded,

"I think both science and religion are beautiful and have their own purposes and both can help people."

Discussions

Findings

Quantifying Findings

The presented data implies a complex relationship between religious upbringing, educational influences, sociocultural factors, and cognitive experiences among students at Denver East High School. Students who identified as Atheist or Agnostic, despite having a strong understanding of evolutionary theory, were notably less likely to believe in the coexistence of science and religion in explaining life's origin. This suggests a potential divergence in perspectives between scientific understanding and religious beliefs within this subgroup. This also might suggest a predisposition against the compatibility of science and religion among those with a strong understanding of evolution, highlighting a potential confirmation bias where pre-existing beliefs about the incompatibility of science and religion shape the interpretation of evolutionary concepts.

The influence of family beliefs and religious affiliation, particularly among Christians, emerged as significant factors impacting students' views. The data suggests that Christian students, more than other religious groups, perceive their upbringing as significantly influencing their beliefs, indicating a potential strong alignment between familial and religious teachings.

Educational influences play a crucial role, with students advocating for balanced teaching perceiving bias in the presentation of evolutionary theory. The importance of fostering open dialogue becomes evident as students comfortable discussing religious beliefs and evolution in class reported fewer conflicts. However, encountering different beliefs in the community had a limited positive affect, emphasizing the resilience of individual belief systems.

Sociocultural factors contribute to nuanced patterns, with Latino/a/x, Hispanic, Chicano/a students reporting fewer conflicts when their religious beliefs did not influence their understanding of science. In contrast, Black students, influenced by religious beliefs, found conflicts challenging but actively sought common ground. This suggests that sociocultural dynamics may intersect with religious perspectives in shaping attitudes toward science and evolution.

Compartmentalization and cognitive strain were observed, particularly among highly religious males who faced higher conflict than females. White individuals exhibited less conflict than other races, and those more involved in religious communities paradoxically showed a higher understanding of evolution but less belief in scientific theory. Highly religious females faced greater difficulty understanding scientific theory than their male counterparts, indicating potential gender-specific challenges.

In summary, the data reflects a nuanced interplay of factors influencing students' beliefs about science and religion. Understanding these dynamics has implications for designing inclusive science education approaches, fostering open dialogue, and recognizing the intricate intersections between personal beliefs and broader sociocultural contexts within the student population at Denver East High School.

Qualitative Findings

Quantitative Theme Analysis

The diverse demographic composition of the school, including a large white population and significant representation from Latino/a/X, Chicano/a, Hispanic, Black, and mixed-race populations, along with various religious affiliations such as Christian, Atheist/Agnostic, Spiritual, and other religions, may contribute to the varied responses in the theme analysis. The intersections of cultural backgrounds, religious beliefs, and personal perspectives within the sample population likely influenced the distribution of themes in the data. The results may

reflect the complexity and diversity of views on the relationship between religion and science within this educational setting, the predominance in the creation aspect might illuminate that my research question is widespread and greatly impacts the conflict between the two subgroups, religion and science have a great amount of intersection and overlap, but the ins and outs of creation are so conflicting and hard to understand that it creates the biggest intersection between the two, simply because we can't go back in time and figure out what happened, science has it's way of justifying it (that may at some points contradict it's own laws) and religion has it's way of justifying it (that may also break the laws of scientific study).

Open-Ended Response Insightful Answers

Each selected quote offers a unique and insightful perspective on the intricate relationship between science and religion. Student One's assertion about the potential for balance and understanding between science and religion provides a nuanced glimpse into the possibility of harmony amid existing conflicts. The quote encapsulates a desire for collaboration and mutual growth while acknowledging the current impediments. Another student's perspective on religion not solely being a spiritual belief but capable of coexisting with scientific advancement adds depth to the conversation, emphasizing the varied roles that religious teachings can play in shaping moral frameworks. The nuanced reflection on the interconnection of science and religion, considering both empirical evidence and faith as evidence for societal development, brings a sophisticated layer to the discourse, recognizing the complexity of these two realms. The quote about religion serving as a temporary substitute for scientific gaps and evolving alongside technological progress delves as well into the adaptive nature of religious beliefs.

The historical perspective asserting that religion was our ancestors' response to scientific questions adds a temporal dimension to the discussion, highlighting the enduring role of religion in human inquiry. The exploration of the inherent link between science and religion through notable figures and their inspirations for scientific discoveries showcases a fascinating interplay between faith and scientific pursuit. The notion of life's improbability as a potential miracle introduces a philosophical dimension to the dialogue, blending scientific probability with spiritual awe. The acknowledgment of science driving the understanding of the past, despite skepticism toward certain religious narratives, reflects a balance between critical thinking and appreciation for historical significance.

Comparing the methodologies of science and religion, the quote aptly highlights the distinctive approaches each domain employs, shedding light on the differences in rules, processes, and transparency. The consideration of religion bridging gaps in understanding where science falls short demonstrates a pragmatic recognition of the potential complementary roles these realms can play. Lastly, the concluding quote expressing the beauty and unique purposes of both science and religion encapsulates an appreciative and inclusive sentiment, recognizing the intrinsic value each brings to individuals and society. Together, these quotes offer a rich tapestry of perspectives, contributing to a more comprehensive understanding of the intricate dynamics between science and religion.

Conclusion

Fulfillment of Gaps in the Research

The localized influences on the formation of views among students at Denver East High School proved to be deeply divided and greatly evident. The demographic diversity among the students at the school has significant and obvious impacts in the consideration of the data, different demographics responded in different ways and through the study I was able to identify those factors and what might be causing them. The fulfillment of this gap in pre-existing research could prove as a valuable tool not just for the school itselves but for educators and parents alike to redress their teaching methods to expand understanding and acceptance of all theories without the cognitive strain associated with compartmentalization.

Implications

Human development is a delicate and complex topic, the findings of my study reflect that the isolation of different beliefs could cause more conflict in adolescents and adults that were taught in schools that religion and science cannot mix, in reality, the data reflected in my study shows that the wider sociocultural demographics have a huge effect on increased religiousness or belief in scientific teachings, students themselves are fully capable of understanding a topic as complex as scientific teachings and compartmentalizing it or not believing it and vice versa around religious beliefs . And while factors like ethnicity, race, age, religious affiliation and gender all play a huge role in the development of those beliefs, so does the teaching of them, at home and school. The findings illustrate that while scientific technology is expanding and belief in scientific theory is increasing, so is the desire for balance and understanding of both topics. In conclusion, the results of this study can spur educators and parents to extend their teaching style around evolutionary beliefs creating a more all-encompassing approach that would decrease cognitive strain in adolescents and balance the conflict-compatibility continuum between scientific and religious evolutionary belief patterns.

Limitations

The findings of this study are subject to several notable limitations that influence the interpretation and generalizability of the results. First and foremost, the available reach of the survey was restricted to Denver East High School, thus limiting the diversity of perspectives included in the study. The research did not encompass private schools, rural schools, religious schools, or different institutions. The absence of data from private institutions, for instance, prevents a comprehensive understanding of how different educational backgrounds might shape evolutionary beliefs. Moreover, the study focused solely on an inner-city, public school setting, excluding valuable insights from private and rural schools known for distinct educational approaches and sociocultural influences.

Geographically, the survey was confined to Denver and did not extend to other regions within Colorado, the United States, or globally. This regional limitation inhibited the exploration of potential variations in evolutionary beliefs influenced by diverse cultural, religious, or socio-economic factors. Understanding how such differences might impact students' perspectives on evolution remains unexplored due to the study's restricted regional focus.

Furthermore, the study primarily targeted high school students, limiting the generalizability of findings to other age groups. Extending the survey to include adults or younger age groups could provide a more comprehensive understanding of evolutionary beliefs across different life stages. A more expansive participant pool would enhance the study's applicability to a broader population, making the findings more representative of diverse perspectives.

Areas for Future Research

The limitations of this study serve as a catalyst for further research. The subject pool can be enlarged to include students from alternative schools. Future study can go beyond Colorado to cover other places in the United States and abroad. Research may be conducted on schools that promote other religions, such as Catholic schools. Studies could extend to other areas beyond Denver East High School using the demographic factors outlined in my research but also those not before studied including but not limited to political viewpoints, parents marital status, etc. As illustrated in this research, Separating science and religious beliefs can lead to higher cognitive strain. Future researchers could consider investigating the incidence of elevated cognitive strain among institutions in Colorado and abroad. Additionally the results could be expanded to include those outside of traditional

schooling into areas such as homeschooling. The implications can also be reflected onto older generations especially as the generation that participated in the study exits school and begins working, the data collected in the study and the instruments used can be used to collect a general census of the adult population and expand the understanding of scientific and religious beliefs gained in this study.

Acknowledgments

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