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STEM and Belief

UK university STEM students' engagement in belief diversity, with comparisons across the US higher education context







Lucy Peacock and Tiffani Riggers-Piehl

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1. Executive Summary

US research reveals a significant relationship between university STEM (science, technology, engineering and mathematics) disciplines and the development of students' religious or spiritual characteristics and interfaith competencies. Yet, in the UK, while university applications for STEM disciplines hit a record high, little research has considered belief diversity (defined as the diversity of religious, spiritual or non-religious traditions, positions or worldviews, including unbelief) in STEM, despite disparities in the number of STEM student applicants from religious backgrounds.

To better understand how belief diversity is perceived and experienced among STEM students, we conducted analysis on secondary survey data from UK and US studies into worldview diversity in higher education (HE), and interviewed 20 UK university STEM students.

Notable findings related to the **UK context** include:

- The religious and non-religious demographics of the STEM student population are reasonably representative of the student body at large, with a few exceptions. Despite this, many students perceive their university STEM departments to be dominated by atheist and agnostic worldviews.
- STEM students are more likely than their non-STEM counterparts to cite non-religious belief and political views as a 'top 3 influence' on their worldview.
- Studying STEM is significantly associated with perceiving and experiencing insensitivity and divisiveness on campus.
- Studying STEM is negatively associated with experiencing coercive behaviour at university; these students are less likely to feel pressured to change or hide their worldview. Our interviewees, however, share tendencies to *self*-censor their belief expression to avoid conflict or tension.
- Studying STEM is negatively associated with having provocative encounters that prompt students' to challenge their misconceptions and stereotypes.



- Between 2021 and 2022, while we measured no overall significant change in STEM students' belief development, there is some evidence that students are re-evaluating their commitments during the year. There are disciplinary differences; biology students demonstrated the largest proportional growth in their ability to reflexively construct their worldview in thoughtful dialogue with worldviews different from theirs, and mathematics students the largest decline.
- Among our interviewees, competing views related to religious and non-religious perspectives are rooted in the scientific principles of their disciplines rather than within interaction with other students.
- Some interviewees revealed a tendency to compartmentalise their belief and science identities. This risks inhibiting the reflexivity needed to meaningfully make sense of their worldviews in light of other perspectives.
- Engaging in informal interfaith activities, experiencing insensitivity on campus and citing philosophical tradition as a 'top three' influence on worldview is associated with growth in STEM students' belief development; self-identifying as non-religious and experiencing coercion on campus is associated with decline.



Findings related to a comparison across UK-US contexts include:

- US STEM students rank religious beliefs as far more influential in their life choices than UK students, reflecting the role of secularisation in the UK context.
- We can pinpoint disciplinary differences in the ways in which UK and US university STEM students perceive and experience their campus climates:
 - Both UK and US computer science and engineering science students indicated observing divisiveness more frequently than their peers in other fields.
 - UK students studying computer science reported hearing insensitive comments because of their worldview more often than all other fields besides engineering; US computer science students heard these comments more often than *all* other fields.
 - Coercion on campus is experienced differently in the UK and US settings; in the UK it is experienced most frequently among biologists and physicists, and in the US among computing and engineering students.
 - Provocative encounters most frequently occur among UK biology students, a trend inverted in the US, where such encounters most frequently occur among computer science and engineering students.
- US STEM students are much more influenced by campus climate variables (e.g. their encounters with diverse others – positive and negative – on campus) than UK students; insensitivity or coercive experiences are more impactful in the UK.
- In the UK, informally engaging with peers around belief diversity is the most important experience to SAWC, compared to curricular engagement (e.g. coursework examining different traditions) in the US.

The report closes with implications and recommendations for HE institutions, departments and STEM instructors. A future research agenda is proposed to address the growing need to better understand how to foster STEM HE spaces inclusive of belief diversity.

2. Introduction

This report presents findings from the 2022-23 project **STEM and Belief in UK and USA Higher Education**. The project sought to better understand how to foster Science, Technology, Engineering and Maths (STEM¹) environments inclusive of belief diversity (defined as any religious, spiritual, or non-religious tradition, position or worldview, including unbelief). In doing so, we can better promote meaningful university STEM opportunities for students across belief groups.

The findings address questions of how UK STEM students perceive and experience religious diversity in their courses, and measure how their attitudes and behaviours in relation to belief development change during one academic year in comparison to US STEM students. Through these questions we examine how UK STEM students' lived experiences of belief intersect with their identities as scientists. The report closes with implications and recommendations for fostering STEM higher education (HE) experiences inclusive of belief diversity.

Why is this research important?

Universities are undoubtedly influential sites for belief and attitude development, places where individuals from disparate backgrounds and experiences come together in shared spaces to learn new things. In the UK, trends over the past decade reveal a significant increase in HE student enrolments, from just below 2,000,000 in 2000/01, to over 2,800,000 in 2021/22 (HESA 2023a). Furthermore, record numbers of students are taking STEM subjects; acceptances to computer science degrees have risen by 50%, and engineering 21% since 2011 (Gov.uk 2021). Likewise, in the US, STEM enrolment has been rising slowly but steadily for the last decade (NCES 2023). However, there has been a dramatic increase in three distinct areas of STEM in the US when considering conferral of bachelor's degrees: degrees granted in computer science have increased by 144%, in engineering by 65% and biology/biomedical sciences by 46% (NCES 2023). We suggest that these growing and diverse spaces may foster attitudinal growth and development. Despite STEM applications being at an all-time high, efforts to promote inclusivity within STEM fields often overlook students' religious, non-religious and spiritual identities, with UK and US diversity initiatives prioritising closing participation gaps for women and black and minority ethnic (BAME) students. Latest UK STEM enrolment figures indicate that 46% of non-religious students enrolled in a STEM subject in 2020/21, surpassed only by Hindu (51%) and Muslim (49%) students. This figure drops for Buddhist (44%), Christian (44%), Jewish (37%), Sikh (40%) and spiritual (38%) students, as well as those with 'any other religion or belief' (45%) (HESA 2023b). Why some religious students are less likely to enrol in STEM courses than their non-religious peers is unknown, but in the US, research has found that some religiously affiliated adults are less likely than the religiously unaffiliated to recommend young people pursue careers in physics, biology and engineering due to religious concerns (Scheitle and Ecklund 2016).

Religion and belief are legitimate equality, diversity and inclusion (EDI) matters in STEM HE. Across UK HE, religion was excluded from analyses of the 'awarding gap' until 2020, despite research suggesting that Muslim students, on average, are less likely to receive a 2:1 in their degree than non-religious students (Loke 2020). Despite the All-Party Parliamentary Group (APPG) on Diversity and Inclusion in STEM recommending that religion and belief inequality in STEM education be further researched (APPG 2019), their most recent report fails to address these concerns (APPG 2020). Meanwhile, research continues to identify hostility towards Muslim students in general on UK university campuses (Scott-Baumann et al. 2020), and towards young Muslim academics within STEM (Avraamidou 2020).

Creating a positive campus climate for university students across belief diversity is increasingly important. While most religious students in the UK have a positive university experience, some encounter challenges. Weller, Hooley and Moore (2011) found that of 3935 students, 6% felt discriminated against or harassed because of their religion or beliefs; of these, the proportion was highest among Jewish students (27%), Sikhs (17%) and Muslims (14%). More recently, in 2017, the UK's National Union of

^{1. &#}x27;STEM' refers to the following academic subject areas, classed under the UK Joint Academic Coding System: agriculture and related subjects, biological sciences, computer science, engineering and technology, mathematical sciences, and physical sciences. Medicine and medical-related courses are excluded to align with STEM conceptualisations in our comparative US data source.

Students (NUS) survey of 578 Muslim students in further education (FE) and HE found that a third had experienced abuse or crime at their institution; one in five reported experiencing verbal abuse (NUS 2018). While there exists campus-based research into religion, interfaith relations, and discrimination, the question of how to foster an inclusive STEM university experience across belief diversity has been neglected.

Meanwhile, US research has shown that university subject, including STEM, influences students' religious, non-religious, and/or spiritual development. Astin et al. (2011) found that students who study 'pre-health majors' (undergraduate courses undertaken by students in preparation for medical school) tend to develop spiritual characteristics, including fostering a sense of meaning and purpose, while engineering students declined in this area. The study also revealed that technology, maths and engineering students' desire to care for others declined throughout their courses. Bryant (2007) noted gender differences, in that majoring in a scientific field has a negative effect on male students' spiritual development, with no effect on female students. However, newer research suggests that religious beliefs can reinforce STEM identities by helping students reconcile discrepancies in religious and scientific positions (Rodriguez et al. 2019).

Rockenbach et al. (2020) analysed data from the Interfaith Diversity Experiences and Attitudes Longitudinal Survey (IDEALS) US project, a national, longitudinal project exploring 20,000 university students' encounters with religious and worldview diversity and found that US students studying a STEM major are significantly less likely than non-STEM counterparts to value building bridges across religious divides. Riggers-Piehl, Lehman and Sandvall (2020) suggested that in the US, a historic rift between philosophies of science and religion may be at least partially related to such findings, when, using the same data, they found that students studying mathematics and statistics are more likely to develop a stronger worldview commitment during their first year of study than those studying other STEM fields. They further identified that students in other STEM fields have differential experiences regarding their religious worldview experiences in college. These relationships distinguished a fruitful area for scholarly investigation in a UK setting.

The current project is the first of its kind to academically explore these themes within UK STEM HE, at the same time generating international learning across two Western contexts about how to foster and promote a STEM education experience sensitive to, and inclusive of, belief diversity.

The UK and US: Religion and science in two Western higher education contexts

Across the UK and US, the relationships between science and religion, and religion and HE, look very different.

Secularity is on the increase in the UK. Results from the 2021 census of England and Wales marked, for the first time, fewer than half of the population (46%) self-identifying as Christian, a 13% decrease on the previous census ten years earlier, and a 26% decrease on 2001. Conversely, the proportion of the population self-identifying as having 'no religion' sits at 37%, a 12% increase on 2011 (Office for National Statistics 2022). Meanwhile, in the US, the proportion of Christians is declining; more than seven in ten adults still describe themselves as Christian, placing the US as home to more Christians than any other country in the world (Pew 2015).

Ecklund et al.'s (2019) Secularity and Science research, which drew upon survey research with more than 20,000 scientists around the world, as well as interviews with 600 of these, identified key differences between the UK and US scientific and HE contexts. In the US, scientists are significantly less likely than the US general public to 'believe in God' (36% and 92%, respectively), positioning religious scientists as the minority. Despite this, within HE, scientists regularly referenced the religiosity of students within their interviews, most commonly citing religious students to be evangelical Christians. The interview data suggested that US scientists make efforts to create undergraduate course content that "keeps religion from interfering in the science" (2019: 44).

In the UK the majority of scientists are non-religious; only 37% belong to a religious tradition, driven in part by Muslim and Hindu immigrant scientists (2019: 56). As the UK becomes less Christian and we see a rise of non-religion as well as religious diversity, researchers assert that opinions on the relationship between science and religion and more polarised in the UK than any other context they studied (2019: 59). Similarly, they remind us that we might reasonably expect a disconnection between the views and experiences of older, white, Christian scientists and their more religiously and nonreligiously diverse science students (2019:77).

Reflecting these contextual differences, UK and US HE institutions have unique features. Historically, the UK university had religious foundations, providing education for Christian men in the 11th-13th centuries. These days, there are upwards of 150 universities with

degree awarding powers in the UK, and institutions can be largely broken down into three 'types', a merging of Guest et al.'s (2013) typology, which built upon the work of Weller (2008) and Gilliat-Ray (2000): 'Cathedrals Group' universities which have an explicit Roman Catholic or Anglican/ecumenical ethos, 'traditional elite' universities with a historical context shaped by Christian traditions, and 'secular' universities. We use the term 'secular' in a broad sense here, rather than suggesting that these institutions are explicitly secular by ideological choice. These universities might vary in their inclusion of theology and religious studies as a subject area, from long-established centres of excellence in theology, to universities that exclude theology from their curricular, to those that do not appear to have an opinion on the academic study of religion. For the latter, we might expect religion to play no formal part in university policy, aside from being recognised as part of the 'student experience' (Guest 2015).

As in the UK, many colleges and universities in the US began deeply rooted in Judeo-Christian ethics. As time passed and the US expanded geographically, so did the reach of secularity, and the need for increased knowledge (e.g. beyond ministerial, legal, and educational training). This led to the expansion of the state college system, while private religious and secular colleges expanded as well. While passage of different laws in the US endeavoured to improve access to HE for all its citizens, and while religion has been a protected class for employers in the US since the passage of the Civil Rights Act of 1964, US college campuses have not always been welcoming places for those who identify outside of a Christian identity. In the twenty-first century, we observe increased efforts across college campuses to accommodate religious and spiritual practices for all students to increase their sense of belonging on campus.

Research Methods

We adopted a mixed methods approach, comprising secondary data analysis from two surveys, and the collection and analysis of new data through 20 semistructured interviews with UK university STEM students.

Quantitative Analysis: We conducted secondary data analysis of data from two survey sources. We had access to data collected as part of the IDEALS UK research (Peacock et al. 2023), a 2020-23 project that captured the views of 8,019 UK university students across a survey taken at two time-points (2021 and 2022). Sections 3, 4 and 6 of this report present analysis of these data collected through the second time-point, representing 4,619 students (1,847 enrolled in STEM). These sections explore the nature of belief diversity in STEM, perceptions and experiences of STEM department inclusivity, and the place of secularity in UK STEM education in comparison to other UK university subjects (medicine/medical-related degrees, arts and humanities and social sciences).²

We also had access to a portion of survey data collected for the 2015-2019 IDEALS US project, upon which IDEALS UK was adapted five years later. The US data represent the views of 2,191 US STEM students collected in 2015 and 2016. In Sections 3 and 4, we use this data to better understand how STEM students' perceive and experience belief diversity across two very different HE contexts.

Section 5 explores UK students' belief development by adopting the approach of Riggers-Piehl et al. (2020), who examined US STEM students' self-authored worldview commitment' (SAWC), a measure used in the IDEALS US and UK surveys to represent students' reflexive ability to construct their own worldview position in thoughtful negotiation with worldviews different from theirs (Mayhew et al. 2023; Selznick et al. 2022). For this analysis, we consider a smaller sample of STEM students from the IDEALS UK project: 391 students who completed *both* surveys in 2021 and 2022. For this sample, we address the question of how their SAWC *changes* during university, comparing the findings with Riggers-Piehl et al.'s (2020) analyses of the 2,191 STEM students who took part in the original IDEALS project.

^{2.} We use the 0.05 significance level (p, standard in social science research), unless noted, when reporting our findings, meaning that we can be 95% confident that findings have not occurred by chance.

Although UK and US HE sectors represent different contexts in terms of secularisation and organisation, we nonetheless found value in these comparisons as existing research indicates similarities in the polarisation of religion and science in UK and US. While our ability to make meaning across the comparisons is somewhat limited by contextual differences, our findings add to the body of knowledge about STEM and belief in HE contexts and will expand future research agendas. **Qualitative Analysis:** To complement the secondary data analysis, we undertook 20 semi-structured interviews with UK STEM university students (undergraduate and postgraduate) across belief backgrounds.³ The interviews explored, a) the nature of participants' belief commitment, framed in terms of SAWC, b) the ways in which participants' beliefs influence their identities and experiences as scientists, and c) how participants' routine experiences of STEM on campus (e.g., lectures, lab work) foster or hinder their perception of their STEM field as inclusive of belief diversity. Throughout the report, these data are used to add meaning to the survey analysis, with our interviewees' responses denoted using pseudonyms to protect their anonymity.



3. For a full breakdown of interviewee characteristics please see the appendix.

3. STEM students' diverse religious, non-religious and spiritual perspectives

The 2022 IDEALS UK survey provided an opportunity to compare the religious and non-religious demographics of UK university STEM students (1,847 students), in relation to the wider UK student population (4,619 students).⁴ At first glance, breaking down the belief diversity within the STEM student population seems straightforward. However, further analysis indicates that students' religious, non-religious and spiritual belief perspectives are not as easy to categorise as one might assume.



Chart 1: Breakdown of UK STEM students' religious and non-religious worldviews 2022

Chart 1 shows that just over half of STEM students identify as non-religious (51%), including atheist, humanist, nonreligious, and 'none', slightly more than the all-student average of 48%. Just under three in ten STEM students identified as Christian (28%), including those who are Protestant, Roman Catholic, Orthodox and Mormon/ Latter Day Saints, less than the general average of 32%, and echoing the official enrolment figures' indication that Christian students are underrepresented in STEM. The proportions of students identifying as Buddhist (1%), Hindu (3%) Jewish (1%), Sikh (1%) align with the all-student averages, however there are fewer STEM students identifying as Muslim than the general student population (7%, compared to 8%, respectively). In both STEM and across the HE sector in general, 8% of students identify as 'another religion or belief', including 'spiritual', significantly higher than the most recent Higher Education Statistics Agency (HESA) figures, which list 2% of students as spiritual, and 2% as 'another religion or belief.

The religious and non-religious demographics of the STEM student population are reasonably representative of the student body at large, but do STEM students' perceptions of diversity within their courses align with this? The short answer is not always. Whilst there will be variation from the averages at different institutions, our interviewees' responses to the question, 'as far as you are aware, how would you describe the religion and belief diversity across the student body within your academic department?' suggest that perceptions of belief diversity may not accurately reflect reality. Whilst some of our students recognise diversity, describing the student body as "relatively" or "very" diverse, or saying that there is "loads of diversity in terms of... religious worldviews", others hold the perception that non-religious views dominate their courses and departments. Typical responses along these lines include, "amongst the student population, there's definitely a driving assumption of atheism", "students are very much atheist / agnostic, that kind of thing", and "I think we know of one Christian, two Jewish people and that's it".

^{4.} The IDEALS UK 2022 survey data provide the most recent record of UK student religious and non-religious perspectives. Here, we used "weighted" data from the 2022 study in order to represent the national population of students in the UK; in other words, we applied a calculation (that considers multiple variables including gender identity, religion/belief, etc.) and applied that to our dataset to better estimate all students in the UK. For more information about the weight used in this study, see Peacock et al. (2023).

Whilst it is tempting to ascribe an individual's religious or non-religious identity to a single tradition, the reality of religious identity is complex, including the fact that many students in the UK have intersectional identities (e.g. international students' religious traditions may mean something else outside the UK context, or they may have a religious identity by culture but not by practice).⁵ The survey asked students to select the best descriptor of their religious or non-religious identity with the following options: 'religious and spiritual', 'religious, but not spiritual', 'spiritual, but not religious', or 'neither spiritual nor religious'. Students were also able to select 'not sure'.



Both religious	Religious, but not	Spiritual, but not	Neither spiritual	Not sure
and spiritual	spiritual	religious	nor religious	
21%	14%	20%	36%	9%

Breakdown of UK STEM students' religious/spiritual affiliation 2022

Despite over half of STEM students identifying as 'non-religious' when given a list of traditions, only 36% described themselves as 'neither spiritual nor religious'. Comparing religious or non-religious tradition alongside students' religious-spiritual leaning paints a nuanced picture of the internal diversity of STEM students' religious and non-religious identities. Just taking the 51% of students who identified as 'non-religious', only seven in ten within this group (70%) described themselves as 'neither spiritual nor religious'. Indeed, just under two in ten (19%) described themselves as 'spiritual but not religious', and a further 8% were 'not sure', indicating that non-religious students' spiritual identities are far from clear-cut. Furthermore, at least 10% of students idenitfying as Buddhist, Christian, Hindu and Jewish described themselves as 'neither spiritual nor religious', indicating that some categories we might normally use to describe religious perspectives are, for the holder, more likely to be associated with culture or family background, to name just two examples. The group with the greatest proportion describing themselves as 'both religious and spiritual' were Muslim students (61%), followed by Christian students (39%).

Examining the complexity of students' religious, non-religious and spiritual identity characteristics is vital to effectively breakdown stereotypes and challenge misinformation about what it means to be a 'Christian', a 'Muslim' or 'nonreligious', for instance, in a STEM university environment.

5. For a breakdown of UK STEM students' personal characteristics other than religion, please see the appendix.



Non-religious worldviews are more common among UK than US students

Whereas in the UK 36% of students identify as 'neither spiritual nor religious', and 21% as 'both religious and spiritual', in the IDEALS US sample, these proportions are almost reversed with about 28% of students identifying as 'neither spiritual nor religious' and almost 36% as 'both religious and spiritual'. Interestingly, the proportion of students identifying as religious but not spiritual (14% UK, 13% US) and spiritual but not religious (20% UK, 24% US) were similar, with the largest differences falling at the two extremes. This speaks to the strength of secular worldviews overall among students attending UK universities.

The survey asked students to identify the elements that they feel are most influential in shaping their worldview. Given a list of options (religious beliefs, non-religious beliefs, philosophical tradition, political views, family background and traditions, cultural background and traditions, social and/or socioeconomic background, ethnic/racial identity, gender identity and sexual orientation), students were asked to rank the first, second and third most influential element on their worldview. Comparing STEM students' and non-STEM students' responses, three elements were significant in whether they were chosen as one of students' top three influences.

First, religious belief was slightly less influential for STEM students than non-STEM students, with 27% of STEM students ranking it in their top three, compared to 29% of non-STEM students. Second, the opposite was true for non-religious belief; 25% of STEM students chose this in their top three compared to 21% of non-STEM students, a finding we might reasonably expect given that non-religious students are overrepresented in STEM. The final element that was significantly different between the two groups was political views, with 31% of STEM students ranking this in their top three influences compared to 28% of non-STEM students.

Despite a slightly smaller proportion of STEM students identifying religious belief as a key influence on their worldview, for many interviewees their religious perspectives were fundamental in choosing a STEM degree:

...for example, the soul, I'd only heard about it from my mum and other people and just around. But I was trying to find out, could there be anything that tells us where it is, or... how it works or if it actually relates to neurons and grey matter? That was quite a big deal, at least back in Year 9 and I think that did actually motivate me to look into stuff like all of this and watch a tonne of YouTube videos about it.

Aditi, female, Hindu physical sciences student

I think in Christianity humans are created with a purpose to do good in the world and to do the things that I believe God wants to see which very much includes social justice, equality and contributing positively to society and I think doing engineering is a really great way of doing that... my faith helps me to care about these things in a deeper way and prompts me to want to use my skills... for the benefit of others, that will be the thing that continues to motivate me now, to keep doing it and keep wanting to pursue this as a career.

Jenny, female, Christian (Protestant) engineering student

For Jenny, her belief continues to act as motivation to forge a career in her science. The connection between beliefs and subject choice highlights a need to recognise the potential transformative importance of religious belief among prospective STEM students in the UK and elsewhere.

Worldview influences in the UK and US

US STEM students rank religious beliefs as far more influential in their life choices than UK students, with 40% of US STEM students putting religious beliefs as a top 3 influence (compared to 27% of UK STEM students). STEM students in the US also relied more on non-religious beliefs than their UK peers (35% US, 25% UK). US STEM students ranked politics somewhat lower than their UK counterparts however, with only 19% of US STEM students putting their political views in their top 3 compared to 31% of UK STEM students.

4. University climate and UK STEM students: A narrative



In both the original IDEALS US project, and the recent IDEALS UK adaptation, students' experiences of, and engagement with, their university environment, or 'climate', was at the crux of their interfaith learning and development.

Using the IDEALS UK 2022 survey data, we explored the experiences of UK STEM students in comparison to those studying other subjects, identifying key relationships between studying STEM and perceptions of climate. The analyses indicate that studying STEM is associated with students perceiving that their university is divisive and insensitive towards different beliefs. Studying STEM has a negative relationship with perceiving that there is coercion on campus, so students don't tend to feel pressured to change or hide their worldview. However, we also find fewer opportunities in STEM for what we call 'provocative encounters', defined as interactions where "students' beliefs and identities are challenged in ways that enable learning and development" (Peacock et al. 2023: 7).

Recognising that the survey data relate to STEM students' views of the climate across their *whole university*, we asked our interviewees how they would describe the climate or atmosphere for religion, spirituality and worldview in their specific university STEM department, and what factors contributed to the department-specific climate. In combination, these stories paint a complicated, and at times difficult, picture of the climate for belief diversity in UK university STEM departments.

Divisiveness on campus

Given the survey finding linking STEM with perceptions of divisiveness, it is perhaps surprising that the majority of our interviewees drew on the term 'welcoming' when describing the general climate for belief diversity in their STEM department. Typical responses described the STEM environment as a "welcoming atmosphere", as "generally welcoming of worldviews", and one in which "everyone is welcoming and nobody disturbs anybody". For some, such as Anna, a female, Sikh engineering student, physical aspects of the environment contributed to its welcoming climate; she described the presence of a prayer room in her department as "a way of being welcoming and inclusive".

However, despite a general sense among our interviewees that students across belief diversity are welcome in their STEM departments, a climate that is perceived as welcoming by the majority may still be one in which divisiveness is experienced by some students who study within it.

The IDEALS UK survey analysis indicates that studying STEM is significantly associated with 'agreeing' or 'strongly agreeing' with the notion that there is a 'great deal of conflict among people of different religious and non-religious perspectives' and that 'religious and non-religious differences create a sense of division' at students' universities. In other words, STEM students are more likely to see their universities as places of religious and non-religious conflict and division. Chart 2 illustrates the stark differences between STEM students' responses to these statements compared to students studying arts and humanities and social sciences; almost three in ten STEM students reported feeling that religious and non-religious differences create a sense of division on their campus, compared to two in ten arts and humanities students. However, the sense of divisiveness is in fact even higher among students studying medicine or a medical-related degree, raising a question for future research.



Chart 2: Proportion of students who 'agree' or 'strongly agree' that there is divisiveness at their university, by subject area

Furthermore, given the growing secularity of the UK context, our survey analysis found that STEM students are somewhat more likely to 'agree' or 'strongly agree' that 'the world would be a safer place without religion' than their medicine, arts and humanities and social

science counterparts. With over a third of STEM students asserting this in the survey, religious STEM students are potentially faced with the challenge of overcoming this sentiment in their academic department.

STEM	Medicine and related degrees	Arts and Humanities & Social Sciences
35%	28%	31%

Proportion of UK university students who 'agree' or 'strongly agree' that the world would be a safer place without religion, by subject area

A few interviewees indicated that they had not experienced active conflict in their departments. John, a male Christian (Roman Catholic) psychology student, said "I am confronted with people with different beliefs than me all the time, which is absolutely fine, there is no active conflict". Zac, a male, Muslim (Sunni) physical sciences student, described divisiveness in his department as "not a huge issue" but noted that his experiences may differ were he to study a different scientific discipline, reflecting, "if I worked in biology, where... biology is used as more of a tool for certain atheist ideas in the modern world, then I'd have to do a lot more day-to-day reconciliation or defending".

However, others told us that they had experienced conflict first-hand. Chris, a male, Christian (Roman Catholic) biochemistry student, told us about "interactions with people who are more anti-religion when it comes to science... people who are doing STEM and they have certain viewpoints about, for example, the Catholic Church or just religion in general". Robin, a non-binary, Wiccan biochemistry student similarly shared that they felt attacked on the basis of their religious perspective, from other religious students as well as those who are non-religious:

I was talking to a Muslim student who... was determined that I worship Satan so she doesn't much like me anyway ... She entirely believes that everything in the Qur'an is fact and that it will always be fact and that it could never be wrong but she's doing a science degree... I don't know, it's really difficult because she's very much set in her beliefs and cannot see any other side of things, which I do find quite hard. But then on the flip side I've had someone that's completely atheist, doesn't believe in religion at all who is the complete opposite and is like, 'No there's no way religion can fit into anything' and I've clashed with them over a few things... I think when I've had issues with people that have different views to me it's normally the people that are very set in their ways and what they believe.

Our interviewees who discussed these topics grounded the division and conflict explicitly in relation to the scientific nature of the course, suggesting that STEM students may be predisposed to perceive divisiveness in their studies in light of contemporary debates about the relationship between science and religion.



Disciplinary differences: A UK-US comparison

When asked to consider how often they observed divisiveness in their academic departments, UK Students in computer science and engineering were more likely to say their campus was divisive compared to those studying biology. Students in computer science were more likely to report divisiveness compared to physical sciences, and those in physical sciences compare to engineering. While we noted a number of differences across academic programmes for US students, both UK and US computer science and engineering science students indicated observing divisiveness more often than biology students did. This speaks to the inherent research questions guiding the present study asking if there are innate differences by field that may help or hinder students' academic engagement if they are more or less engaged in their own religious or worldview practice while also engaged in certain areas of STEM study.

Insensitivity on campus

IDEALS UK researchers found that insensitivity on campus was related to declines in students' perceptions that they have things in common with those with different worldviews, and feelings of goodwill towards those with different worldviews (Peacock et al. 2023). When it comes to STEM students in particular, studying STEM is significantly associated with 'reading or hearing insensitive comments about your worldview' at university.

Chart 3 illustrates that across all courses, students are most likely to read or hear insensitive comments 'frequently' or 'all the time' from their friends or peers, although proportions reporting this are higher among students studying STEM or a medical or medicine-related degree. When it comes to students reporting that they read or hear insensitive comments from staff, however, there are notable subject-specific differences. The proportion of students reporting that that this happens 'frequently' or 'all the time' in STEM and medical or medicine-related degrees is close to double the proportion of students studying the arts and humanities and the social sciences. Moreover, despite the numbers being small, STEM students are the largest cohort who report being 'mistreated on campus because of their worldview or religion' (7%, compared to 6% in medicine and 5% in the arts and humanities and social sciences).



Chart 3: Proportion of students who read or hear insensitive comments about their worldview 'frequently' or 'all the time' from different groups

Most interviewees did not believe insensitive comments were an issue: "I don't feel like I'm mocked for being religious. I honestly don't" (Zac). Two, however, shared their experiences with insensitivity in academic departments, both concerning staff members. Vani told us that her lecturer described her to a classmate as a "big inconvenience" for rearranging a meeting due to a religious festival. Mali, a female biological sciences student whose doctoral research analyses how organisms use magnetite crystals to navigate the magnetosphere of the Earth, experienced insensitivity first-hand from staff members about her Pagan beliefs during a drinks outing after lectures:

Some of the staff... we were just having drinks after work... it just came up about crystals. One of the ladies is a geologist, so, studies the more physical aspects of crystals. And I was kind of like wearing an amethyst and other crystals. And they were discussing how people use crystals in the spiritual sense... being like, "oh yeah, it's all rubbish, isn't it?" And then one of the ladies turned to me and was like, "oh, you, you like crystals, don't you?"... I felt like trying to explain how it resonated for me and how it worked for me as a scientist, but it was too hard to explain, they probably wouldn't understand it anyway. So, I was just like, "oh, yeah, I just, I like them because they're pretty", because it was too hard to explain my feelings on the science behind it.

Mali's comments are even more meaningful in light of an additional survey finding; studying STEM is significantly associated with 'agreeing' or 'strongly agreeing' that 'religion is based on irrational ideas and superstitions'. More than a third of STEM students aligned themselves with this sentiment, compared to around a quarter of students studying medicine or a medical-related degree, or arts and humanities and social sciences, respectively.



STEM	Medicine and related degrees	Arts and Humanities & Social Sciences
35%	26%	25%

Proportion of UK university students who 'agree' or 'strongly agree' that religion is based on irrational ideas and superstitions, by subject area

Mali continued, saying that her lecturers "wouldn't have the patience really to listen or be open minded to a different perspective". Instances like these caused her to rethink her studies, as "pursuing things in science is going to be more difficult because I'm not going to have that feeling of being so welcome".

Mali's story reminds us of the potential ramifications of insensitivity on campus; the minority that experience insensitivity to this extent may reconsider their career plans, despite a passion for their science.



Disciplinary differences: a UK-US comparison

When we asked students how often they observed insensitive remarks on campus made by students and faculty or staff in their academic programs, UK and US Students majoring in computer science were more likely to indicate that they heard such comments or had been mistreated because of their worldview more than those in biology, physical sciences, and mathematics. UK engineering students also reported a more insensitive climate than those students in biology and physical sciences. These results were similar to those from the US engineering students who observed more insensitive remarks than their peers studying biology, physical sciences, and mathematics.

Coercion on campus

Coercion on campus is a term used to describe students' experiences of feeling pressured to change their worldview, listen to others' perspectives when they didn't want to hear about them, keep their worldview to themselves, and/or separate their academic experience from their personal worldview. In the IDEALS UK project, experiencing coercion on campus was found to lead to declines in students' belief development (Peacock et al. 2023), a concept we revisit more fully in the next section of the report.

Our analysis of the IDEALS UK data indicates that studying STEM is negatively associated with experiencing coercive behaviour at university. Illustrative of this, across all subject areas, STEM students are the least likely to report feeling pressured to keep their worldview to themselves 'frequently' or 'all the time'. This sentiment is perhaps surprising given the stories above, and is reflected in our interviews to a degree. Some students, such as Mali, "don't make particular efforts to hide" their worldview; she reflects that "I've come a long way from being completely secretive about my beliefs, and not telling anyone for fear of backlash and discrimination". Others agree that they don't go to lengths to purposely hide their beliefs, however it is something they still keep to themselves. Chris explained, "I'm not necessarily trying to hide it, but yeah I wouldn't necessarily be confrontational about it". Zac takes a similar stance: "I basically think if I keep my religion to myself, as in not that I hide it from people, that it's not a matter of common discussion and then there never seems to be any tension". In these cases, Chris and Zac, though not explicitly pressured to do so, are self-censoring their belief expression to avoid conflict or tension.

We directly asked our interviewees to what extent they feel comfortable expressing their religious or non-religious worldview in their department. Some students, such as Purti, a female, Jain biological sciences student, noted that her belief isn't pertinent to departmental conversations in general. She told us, "I've never felt embarrassed or ashamed of talking about my religion. I guess most days if I've gone into the department maybe the topic just doesn't even come up". This sentiment is echoed by Tyler, a male Christian (Protestant) physical sciences student, who reflected, "I wouldn't say I'm uncomfortable, I just don't always think it's massively relevant to explain myself in that way". Similarly, Bahiya, a male, Buddhist computer sciences student, described belief expression as "pragmatic", saying "it saves my effort and saves wasting anyone else's time, I'll only do it if asked, right? Or if relevant. I'm quite comfortable".

For others, comfort levels are situational, dependent on the person or people with whom they are interacting. Aditi, a female, Hindu physical sciences student, explained that she only expresses her beliefs "with closer friends in the department because it's more comfortable". Vani, a female, Hindu mathematics student, "would shy away from talking about it and wearing any of the clothes" when younger. She is now more comfortable, but it still "depends on the person". Lastly, there are those who feel that their comfort levels are not a departmental concern. Anna stated that "if there's any reason I don't feel comfortable, that's more down to me as a person than the department". For Anna, the onus is on the individual to navigate the climate for belief expression, rather than the department taking the steps to meet the needs of individuals who feel uncomfortable in the climate as it is.



Disciplinary differences: A UK-US comparison

When asked if they felt pressured to change their worldview or keep it to themselves, UK biology students indicated more agreement than those studying engineering and computer sciences. Likewise, UK students studying physical sciences reported higher levels of coercion than those in engineering. These patterns did not align as closely with the US sample, where computing and engineering students were more likely to feel coerced then peers in biology, maths, and physical sciences.

Provocative encounters

Students' comfort levels have implications for the final aspect of university climate discussed here; provocative encounters. Provocative encounters occur during interactions "where students' beliefs and identities are challenged in ways that enable learning and development" (Peacock et al. 2023: 7). In the same way that studying STEM has a negative relationship with coercion on campus, so too is it negatively associated with provocatively interacting with others at university. In other words, STEM students are less likely than students of other disciplines to have had provocative encounters that lead to inter-worldview learning.





Chart 4: Proportion of students who engage in provocative encounters, by subject area

Chart 4 provides three examples of provocative encounters, illustrating that STEM students are consistently the least engaged in these kind of interactions compared with students studying other degree programmes. This is not to say that provocative encounters do not take place among STEM students; some of our interviewees hint that challenging discussions are taking place.

For Robin, such encounters happen after lectures, prompted by the lecturer expressing his own belief position in his teaching. She explained, "we had one lecturer flat out tell us, 'I'm a Christian, that will affect what I'm about to teach you' because he was about to teach us about a thing on ethics and stuff... We've had a lot of conversations with them outside of lectures about it". Nick, a male, Christian (Protestant) mathematics and physical sciences student, had a similar encounter; his topic supervisor, a Christian, integrated discussions around belief into their conversations: "we would have these two and a half hour chats, which were absolutely fascinating because we move from quantum mechanics to questions of freewill. We move from physics to philosophy, and then move from philosophy to discussions about the Bible". David, a male, agnostic biological sciences student, provided the example that came closest to the provocative encounters provided in the chart. He described that before university "I would have probably called myself like an atheist" who "knew concretely that there is no existence of a God". He assumed if he studied science at university he would encounter "mostly people who probably don't believe in God", however, he conceded that "the more people I've talked to who have more perspectives... and the more I learn, I kind of understand that it doesn't have to be like a complete opposite to that... both [science and religion] can exist".

Unlike the students above, many other interviewees had not witnessed, or engaged in, a provocative encounter. The reasons given for this were varied, and point to a difficult relationship between belief expression, student interaction and STEM climate. Kate, a female, atheist biological sciences student, described her department as "quite segregated", explaining that Christian students "do their own philosophical questions between themselves and probably the same for atheists... people are just scared to like actually talk about it or offend anyone". For Nick, the academic tone of the department prohibits this type of encounter: "people wouldn't want to get into these conversations because they haven't thought about it, and therefore, they don't want to embarrass themselves. There's always an academic pressure to come across as thought through and figured out". Lastly, other aspects of students' identities are at risk of being exposed and/or exploited when entering into a provocative encounter. Aleena, a female, Muslim (Sunni) biochemistry student travelled from Pakistan to study in the UK. Aleena avoids interactions that are potentially provocative out of concern for her reputation as an international student:

I usually don't discuss about my religion too much... I feel that if I tell them, they maybe criticise it, they maybe don't like it. And if they say such a thing, which I can't bear, I might be become so aggressive, and then things can get out of my hand... So I always take care of this thing, because I don't want to create any mess, or that other people start thinking like the people from my country are not good.

Whilst the IDEALS UK researchers advise caution in ensuring that provocative encounters do not spill over into interactions shaped by insensitivity and coercion, their findings showed that engaging in challenging conversations had a significant positive effect on influencing students' attitudes that Buddhists, Christians, Hindus, Jews, Muslims, Sikhs and religious people in general a) contribute to society, b) are ethical people, and c) are people who have things in common with the student. In their words, "having a reflexive capacity to review one's own assumptions in the face of worldview difference makes a significant difference to the likelihood of viewing religious groups in a positive way" (Peacock et al. 2023: 33). Now that we have further identified that STEM students are less likely to experience provocative encounters in their departments or during their studies, this begs the question, is informal and extra-curricular provocative encounter enough?



Disciplinary differences: A UK-US comparison

In the UK, biology students reported having more engagement others around the topic of worldview that challenged them to rethink their own or consider others' opinions about their worldview more often than those students studying computer science or engineering. This was inverted from our US results. In the US sample, computer science and engineering students, perhaps because of the other situations they experienced as reported in this section, reported more engagement around topics of worldview than peers in biology, mathematics, and physical sciences.

5. STEM students' worldview commitment: Reconciling diverse and competing belief perspectives during a year of university

Integral to the interfaith learning and development framework explored in our UK and US secondary data sources is students' self-authored worldview commitment (SAWC). Our framework representing 'belief development', SAWC is a measure of students' reflexive ability to construct their own worldview position in thoughtful negotiation with worldviews different from theirs (Mayhew et al. 2023; Selznick et al. 2022). This outcome is constructed in the UK and US IDEALS surveys as the extent to which students have a) thoughtfully considered other religious and nonreligious perspectives before committing to their current worldview b) reconciled competing religious and nonreligious perspectives before committing to their current worldview, c) talked and listened to people with points of view different to their own before committing to their worldview and d) integrated multiple points of view into their existing worldview.

Research into the influence of university study on SAWC has indicated that, in both the UK and US, university climate can act as a support and an inhibitor to students self-authoring their worldview. Namely, in both contexts, a university climate that is coercive, in other words, one in which students experience worldview-related pressure, limits students' ability or willingness to self-author their worldview (Mayhew and Bryant 2013, Peacock 2023). The previous section has illustrated that STEM students are less likely than their non-STEM peers to report experiencing coercion at university, begging the question, to what extent are STEM students self-authoring their worldview commitment during their studies?

Using the IDEALS UK data⁶, we analysed how UK STEM students' SAWC changed over the course of a single year at university (2021 to 2022), first by measuring overall change in relation to STEM discipline (biological sciences, computer sciences, engineering and technology, mathematics and physical sciences). We found no significant change in SAWC over the course of this year, and no difference between the disciplines. This was similar to the finding of the US study, wherein the researchers also noted no differences in change between their first (2015) and second (2016) surveys.

To determine if there were *smaller* changes in SAWC that were perhaps more difficult to detect at a general level, we followed the example of the US study and separated students into 'low', 'medium' and 'high' scorers. This method enabled us to identify movement in STEM student levels of SAWC over time. Overall, students in STEM tended to move either from medium levels to lower levels (7.4% of low scorers in 2021 to 8.7% in 2022), or from medium levels to higher levels (25.1% of high scorers in 2021 to 27.4% in 2022), indicating that across the board, students' university experiences and their impact on SAWC, can have drastically different outcomes.

Changes in students' SAWC were also distinct between scientific disciplines. Table 1 demonstrates that across disciplines, students in the biological sciences tended to move from medium to high levels (+4.1%), while engineering students moved from low to medium and high levels (+4.9% and +2.7% respectively). Students in mathematics moved out of medium into lower and higher levels with a smaller movement from medium to high (+3.2%), and demonstrated the largest proportional shift in the sample from medium to low (+12.9%), highlighting a potential propensity within the discipline to negatively impact students' interfaith learning. Finally, students in the physical sciences moved out of medium levels to low levels (+2.9%) and high levels (+2.3%). Changes in computer sciences were evident but too few students were in this group for us to make statistically sound conclusions.

^{6.} Earlier in this report, examining all responses from all IDEALS UK respondents, we used weighted data that estimated the population of all students in the UK. For the STEM specific analyses as well as those comparing the UK/US data, we examined the sample of students who responded to time 1 and 2 data only (n=391), unweighted, in order to have more accurate comparisons with the US data (Riggers et al. 2020) which was also unweighted.



Area of Study	Low	Medium	High
Biology (n=170)	+2.4	-6.5	+4.1*
Computer Sciences (n=38)+	-5.2	+5.2	N/A
Engineering (n=81)	-3.7*	+4.9*	-1.3*
Mathematics (n=31)	+12.9*	-16.2*	+3.2*
Physical Sciences (n=71)	+2.9*	-5.6*	-2.8*
* p<.05			

Table 1: Changes in SAWC by STEM discipline from2021 to 2022 (n=391)

These initial findings demonstrated that although there were no changes at the overall average level of STEM students' SAWC, students were certainly re-evaluating their worldview commitments throughout the time of the research.

SAWC within UK and US STEM education

In both the UK and US data, there are changes in SAWC levels by STEM discipline, with some students becoming more critically engaged with their worldview and others becoming less so. Patterns were different between the two contexts, however. In the US data, mathematics students showed the largest movement into high SAWC whereas in the UK they showed the largest movement to low SAWC. In the UK, 4% of engineering students moved out of the lower levels and into medium and high levels whereas in the US engineers moved out of medium levels into lower and higher levels. While we can't explain the differential movement itself, our results indicate that at the very least, there are changes in the extent to which students are self-authoring their worldviews within and across academic departments.

When asked whether they have been faced with having to reconcile competing perspectives related to religion and non-religion, interviewees drew on examples based within their own sciences to illuminate how they are self-authoring their worldview commitment during their studies; for them, competing views are rooted in the scientific principles of their disciplines rather than within interaction with others. Chris, a male, Roman Catholic biochemistry student told us how in his first year of undergraduate study, he moved from a "literal take" of the Genesis story of Adam and Eve to the realisation that "from a scientific perspective that doesn't really work and isn't as compatible". Ahmed, a male, Muslim (Sunni) biochemistry student told us of his struggles to reconcile the principles of quantum mechanics, which "change the world from a computable system to a random one", with the Islamic tenant that "everything's within God's control". Other topics that provoked students to self-author their worldview in (personal) conversation with competing views included evolution, the multiverse and artificial intelligence.

A minority of our interviewees were unable to provide an example of a time they had to reconcile competing perspectives during their studies, so we asked them why. Aditi, a female, Hindu physical sciences student, saw her identities as a Hindu and a material scientist as inherently independent of each other: "Hinduism is really broad so it doesn't specify anything to do with science... It's easy to be a Hindu student and study material science, I don't think religion plays a factor in it". Others, however, were aware of actively compartmentalising aspects of personal identity and university experience. Mike, a male, Christian (Protestant), computer sciences student stated, "I feel like a actually separate both", while Ahmed, a male, Muslim (Sunni) biochemistry student, reflected:

I think people definitely compartmentalise different parts, right. So when we're talking about biochemistry and computer science and mathematics, I really think religion is something that looks like a secondary requirement or a secondary trait of a person, right, at least when they're in university.

The previous section on provocative encounters explored how some STEM students self-censor their belief expression to avoid interactions out of fear of conflict or tension. Here we can see that students do a similar thing in relation to their SAWC. In this case, however, a tendency to compartmentalise their belief and science identities risk inhibiting the reflexivity needed to meaningfully make sense of their worldviews in light of other perspectives.

Predicting change: What influences growth and decline in STEM students' SAWC?

We determined that, although in general there was very little change from the first survey of students' SAWC to the second survey, students were moving *within* the measure. In other words, students are nevertheless growing or declining in their ability or willingness to selfauthor their worldview during their STEM studies.

Our next step was to identify the aspects of university life or personal characteristics that influence this growth and decline. We chose to analyse identity characteristics (including gender identity, sexual orientation, political affiliation, race/ethnicity, and of course, religious/spiritual worldview) that have previously been associated with students' worldview commitment, their specific STEM discipline, where they lived while at university, and then a set of campus experience and climates, including their attestation of how strongly their religious, non-religious, and philosophical beliefs influenced their life, their curricular and informal engagement with interfaith/spiritual/religious activities, and measures of campus climate, including those discussed in the previous section. We also included measures of university type (Cathedrals Group, divided into Roman Catholic and Anglican/ecumenical, secular and traditional elite) in order to control for institutional effects.

Notably, STEM discipline was not a significant predictor of change in SAWC. In other words, there was not one particular STEM area that was more or less likely to change SAWC when controlling for identity characteristics or university experiences. So, whilst Table 1 indicated that changes in SAWC are associated with certain disciplines (mathematics students demonstrating the largest proportion of students moving into 'low' levels of SAWC, for example), we would need to explain these changes in terms of the wider experiences students have in their departments, rather than concluding that certain STEM disciplines have inherent predispositions for growth or decline in students' SAWC. In fact, while it's possible that students' academic study may have a role in their experience (as we've outlined in section 4) there may be further experiences that are more salient to their self-authoring experience in the moment that better account for changes in their SAWC.



In terms of identity characteristics, it is perhaps surprising that gender identity, sexual orientation, political affiliation and race/ethnicity were not significant predictors of change in SAWC. Instead, just one secular/ religious identity was related to change in students' SAWC. Specifically, non-religious students showed a slight negative relationship, so are more likely to decline in their SAWC during the year. We interviewed one non-religious student, Kate, who, when asked if she has been faced with having to reconcile competing perspectives relating to religion and worldview during her studies, replied, "I don't think so, I'm trying to think. No". Conversely, students who indicated that philosophical tradition was a 'top three' influence on their worldview were more likely to increase in SAWC. Several of our interviewees discussed philosophical interests as influential in shaping their SAWC; two Christian students reflected:

In biological fields... there is a lot about the natural environment that we don't understand in that much detail... so it definitely got me thinking quite a lot of philosophical questions and whether they have space in that kind of environment.

John, male, Christian (Roman Catholic) psychology student

My lecturers have been influential as well. They often drop in little sort of semi-philosophical quotes into their lectures.

Nick, male, Christian (Protestant) mathematics and physical sciences student

STEM students who engaged in informal interfaith engagement more frequently were more likely to report gains in SAWC. In the surveys, 'informal interfaith engagement' was represented by students reporting that they have a) socialised with someone of a different religious or non-religious perspective, b) had conversations with people of diverse religious or

non-religious perspectives about the values they have in common, and c) had conversations with people of diverse religious or non-religious perspectives about their different values. Our interviews point to a lack of general conversation about belief diversity in STEM departments, suggesting informal interfaith engagement happens among a minority. When asked the extent to which conversations about religious and non-religious diversity happen among peers, typical responses included, "I'm struggling to think of any time that we've discussed this", "we rarely talk about it", and "for the most part I wouldn't say that like religion itself is discussed too much". In response to the question of why this is, students generally suggested that their department is not conducive for such conversations, stating "there's not the room for these kinds of conversations", "you're in the lab and... just getting on with it" and "the atmosphere that I can feel is more... practical so students just focus on their tasks".

Lastly, campus climate. Section 4 explored how students studying STEM are more likely to experience insensitivity on campus, and less likely to experience coercion. For the STEM students analysed in this section, experience of a coercive campus climate was associated with a decline in SAWC, echoing the finding across all students in the main IDEALS UK research (Peacock et al. 2023: 34). However, those who experienced insensitive campus climates were more likely to demonstrate gains in SAWC. We might expect that students who read or hear insensitive comments about their beliefs or worldview are faced with having to reconcile competing, or even conflicting, perspectives. However, previous research indicates that experiencing insensitivity can negatively influence other aspects of students' interfaith learning and development, including causing declines in students' feelings of goodwill towards, and commonality with, those with different worldviews (Peacock et al. 2023: 34-35). Our analysis indicates that interfaith learning and development outcomes are not mutually exclusive; making gains in one area of development can come at a cost of another, reflecting the often difficult path that students must navigate when engaging with matters of belief diversity.



Predictors of change: A UK-US comparison

In the US study, many more variables were found to be significant predictors of change than in the UK, however there was one variable that was similar between the two groups. Specifically, STEM students who ranked 'philosophical beliefs' as a top three influence on their worldview were more likely to increase in their SAWC over time.

None of the other variables that were predictors for the UK STEM students were predictors of change in SAWC for the US STEM students. Notably, US STEM students were much more influenced by campus climate variables (e.g. perceived worldview diversity on campus, experiences with a divisive or welcoming campus, and encounters with diversity) than the UK students, whereas when UK students encountered insensitivity or coercive experiences, they were more impactful. Likewise, UK STEM students found informal interfaith engagement to be more influential in affecting their SAWC whereas in the US, curricular religious engagement (for example, coursework examining different religious traditions) was the experience most influential on SAWC.

	Predictive of Changes in SAWC for:	
	UK STEM?	US STEM?
Worldview Influences		
Religious beliefs/perspectives	No	No
Non-religious beliefs/perspectives	No	No
Philosophical beliefs	Yes	Yes
University Experiences		
Curricular interfaith engagement	No	Yes
Formal interfaith engagement	No	No
Informal interfaith engagement	Yes	No
Campus Climate		
Perceived worldview diversity	No	Yes
Divisiveness on campus	No	Yes
Insensitivity on campus	Yes	No
Welcoming campus	No	Yes
Coercive experiences	Yes	No
Provocative encounters	No	Yes
Negative worldview interactions	No	No

6. UK university STEM environments: A secular space?

Christianity is declining in the UK, with non-religious views and other minority religious diversity on the rise. Universities can struggle to engage with this changing landscape, inhibiting meaningful discussions around religion (Dinham 2016). Earlier, we explored how some students avoid or, at the least, do not experience 'provocative encounters' that challenge their assumptions, noting that students compartmentalise aspects of their identities, actively keeping their 'religious self' from their academic endeavours. Moreover, despite finding that greater informal interfaith engagement leads to students more actively self-authoring their worldview positions, students do not view their STEM departments as places in which casual conversations about belief diversity can take place.

The IDEALS UK survey asked students the extent to which they agreed with the statement, 'universities are secular public spaces that function best when matters of religion and faith are excluded from them'. Four in ten STEM students 'agreed' or 'strongly agreed' with this statement, aligning themselves with this position slightly more than their peers.



STEM	Medicine and related degrees	Arts and Humanities & Social Scinces
40%	34%	37%

Proportion of UK students who 'agree' or 'strongly agree' that universities are secular public spaces that function best when matters of religion and faith are excluded from them, by subject area

To what extent, then, do religious STEM students perceive and experience this attitude on campus? In this section, we introduce students' *aspirations* for the role of belief diversity within STEM. In the introduction to this report, we mentioned the polarisation between religion and science in the public sphere. Our interviewees' responses echoed these polarised views, to a degree, within the HE context. When we asked our interviewees, 'What should an ideal STEM environment feel like and how does belief diversity play into this?', none suggested that religion be explicitly silenced. however, various responses aligned with the position that STEM spaces should be 'neutral'. Typical responses were "in a STEM space neutrality is much better" and "an ideal place would be one where there isn't really a preference for religion". Ahmed, a male, Muslim

(Sunni) biochemistry student reflected that "diversity exists but nobody really talks about it and nobody really cares, in a sense. I think it's almost a good, benevolent ignorance and we should just leave things as they are".

For other students, their 'ideal' is that religion and belief diversity is openly discussed and embraced. Notably, these students drew upon language around the compatibility of science and religion in their reasoning; for them an embracing of belief diversity in STEM is integral to scientific performance:

I think a STEM department should feel like a place that's open for discussion and debate... That's really needed when you're going into STEM, you need to be open to new possibilities... for discussions and debates on cutting edge research and how that relates to belief.

Mali, female, Pagan, biological sciences student

also, a critical mass of knowledge... basic knowledge of some of the key questions and some of the ways that people have tried to answer them". For Nick, these discussions are "absolutely fundamental", and although difficult to implement, "it's not impossible". Ahmed, a male, Muslim (Sunni) biochemistry student recognised that there ought to be "reasonable limits". He recognised that students "don't have much to lose by talking about these things" but that staff are "at a bigger risk of being cancelled if they do something wrong". Lastly, Zac, a male, Muslim (Sunni) physical sciences student, described his STEM department as "a microcosm of how society functions" in that there should be a "harmonious tension". For him, "we shouldn't secularise the workspace to the extent that people feel uncomfortable sharing their view if someone approaches them, but it also doesn't need to become speaker's corner".

What is clear to us is that, in the same way that students across belief diversity can experience their STEM environments in radically different ways, so too, can their aspirations for an inclusive STEM space drastically differ.

Belief diversity] makes STEM a more interesting environment because you interact with so many different people with different opinions... Within the STEM world where you are constantly coming up with experiments, with ways to test hypotheses, having different points of view and integrating them is actually enabling you to perform the science better because the ways you analyse situations differ.

Purti, female, Jain, student studying biological sciences

Lastly, students were cognisant of the barriers in trying to change departmental culture to be more inclusive. Nick, a male, Christian (Protestant) student studying computer science desires belief diversity to be openly discussed in his department, however notes "there has to be a critical mass of people willing to do it. And



Making change and encouraging prospective applicants

We closed our interviews by asking students what their universities can do to work towards their vision of an 'ideal' STEM department, as well as how universities can encourage STEM applications from students across belief diversity. Students' responses tended to fall under two overlapping categories: representation and dialogue.

Some students told us what representation means to them during their studies. Aditi, a female Hindu physical sciences student reflected, "I heard one of my lecturers during our lunch break talking about Diwali and sharing sweets with his research group. Me and my friend got really excited because we were like, 'Whoa, this lecturer celebrates the same thing as us' and that felt so cool. We just felt very represented then". Bahiya, a male, Buddhist computer science student, would like to see departments visually recognise a wider variety of religious holidays, stating, "you might see things around Easter, you might see things around Christmas, you rarely see things around Diwali... I will happily say Merry Christmas and Happy Easter, like that's not the issue, the issue is the silence around the other ones".

Students want more visibility for minoritised religious identities, but also a recognition that STEM education is not exclusively for the non-religious. As Chris, a male, Christian (Roman Catholic) biochemistry student told us, "there is that sort of perception that if you're a scientist then you can't be religious and I think that makes a lot of people not want to go into STEM". Chris suggests that religious STEM students should "talk more about their religion and how that interacts with their research" so that "people from different backgrounds and worldviews can see that there is a place for them". In Mali's biology department, staff have held "women in STEM" events, as well as other events for minority groups. For Mali, a similar event in which "the focus is literally about our beliefs and how our beliefs can coincide with our studies" would help encourage "acceptance that actually, religious views don't necessarily always clash with STEM things". Lastly, Jenny, a female Christian (Protestant) engineering student, suggested that staff be encouraged to talk more casually about "the small acts" related to their beliefs, if applicable, such as "celebrating Christmas"; for Jenny, a cultural shift towards staff casually speak about their own beliefs without "losing respect within the science community" would send a message to students that they can safely do the same.

It's clear from these data that STEM students are interested in being in academic spaces where their full selves are being recognised and that includes their religious or spiritual identity, and that students are interested in including conversations around meaning and belief in their academic environments. However, students are also hesitant to do so, concerned – regardless of their secular or spiritual identity – that they will not be welcomed into the conversation. The following section offers implications and suggestions for these findings.



7. Implications and recommendations

The recommendations made here are based upon on analyses, as well as the ideas and suggestions of our interviewees.

- 1. Our campuses remain difficult places for STEM students across belief diversity. This will be increasingly true as non-religious and minority religious views grow in the UK. As Dinham (2016) points out, secularity itself can be distrustful of religious practice and for students who are ardent adherents, they may find that their campuses are becoming more insensitive or coercive, two qualities that we know are particularly impactful for STEM students.
- Recommendation: Create inclusive spaces. Do not schedule work on religious holidays (departments and instructors can liaise with chaplaincies to identify these), identify usable prayer spaces, allow students to wear appropriate religious clothing in the lab without remark. Departments and instructors should work with student faith societies to elect course representatives to act as liaisons, with whom students can freely discuss matters relating to belief and worldview.
- 2. Reasonably representative belief diversity does not do enough to challenge perceptions. To widen participation and retention of students across belief diversity, more proactive steps must be taken to challenge the perception that atheist views dominate UK STEM departments.
- Recommendation: Ensure visible and explicit diversity in departmental prospectuses (e.g. promoting images and quotes from visibly religious STEM students), open days and outreach events (e.g. recruit visibly religious students to act as 'subject ambassadors'). Across religious staff, normalise talking about religion informally, stating belief perspectives in online biographies, or mentioning religious perspectives, even briefly, in the classroom when the opportunity arises (e.g. around religious holidays).

- 3. Philosophical worldviews are important for STEM students who are developing their SAWC. Ranking philosophical beliefs as highly influential on worldview predicts increases in both UK and US students' SAWC. Bringing "big questions" into the classroom led our interviewees to reconsider their own beliefs, a key element in developing SAWC.
- Recommendation: Do not shy away from creating spaces which foster philosophical conversations (developmentally) but rather provide more of them. The 4C framework (culture, curriculum, co-curriculum, and community) as suggested by Braskamp et al. (2008) suggests that when staff enable students to ask big questions and provide opportunities to discuss philosophical topics, inside and out of the classroom or lab, they help enhance students' personal and professional growth. Institutions and departments should provide training and support to encourage instructors to confidently and safely facilitate conversation.
- 4. Informal interfaith interaction with peers is a valuable experience for the development of SAWC but is also a productive skill in a world which is becoming increasingly diverse. Teaching students how to interact across aspects of difference in safe environments will serve them well as they move out into their personal and professional spheres.
- Recommendation: Institutions should maximise opportunities for informal interaction. Institutions can offer events that allow students to hear from and interact with those from diverse worldviews and traditions. At the department level, creating open seating arrangements in socialising spaces maximises opportunity for informal conversation. Staff may also consider worldview diversity, among other aspects of difference, when pairing or grouping students in work teams. An anonymous survey of students at the start of the academic year would enable STEM instructors to better understand the worldviews represented in the classroom.

Future research agenda

As we consider the findings and implications from this study, we have identified three areas for future research:

- The interview data highlight the need to better understand the experiences of UK STEM students who report having difficulties around the topics of worldview diversity within their areas of study. This could be an avenue of study in the US as well.
- 2. The quantitative findings suggest there is more to be learned about disciplinary differences within UK STEM fields and how students are experiencing SAWC in terms of campus climate. Repeating the present study with a larger sample to better identify differences is an important future direction.
- 3. There is more to be learned about contextual differences between UK and US STEM fields. We suggest that further investigation into the roles that differences in religious/secular contexts and institutional differences play in students' experiences in STEM is warranted.

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Appendix

Identity characteristics of interview participants

Religious/non-religious perspective	Gender identity	Ethnicity	Discipline	Level of study
Agnostic: 2	Female: 10	Bangladeshi and Pakistani: 1	Biological sciences: 6	Undergraduate: 10
Atheist:1	Male: 9	Black African: 2	Biological and	Postgraduate (Masters): 6
Buddhist:1	Non-binary: 1	Chinese: 2	chemical sciences: 3	Postgraduate
Buddhist/Confucianist/ Humanist: 1		Indian: 4	Computer	(PhD): 4
Christian (Protestant): 3		Mixed: 1	Engineering and	
Christian		Other Asian: 1	technology: 2	
(Roman Catholic): 3		Pakistani: 1	Mathematical and physical	
Hindu: 2		Prefer not to say: 1	sciences: 1	
Jain: 1		White: 7	Physical sciences: 3	
Muslim (Sunni): 3			Psychology: 2	
Pagan: 1				
Sikh: 1				
Wiccan: 1				

Identity characteristics of STEM students in relation to all students (2022, source IDEALS UK project data)

Characteristic ⁷	STEM students	All students
Belief perspective	Non-religious: 51.1% Buddhist: 1.2% Christian: 28.1% Hindu: 3.2% Jewish: 0.9% Muslim: 7.2% Sikh: 0.4% Other: 7.9%	Non-religious: 47.7% Buddhist: 1% Christian: 31.4% Hindu: 2.5% Jewish: 0.6% Muslim: 8.1% Sikh: 0.7% Other: 8%
Home/international status	Home students: 86.9% International students: 13.1%	Home students: 85.9% International students: 14.1%
Gender identity	Female: 47.1% Male: 51.9% Other: 1%	Female: 55.6% Male: 42.7% Other: 1.7%
Sexual orientation	Heterosexual: 72.8% LGBTQI+: 21.6%	Heterosexual: 74.5% LGBTQI+: 25.5%
Ethnicity	Asian: 16.1% Black: 4% Mixed: 5.5% White: 73.1% Other: 1.2%	Asian: 15.4% Black: 5.6% Mixed: 4.1% White: 73.2% Other: 1.7%

7. Excludes students who selected 'prefer not to say'