Religiosity and identity interference among graduate students in the sciences

Christopher P. Scheitle [*], Ellory Dabbs

West Virginia University, United States

ABSTRACT

Individuals who hold an identity that is stigmatized in a particular social context will often, if possible, conceal that identity. While such concealment is intended to help the individual fit into that context, research has found that concealment often harms the individual's ability to form an identity and sense of belonging. The study presented here examines this dynamic as it relates to religious individuals in science. Past research suggests that being religious is a stigmatized identity within academic science and that many religious scientists conceal their religious identity to avoid that stigma. Using data generated from a survey of U.S. science graduate students and structural equation modeling, we examine concealment of religious identity among religious students and whether this concealment mediates a negative relationship between student religiosity and identification as a scientist. The analysis finds that religiosity is positively associated with concealment of religious identity, which itself is negatively associated with identification as a scientist. This study contributes to the sociological study of religion and science by shifting the focus away from epistemological conflicts and towards more social and cultural forms of religion-science conflict. These findings also contribute to research on identity conflict, stigma management, and the role of social identities in workplaces.

There is a tendency to focus on epistemological questions when considering the relationship between religion and science. More precisely, there is a tendency to focus on how religion and science are inherently in conflict with each other because of their competing truth claims (Evans and Evans 2008). Research has examined the dynamics of this supposed epistemological conflict across a range of units of analysis. At the individual level, much interest has been paid to the religiosity, or lack thereof, of scientists (Leuba 1916, 1934; Lehman and Shriver 1968; Ecklund 2010). The assumption guiding this research is that scientists will tend to be irreligious because they are highly exposed to the evidence and claims of science, which are assumed to undercut the competing claims of religion.

The potential for individual scientists to experience tension between religion and science, however, is not limited to competing claims about the age of the earth, the origin of life, or other empirical issues. A likely more salient form of conflict comes from social and cultural tensions between the professional culture of science, which might suggest to religious scientists that they do not fit within the norms of the profession. Indeed, Ecklund's (2010:43) study of religion among academic scientists found that "[t]he majority of religious scientists are rarely public with their colleagues about their views … because of the perception that other faculty in their departments think poorly of religious people and religious ideas." Ecklund (2010:43, emphasis in original) concludes that the culture of science, or at least the perceived culture of science, produces "a *closeted faith* and a strong culture of suppression" or concealment.

* Corresponding author. Department of Sociology and Anthropology, West Virginia University, PO Box 6326, Morgantown, WV, 26506-6326, United States.

E-mail address: cpscheitle@mail.wvu.edu (C.P. Scheitle).

At an individual level, this culture of suppression can be seen as resulting from competing or conflicting identities (Stryker and Burke 2000). Identity theory and research argues that an individual holds multiple identities at any one time, and these identities vary in their associated demands, meanings, and the salience that the individual places on them. Some of these identities will interfere or conflict with each other, which can lead to stress and the shifting of the individual's commitments to particular identities to relieve that stress (Burke 1991). In some cases, one identity will be stigmatized within the social context of another. In such cases, individuals are frequently tempted to conceal the stigmatized identity as a way to blend in. Research has shown, though, that such concealment ultimately often harms the individuals' ability to form a connection to that other social group (Beals et al. 2009; Newheiser and Barreto 2014).

The study presented here uses an original national survey and structural equation modeling to consider these dynamics among graduate students in the sciences. The first part of our conceptual and analytical model considers whether religious graduate students in the sciences feel the need to conceal their religious identity from others in their program. The second part of our model examines whether this concealment, as an indicator of identity interference, is associated with a weaker identification as a scientist. Putting these parts together, our analysis assesses whether religiosity, through identity concealment, hampers graduate students' adoption of their emerging identity as a scientist.

1. Identity interference and identity concealment

Identity can be understood as a "set of meanings that individuals attach to themselves" (Karelaia and Guillén 2014:205). These meanings often have a social component to them and can differ by which group the individual is interacting with (Tajfel 1982; Karelaia and Guillén 2014; Hirsh and Kang, 2016). Social identities are evaluated by the individual based on how the individual perceives other's reactions to their identity and how much they, as a person, value that identity. If the individual perceives one of their identities as less favorable to others, they will be less likely to share and develop that identity with others (Steinke 2013; Karelaia and Guillén 2014).

Identity interference, or identity conflict, occurs when an individual holds two or more identities that clash (Van Sell, Brief, and Schuler 1981; Settles 2004; Karelaia and Guillén 2014; Steinke 2013; Hirsh and Kang, 2016). Interference can happen when the expectations of an identity interfere with the individual's personal values, or when the expectations of an identity interfere with the expectations of another identity they hold (Van Sell et al., 1981; Ramarajan and Reid 2013). This is common in adults, who, for example, hold identities within their family, social groups, and work groups (Korte 2007; Ridgeway 2011; Ramarajan and Reid 2013; Steinke 2013). While multiple identities can be beneficial for learning and networking, when they interfere, this can have negative impacts on the individual (Van Sell et al., 1981; Settles et al. 2009; Ridgeway 2011). Interference often occurs when the expectations associated with one identity do not line up with the expectations of another identity (Steinke 2013; Karelaia and Guillén 2014). Interference leaves the individual with the task of navigating multiple identities in various situations, either complying with the norms of a given situation or resisting the norms of a given situation (Ramarajan and Reid 2013).

Identity interference has been associated with multiple psychological and physical symptoms (Van Sell et al., 1981; Settles 2004). Individuals who experience identity interference are often subject to increased stress, anxiety, low self-esteem, less satisfaction at work, tension at work, lack of job performance, lower satisfaction in family-life, depression, and multiple physical symptoms, such as increased heart rate (Van Sell et al., 1981; Settles 2004; Settles et al., 2009). Moreover, when individuals feel like the people they are working with do not share their identities, the performance of the group overall can suffer (Chowdhury et al. 2016).

An important indicator for assessing an individual's awareness of potential interference is whether they are trying to conceal one of their identities around representatives of the other identity group. If an individual is trying to hide one of their identities around representatives of an additional identity they hold, this suggests that the individual is responding to a belief that the former identity would be seen as violating their membership in the latter identity group. Some research has suggested that concealment of an identity is not simply an indicator of perceived identity interference, but actually amplifies that interference. That is, although concealment is seen by an individual as a way to prevent identity interference, concealment might actually fuel interference. As Newheiser et al. (2017: 341, emphasis in original), "although people may choose to conceal stigmatized identities to increase their chances of acceptance and belonging, identity concealment in fact *reduces* feelings of belonging."

2. Identity interference among scientists

As with any professional identity, the identity of "scientist" entails more than a set of technical skills and knowledge. It also entails assumptions about one's values, priorities, beliefs, and group loyalty. As Merton (1942: 126) noted, "[i]nstitutional symbols and values demand attitudes of loyalty, adherence, and respect," and scientists who cross these boundaries risk being perceived as or feeling like they are disloyal. This has been examined for other issues involving scientists. Several studies have examined identity interference among women and racial minorities who are underrepresented in many of the sciences (Settles 2004; Karelaia and Guillén 2014; Quinn and Chaudoir 2015). Individuals belonging to these underrepresented groups are often made aware of negative stereotypes concerning the group's abilities to be successful in science (Lane et al., 2012), or at least aware that these groups do not represent the demographic norm in science (Murphy et al. 2007). Such stereotypes and perceptions of marginalization can produce a stigma surrounding an individual's identification with those groups.

The more that an individual identifies with the part(s) of their identity they see as stigmatized within science, the more they are likely to experience the negative consequences of identity interference (Settles 2004; Steinke 2013; Hirsh and Kang, 2016). When possible, individuals will conceal identities seen as conflicting with their identity as a scientist. These identities are concealed by the

individual because they anticipate being stigmatized or discriminated against because of this identity. This identity might not fit the stereotypical "mold" of a scientist but is still important to the individual's personal identity (Quinn and Chaudoir 2015). Living with a "concealable stigmatized identity" can cause major identity interference, especially for those in the sciences (Quinn and Chaudoir 2015: 36). These types of identities can include things such as parenthood, sexuality, racial identity (if not readily apparent), and religious identity (Ramarajan and Reid 2013; Hirsh and Kang, 2016). Similarly, a scientist who is religious could be perceived by other scientists as violating the "organized skepticism" that forms the scientific ethos and, in turn, threatening the boundary between scientist and non-scientist (Merton 1942).

3. Religion and identity interference among scientists

Studies of the public's stereotypical image of scientists have found that scientists' lack of religiosity is a key part of that image (Losh 2010). This image is at least in part driven by the many cultural messages suggesting that scientists who are religious are fundamentally odd. For example, when Francis Collins, a devout Christian, was appointed to be the director of the National Institutes of Health, a New York Times profile mentioned that "many scientists view [his] outspoken religious commitment as a sign of mild dementia" (Harris 2009). The article quotes several scientists concerned about having a devout Christian lead a scientific agency. These messages are reinforced by high-profile scientists, such as Richard Dawkins, who present religion and religious people as hostile towards and ignorant of science (Johnson et al. 2018). Such messages imply that a "real scientist" cannot be religious. For a religious graduate student in the sciences, these messages might understandably amplify tension between having a religious identity and developing a scientist identity.

Bolstering such anecdotal evidence is research showing that at least some religious groups are stereotyped in the general public as being less competent in science. Rios, Cheng, Totton, and Shariff (2015) found that non-Christians and non-religious individuals, whom are prominent among academic scientists, view Christians as being less competent in science. Interestingly, even Christians in this study recognized this stereotype, although they did not personally agree with it. This same research found that Christians who were exposed to the stereotype that they are less competent in science actually performed worse on scientific tasks than Christians who were not exposed to the stereotype. As the authors concluded (2015: 959), "Christians' awareness of the negative societal stereotypes about their group's scientific competence may be partially responsible for the underperformance and underrepresentation of Christians in scientific fields."

Research like Rios et al.'s (2015) highlights the fact that even when a religious science student does not encounter instances of explicit or objective hostility from external sources, the awareness that they might be violating the ethos of science by also holding onto his or her religious identity could lead to feelings of identity interference and, potentially, the need to suppress the religious identity. Indeed, the feeling that one must suppress or conceal one identity in the presence of another identity is a key indicator of underlying identity interference.

4. Expectations

Based on the literature just reviewed, we can specify a few expectations concerning the linkages between religiosity, religious identity concealment, and professional identity among graduate students in the sciences. Our first expectation concerns the link between student religiosity and religious identity concealment. At first glance it might seem obvious to state that religious students will be more likely to report concealing their identity, as they would seem to have something to conceal while nonreligious students do not. However, we argue that such a hypothesis, if it is supported by the data, should not be quickly overlooked.

First, there are likely some identities that would not be associated with concealment among science graduate students, as there is no stigma associated with holding those identities. We hypothesize that religiosity will lead to such concealment, though, because of social, cultural, and professional messages that science students are exposed to which suggest that an individual cannot be a scientist and religious. Similarly, there are situations where individuals expressing nonreligious identities or views (e.g., atheists) face stigma and discrimination, particularly in more religious contexts (Edgell et al. 2006; Edgell et al. 2016; Scheitle and Corcoran 2018; Scheitle et al. 2019). In these contexts, it might be nonreligious individuals who feel more pressure to conceal their views.

Second, such a finding might be dismissed if the difference in concealment was dichotomous in nature, with the difference being between nonreligious and religious students and little variation in concealment within the religious students. However, if there are variations among religious students, with more religious students feeling greater need to conceal their identity, then this suggests that feelings of stigma increase as the saliency of the religious identity increase.

Finally, from an applied perspective, most would argue that students would ideally not have to conceal their religious identity regardless of how religious they are. That is, in an ideal world the relationship between religiosity and concealment of religion would be null.

Hypothesis 1. Religiosity will be positively associated with science graduate students' self-reported concealment of their religious identity.

If an individual feels that they must conceal part of their identity from individuals who represent another part of their identity, then they have likely internalized the belief that the two identities are in conflict with each other or at least the belief that *others* perceive the two identities as being in conflict (Steele 1997). A potential consequence of this internalized identity interference is a weakened attachment to one of the identities, as the individual comes to believe that they cannot fully embrace one of the identities while holding the other. In this study, this means that religious graduate students who feel a need to conceal their religious identity will be expected

to have lower identification with their identity as a scientist.

Hypothesis 2. Concealment of religious identity will be negatively associated with science graduate students' identification as a scientist.

Identification as a scientist has been shown to be associated with the related but distinct concept of self-efficacy as a scientist. This concerns students' belief that they can successfully complete tasks related to being a scientist. As might be expected, students who tend to have stronger identities as a scientist tend to also have stronger self-efficacy as a scientist (Chemers et al. 2011; Robnett et al., 2015; Stets et al. 2017). Given our expectations concerning religious identity concealment and weakened identification as a scientist, it would seem likely to expect a similar relationship between religious identity concealment and self-efficacy as a scientist.

Hypothesis 3. Concealment of religious identity will be negatively associated with a science graduate students' self-efficacy as a scientist.

Finally, if we combine Hypothesis 1 with Hypothesis 2 and 3, we can specify an indirect relationship between religiosity and identification and self-efficacy as a scientist. That is, if religiosity is positively associated with religious identity concealment and that concealment is negatively associated with a graduate student's identification and self-efficacy as a scientist, then religiosity will have a negative indirect association with those outcomes.

Hypothesis 4. Concealment of religious identity will mediate a negative relationship between graduate student religiosity and their identification and self-efficacy as a scientist.

5. Data

The data used in this study come from a survey designed and fielded by the authors and supported by funding from the National Science Foundation. The sampling for the survey occurred in two stages. The first stage of building the sample frame consisted of selecting programs across five disciplines: biology, chemistry, physics, psychology, and sociology. The top sixty graduate programs in each of five disciplines were identified using rankings from US News and World Report. Then, each discipline's top sixty programs were stratified by rank into four tiers of fifteen programs each. Three programs were then randomly selected from each tier. This resulted in twelve programs for each discipline. The intent of this stratification was to account for potential material and structural differences that could shape the identities of graduate students and also the different "moral orders" or "social worlds" that have been found across tiers of academic departments (Hermanowicz 2005).

The second stage of building the sample frame consisted of identifying graduate students in the programs selected in the first stage. The authors took the programs selected during the first stage and extracted graduate student information from the programs' online directories. If a program did not have an online graduate student directory then it was replaced randomly by another program in the same discipline-tier stratum. This produced a sample frame of 6466 graduate students. A couple of the departments selected for the sample appeared to offer terminal master's programs in addition to a PhD program based on their websites, but the overwhelming majority of programs appeared to be PhD-focused. Indeed, on the survey 98% of the students reported that they were in a doctoral program, with the remaining 2% representing students saying they were in a terminal master's program or some other type of program (e.g., dual-degree).

The authors then randomly selected 800 students from each discipline for a total sample of 4000 students. Note that this represented disproportionate sampling across disciplines, as the total number of students varied across each discipline (e.g., there were fewer sociology students in the sample than biology students, so the 800 represented an oversample of the former and an undersample of the latter). Weights were constructed after data collection to account for both this disproportionate sampling and response rate patterns. These weights return the estimated proportions across gender-discipline-tier strata in the survey responses to those observed in the full sample frame.

The survey was distributed through email, with each selected student receiving a unique URL. Each student was offered a $5 Amazon.com gift code as an incentive for completing the survey. Following an advanced notice email, an email with the URL, and two reminder emails, the survey received 1307 complete responses and 72 partial responses for an overall response rate of 35.9% (American Association for Public Opinion Research Definition #4)(AAPOR, 2019).

6. Measures

Religiosity. We utilize three items from the survey to measure graduate students' religiosity. All three items were taken directly or slightly adapted from existing, widely-used surveys, such as the General Social Survey. The first item asked, "Apart from weddings and funerals, about how often do you attend religious services these days?" Responses ranged from (1) More than once a week to (6) never. Responses were recoded so that higher values represent more frequent attendance. The second item asked, "Independently of whether you attend religious services or not, would you say you are … (1) A very religious person, (2) A moderately religious person, (3) A slightly religious person, or (4) Not a religious person. Again, responses were recoded so that higher values represent greater levels of religiosity. The third item asked, "Please indicate which statement below comes closest to expressing what you believe about God. Would you say … ?" Responses ranged from (1) I don't believe in God to (6) I know God really exists and I have no doubts about. Respectively, these items represent dimensions of religious behavior, salience, and belief.

Concealment of Religious Identity. One item from the survey is utilized to measure graduate students' concealment of their

religious identity. This item asked, "How much do you agree or disagree with the following statement: I conceal or camouflage signs of my religious views or identity around people in my graduate program." Responses ranged from (1) Strongly agree to (5) Strongly disagree. Responses were later recoded so that higher values represent more agreement (i.e., a response of 5 was recoded to strongly agree, meaning more concealment).

Identification as Scientist. The analysis below considers two distinct but associated outcomes. The first outcome represents science graduate students' strength of identification as scientist. Three items from the survey are used to measure this concept. These items originate from other studies of identification as scientist among students (e.g., Chemers et al. 2011; Robnett et al. 2015). All three items asked students to respond to a statement on a scale of (1) Strongly agree to (5) Strongly disagree, although like the concealment variable, the items were recoded in the analysis below so that higher values represent stronger identification as a scientist. The first statement was, "I have come to think of myself as a scientist." The second statement was, "Overall, being a scientist has a lot to do with how I feel about myself." The third statement was "In a group of scientists, I really feel that I belong."

Self-efficacy as Scientist. The second outcome considered in the analysis below considers science graduate students' self-efficacy in the scientist role. This concept is also measured using three items. Specifically, we use three items from the Science Self-Efficacy scale developed by Chemers et al. (2011). Graduate students were asked to rate "the extent to which you are confident that you can successfully complete the following tasks …" on a scale from (1) Not at all confident to (4) Very confident. The first task was "Relate results and explanations to the work of others." The second was "Generate a research question to answer." The third task was "Publish research in peer-reviewed outlets."

Controls. In addition to the focal measures described above, the analysis below controls for students' discipline, number of publications, year in their graduate program, race, and gender. The survey's religious identity question asked respondents, "Religiously, do you consider yourself to be Protestant, Jewish, Mormon, Muslim, not religious, or something else?" Students were provided 16 possible responses including a "something else" response. As many responses had relatively few cases, they were recoded into five broad categories for this analysis: Christian, Jewish, Muslim/Hindu/Sikh/Buddhist, other religion, and no religion.

Discipline is accounted for a group of dichotomous indicators with biology serving as the comparison group. Also included is a measure representing "the number of articles, solo-authored or co-authored, that [the student has] published or have had accepted for

Table 1
Descriptive statistics (N = 1294).

	Weighted Mean or %	Linearized Std. Error	Min	Max
Religiosity				
Religious Person	1.6	.03	1	4
Religious Service Attendance	2.2	.05	1	6
Belief in God	2.7	.07	1	6
Concealment of Religious Views or Identity	2.1	.03	1	5
Religious Identity				
No religion	62.7%	–	–	–
Christian	24.6%	–	–	–
Jewish	4.3%	–	–	–
Muslim, Hindu, Buddhist, Sikh, Jain	5.6%	–	–	–
Other	2.9%	–	–	–
Identification as Scientist				
I have come to think of myself as a scientist.	3.9	.04	1	5
Overall, being a scientist has a lot to do with how I feel about myself.	3.6	.05	1	5
In a group of scientists, I really feel that I belong.	3.5	.04	1	5
Self-Efficacy as Scientist				
Relate results and explanations to the work of others.	3.2	.03	1	4
Generate a research question to answer.	3.0	.05	1	4
Publish research in peer-reviewed outlets.	2.7	.03	1	4
Publications	2.0	.09	0	5
Years in Program	3.9	.08	1	8
Discipline				
Biology	22.4%	–	–	–
Chemistry	28.1%	–	–	–
Physics	21.5%	–	–	–
Psychology	15.0%	–	–	–
Sociology	13.0%	–	–	–
Gender				
Female	44.6%	–	–	–
Male	53.5%	–	–	–
Other	1.9%	–	–	–
Race/Ethnicity				
Caucasian, White, European	62.0%	–	–	–
Black, African, Caribbean	3.6%	–	–	–
East Asian (Chinese, Japanese, Korean)	15.1%	–	–	–
South Asian (Indian, Pakistani, Bangladeshi)	5.5%	–	–	–
Hispanic or Latino	4.6%	–	–	–
Other or Multiracial	9.3%	–	–	–

publication in refereed journals." On the survey the respondents were able to enter any numerical value, which was recoded here due to the skewed nature of the responses so that 5 represents "5 or more publications." Year in program is measured from (1) This is my first year to (8) This is my eighth or more year. The survey asked students to select as many of the following race or ethnicities that apply to them: (1) American Indian or Alaska Native, (2) Black, African, Caribbean, (3) Caucasian, White, European, (4) Central Asian/ Arab (5) East Asian (Chinese, Japanese, Korean, Taiwanese, etc.), (6) South Asian (Indian, Pakistani, Bangladeshi, etc.) (7) Other. Because of small numbers of responses to some of these categories, these were recoded into the following for the analysis: (1) Caucasian, White, European alone, (2) Black, African, Caribbean alone, (3) East Asian alone, (4) South Asian, (5) Hispanic or Latino alone, (6) Multiracial or other race/ethnicity. The Caucasian, White, or European alone category serves as the reference group in the analysis. Finally, students were asked, "With what gender to you currently identify?" Possible responses were (1) Male, (2) Female, (3) Other. In the analysis below the Male category serves as the comparison group.

7. Analytic strategy

Given the presence of multiple measures of latent concepts in the data and the interest in the mediation, structural equation modeling was selected as an appropriate strategy for this study. Structural equation models (SEM) have two particular advantages for the purposes of this study. First, SEM combines structural estimation (i.e., relationships between predictors and outcomes) and measurement estimation (i.e., creating latent variables from observed items). Second, it allows for the simultaneous estimation of paths between multiple predictors and outcomes along with indirect effects through mediators. In short, rather than constructing latent concept measures separately and\or running multiple regression models and piecing out direct and indirect effects after the fact, SEM allows for this to be done within a single model.

The specific software used in conducting our SEM analysis is Stata 15.0. The analysis accounts for the sample structure and weighting through the use of Stata's complex survey data feature (*svy*). After removing cases with missing data on the items described above, the analysis examines 1294 graduate students in the sciences.

8. Results

8.1. Descriptive results

Table 1 presents descriptive statistics for all the survey items used in the analysis. We can see that the mean values for the three religiosity items leans towards the lower end of their respective scales. The mean for the religious person item, for example, is 1.6 with a range of 1–4. This would put the average religiosity of graduate students in these five disciplines between the "not a religious person" and "a slightly religious person" responses. The mean for the concealment of religious identity item is 2.1, which is also towards the lower end of the scale. This might not be particularly surprising given the average low religiosity among the students. We would
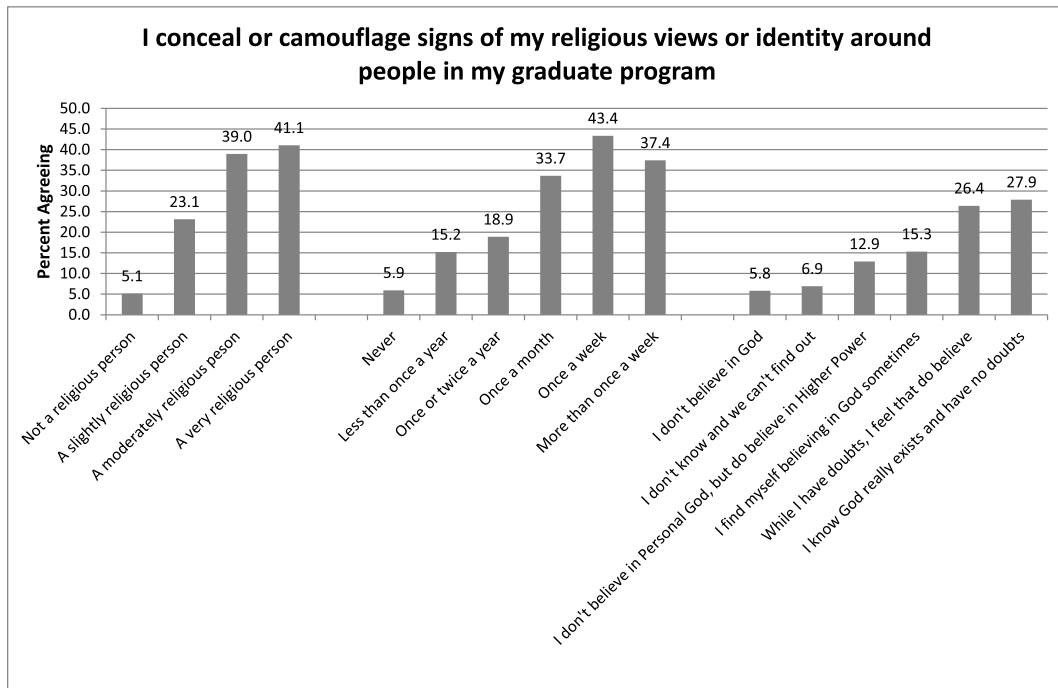

Fig. 1. Percentage of graduate students agreeing that they conceal their religious views or identity by individual measures of religiosity (N = 1294).

expect, though, that religious students would tend to score higher on this measure, a hypothesis which we will examine momentarily.

The means for the three items measuring graduate students' identification as a scientist are relatively higher than those for the religious items, ranging from 3.5 for the "In a group of scientists, I really feel that I belong" to 3.9 for the "I have come to think of myself as a scientist" statement. The three items measuring graduate students' self-efficacy as a scientist are slightly lower than these identification means. The students reported the most confidence on the "Relate results and explanations to the work of others" statement (mean of 3.2) and the least with the "Publish research in peer-reviewed outlets" statement (mean of 2.7).

Demographically, the students are 53.5% male, 44.6% female, and 1.9% identifying with an other gender identity. In terms of race and ethnicity, 62% of the students are Caucasian/White/European, 2.6% are Black/African/Caribbean, 15.5% are East Asian, 5.5% are South Asian, 4.6% are Hispanic or Latino, and 9.3% identify with an other race/ethnicity or multiple races/ethnicities. Chemistry graduate students represent the largest disciplinary group at 28.4%, followed by biology (22.4%), physics (21.5%), psychology (15.0%) and sociology (13.0%). The mean for students' number of years in their graduate program is 3.9.

Fig. 1 examines concealment of religion by the three items used to measure graduate student religiosity. We see that 5.1% (95% confidence interval = 4.4–7.8%) of students who reported that they were "not a religious person" agree or strongly agreed that they conceal signs of their religious views or identity around people in their graduate program. This increases to 23.1% (17.0–30.6%) of those students saying that they are "a slightly religious person," and increases again to 39.9% (30.7–47.9%) among students identifying as "moderately religious" and to 41.1% (28.3–55.1%) among students who report being "very religious." This pattern suggests that there is not a simple difference between religious and non-religious students in concealment, but that the tendency to conceal increases as the saliency of students' religious identity becomes greater. We see similar patterns of increases in Fig. 1 when looking at the religious service attendance and belief in God items.

8.2. Structural equation model results

Fig. 1 presents the standardized path coefficients of primary interest in this study. Table 2 presents every standardized path coefficient in the model, including those for the controls. The fit statistics for the model indicate a good fit ($SRMR = 0.03$), meaning that the proposed paths correspond well to the observed data (Bagozzi and Yi 2012; Schreiber et al., 2006). Note that some common fit statistics are not considered appropriate for SEM models based on complex survey data. However, if the model is estimated while ignoring the complex survey structure, these other statistics also indicate a reasonably good model fit ($RMSEA = 0.05$; $CFI = 0.92$).

Table 2
Standardized path coefficients for all predictors and outcomes in model (N = 1294).

Predictors	Outcomes			
	Religiosity	Concealment of Religious Identity	Identification as a Scientist	Self-Efficacy as Scientist
Religiosity	–	.43**	.02	.08
Concealment of Religious Views or Identity	–	–	-.08*	-.05
Religious Identity				
No religion (ref.)	–	–	–	–
Christian	.83**	.05	-.01	-.07
Jewish	.14**	-.03	-.03	-.02
Muslim, Hindu, Buddhist, Sikh, Jain	.26**	-.02	-.01	-.02
Other	.17**	.02	.02	.01
Publications	-.04	-.02	.13**	.27**
Years in Program	.03	.01	-.02	.16**
Discipline				
Biology (ref.)	–	–	–	–
Chemistry	.01	-.06	-.06	-.05
Physics	.01	-.04	-.04	-.21**
Psychology	-.01	.02	-.10**	.06*
Sociology	-.01	-.06*	-.27**	.07*
Gender				
Female (ref.)	–	–	–	–
Male	-.02	.03	.11**	.15**
Other	-.04**	.04	.01	.04
Race/Ethnicity				
Caucasian, White, European (ref.)	–	–	–	–
Black, African, Caribbean	.05*	-.04	-.05	02
East Asian (Chinese, Japanese, Korean)	.01	.03	-.05	-.07
South Asian (Indian, Pakistani, Bangladeshi)	.02	.02	.01	.03
Hispanic or Latino	-.05	-.03	-.01	-.01
Other or Multiracial	-.01	.01	.01	-.03
R^2	.72	.22	.12	.22

Model fit: Standardized root mean squared residual = 0.03; Note that, because the model takes into account the structure of the survey data using Stata's *svy* command, other traditional structural equation model fit measures are not considered valid. However, the same model estimated without taking into account the complex survey structure of the data shows acceptable levels of model fit on these measures (e.g., RMSEA = 0.05; CFI = 0.920); *$p < .05$ **$p < .01$.

Examining the measurement components of the model, we see that the three indicators of religiosity load well onto the latent concept with paths ranging from 0.80 to 0.91. The paths for the three indicators of identification as a scientist range from 0.58 to 0.80. The paths for the three indicators of self-efficacy as a scientist range from 0.60 to 0.73. Overall, these factors appear to be measured with satisfactory reliability (Bagozzi and Yi 2012; Matsunaga 2010).

Turning to the structural components of the model, we first see in Fig. 2 that religiosity has a fairly strong relationship to the concealment of respondents' religious identity ($\beta = .43$, $p < .01$). This relationship supports Hypothesis 1. Fig. 2 also shows that a graduate student's concealment of their religious identity is negatively and significantly associated with their identification as a scientist ($\beta = -0.08$, $p < .05$). This is *net of their religiosity*, which means that concealment itself is associated with a weaker identification with being a scientist. This finding supports Hypothesis 2. Concealment of religious identity is also negatively associated with graduate students' self-efficacy as a scientist, but this coefficient does not reach statistical significance ($\beta = -0.05$, $p = .18$). Hypothesis 3, then, is not supported, meaning we did not find a significant relationship between a graduate student's religiosity and feelings of self-efficacy as a scientist.

If we consider the model as a whole, we see that there is an indirect effect from religiosity to identification through the concealment mediator. Specifically, the standardized indirect effect is $\beta = -.02$, $p < .05$. This provides partial support for Hypothesis 4.

Before discussing these primary findings, we turn to Table 2 to briefly examine findings related to the other measures included in the model. The first column presents the standardized path coefficients for all measures in the equation for the religiosity latent outcome. We see that there are not significant disciplinary differences in graduate student religiosity relative to biology graduate students. We also find no significant differences related to students' years in their graduate program. The analysis does find, though, that science graduate students with an other gender identity are significantly less religious as compared to students identifying as female. We also see that, relative to white science graduate students, black students are significantly more religious.

The second column in Table 2 presents the predictors of religious identity concealment. Other than the positive association between religiosity and religious identity concealment, the only other statistically significant finding for this outcome is that sociology students are less likely than biology students to say they conceal their religious identity or views. The third column shows the results for the identification as a scientist outcome. Perhaps surprisingly, the analysis shows that years in the graduate program is not significantly associated with a student's strength of identification as a scientist. It might have been expected that the strength of this identity would increase with time in the program. The analysis does find significant disciplinary differences in students' identification as a scientist. Relative to biology graduate students, students in psychology and sociology have significantly weaker identities as a scientist. We also find that male graduate students in science have stronger identities as a scientist when compared to female students. The analysis does not find significant racial or ethnic differences in identification as a scientist, at least when compared to white students.

Finally, the last column in Table 2 presents the results for the self-efficacy as a scientist outcome. Unlike for the scientist identity outcome, we do find a significant positive association between years in the graduate program and self-efficacy. That is, science graduate students who are more advanced in their program feel more confidence in their ability to complete key tasks, such as generating a research question and publishing research. We also find some disciplinary differences. Specifically, physics graduate students report significantly less self-efficacy when compared to biology students. On the other hand, psychology and sociology graduate students report significantly greater self-efficacy when compared to biology graduate students. As with the scientist identity outcome, the analysis shows that male science graduate students report significantly greater self-efficacy relative to female students. We do not find any significant racial or ethnic differences in self-efficacy, though.
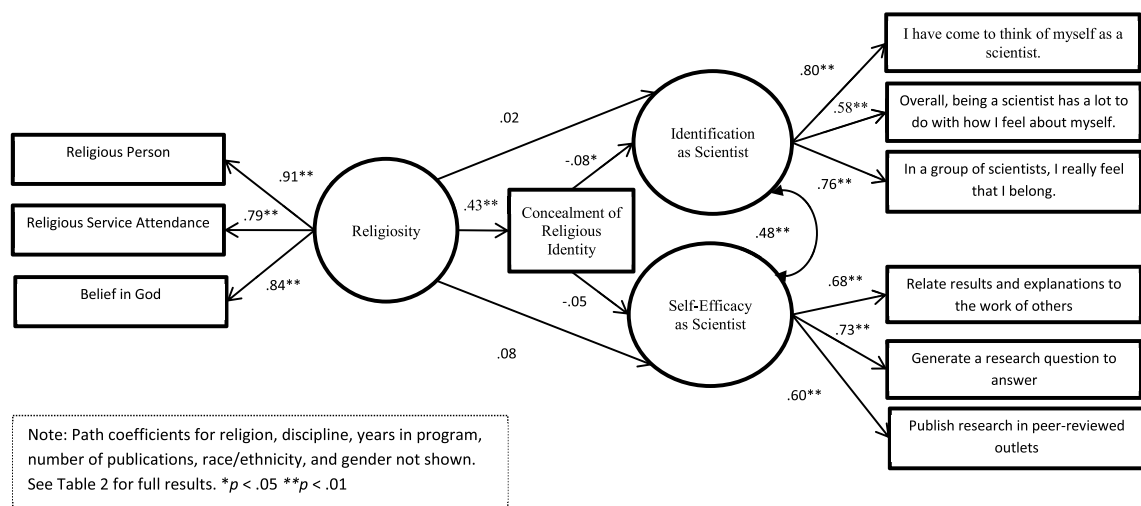

Fig. 2. Standardized path coefficients between religiosity, concealment of religious identity, identification as a scientist, and self-efficacy as a scientist among graduate students in five disciplines (N = 1294).

9. Discussion

We proposed four hypotheses based on past research and theory on identity concealment and identity interference. Some, but not all, of these hypotheses were supported. Our first hypothesis stated that religiosity would be positively associated with the concealment of religious identity among science graduate students. This hypothesis was supported. As seen both in the bivariate analysis shown in Fig. 1 and the structural equation model analysis shown in Table 2, the more a student attends religious services, the more strongly they believe in God, and the more strongly they think of themselves as a religious person, the more likely they are to say that they conceal their religious identity from others in their graduate program. That more religious students are more likely to conceal their religiosity seem unsurprising, it is worth remembering that many would argue that students should not feel a need to conceal important parts of their identity in graduate programs, whether it is their racial identity, sexual identity, or religious identity. Such concealment indicates that there is a concern about the consequences of others knowing that an individual identifies in a particular way, which should be concerning from a policy standpoint.

The second and third hypotheses stated that concealment of religious identity would be negatively related with a student's strength of identification with science and science self-efficacy. The former expectation was supported, as the analysis showed that, net of a variety of controls including religiosity, concealment of religious identity is negatively associated with a graduate students' strength of identification with science. On the other hand, the third hypothesis was not supported, as the findings did not show a significant association between concealment of religious identity and students' self-efficacy as a scientist. This is noteworthy, as it suggests that feeling like one must conceal an important part of their life harms an individual's willingness or ability to strongly identify with the social context or group perceived as requiring the concealment. However, this feeling of concealment does not appear to harm the individual's self-perceived ability to fulfill their role within that social context or group. In short, graduate students concealing their religious identity are less likely to strongly identify with science, but that does not mean that they think of themselves as less capable scientists.

The fourth hypothesis argued that religiosity would be indirectly negatively associated with student identification with science and self-efficacy as a scientist. This hypothesis was partially supported, as the analysis did find a significant indirect path from religiosity to concealment to identification with science but not from religiosity to concealment to self-efficacy. Again, it is interesting that religiosity, through its association with concealment of religious identity, seems to harm students' ability or willingness to identify strongly with science but not their confidence as scientists.

There are several other findings that are worth highlighting even if they were not the foci of this study's hypotheses. For instance, the findings in Table 2 show that black graduate students score higher on measures of religiosity relative to their white peers, net of other controls. Women also score higher on religiosity relative to men, although this finding becomes non-significant after accounting for women's greater affiliation with Christianity. Increasing the number of religious students in science is not a goal of many science educators, employers, and policymakers. These actors, however, have expressed interest in increasing the gender and racial diversity of the scientific pipeline (Allen-Ramdial and Campbell 2014; Griffin 2018). The greater religiosity of these students could indirectly be contributing to their ability to full adopt an identity as a scientist. Or, more accurately, *these students' perception that they need to conceal their religiosity among colleagues in science* could be harming their adoption of a scientist identity.

We also note that the analysis shows no significant differences in graduate student religiosity across disciplines. Previous theory and research have presented diverging arguments about disciplinary differences in religiosity among scientists. Some have argued that individuals in the natural sciences would be less religious given the presumed secularizing effects of science, while others have argued that individuals in the social sciences would be less religious because, in part, they have less scholarly distance from religion (Lehman and Shriver 1968; Thalheimer 1973; Wuthnow 1985; Stark and Finke 2000). As with more recent studies (Ecklund and Scheitle 2007; Gross and Simmons 2009), our analysis does not find any clear disciplinary differences in religiosity. The analysis does indicate, though, that graduate students in sociology are less likely than those in biology to say that they conceal their religious views, net of other variables. This may reflect greater stigma of being religious in biology resulting from the fact that many of the public conflicts between religion and science (e.g., evolution, stem cells) are concentrated in the biological sciences (Scheitle and Ecklund 2018).

There are limitations to this study, of course. This study, for instance, did not assess actual outcomes of weakened identification as a scientist. That is, it is not clear from this analysis whether the weaker identification as a scientist reduces retention in graduate programs or influences students' success or outcomes as scientists. Future research could follow-up with these students to assess these outcomes. Past research, though, has found significant links between students' identity as a scientist and outcomes such as student's commitment to a science career and intent to remain in science (Chemers et al., 2011; Cundiff et al. 2013; Perez et al. 2014). Furthermore, given the cross-sectional nature of these data, we cannot assess how students' religiosity or their concealment of religiosity changes over time, particularly for those experiencing strong feelings of identity conflict. Do such students reduce the salience of their religious identity to mitigate this conflict? Or, do they leave science and their identity as scientist behind as a way to alleviate these tensions? These are natural questions for future studies.

Finally, while the negative association between concealment of religious identity and strength of identification as a scientists is statistically significant, it is not necessarily overwhelming in its strength ($\beta = -0.08$). We are hesitant to discount this association based on this entirely, though. This study relied on a single item of identity concealment, which is itself a measure of a larger concept of internalized stigma. It is possible that future studies using additional or more direct measures of such stigma could find a stronger association. More importantly, it is possible that such a seemingly small reduction could have tangible consequences for the personal well-being or professional trajectories of these students. As noted earlier, such outcomes are outside of the scope of what can be assessed here.

Despite its limitations, the findings presented here contribute to several research literatures, including social science research on

religion and science. Such research has tended to focus either on morally charged issues (e.g., stem cell research) or on issues where religion and science appear to present conflicting empirical claims (e.g., origin of life, age of earth) (Nisbet 2005; Evans 2011; Hill 2014). The research presented here, though, highlights a more social and psychological form of religion-science conflict.

Given their fairly advanced state of education and training, graduate students in the sciences have likely resolved many of those moral and epistemological conflicts they might have experienced between religion and science, and those who could not resolve these conflicts are likely to have left science. This means that the more pressing conflict between religion and science is between students' identity as religious individuals and the perception that this in some way conflicts with their emerging identity as a scientist. This perception is fueled in part by messages about religious individuals' scientific attitudes and talent (Rios et al., 2015) and, at the same time, messages about scientists' attitudes concerning religion (Weitekamp 2015; Evans 2018). As seen in the analysis presented above, some religious students conceal their religiosity from others in their graduate program, seemingly as a way to avoid being perceived as a less capable scientist or as a way of avoiding explicit discrimination or hostility. By concealing their religiosity, then, religious students are illustrating a type of anticipatory socialization (Merton 1957), as they try to appear to be something that they assume is preferred within their graduate programs. This finding suggests that religious graduate students in the sciences are presenting themselves in a way that they assume will be seen as more favorable in their programs and laboratories. While some research has examined anticipatory socialization processes among science students and graduate students' (Bess 1978; Jahn and Myers 2014, 2015), we are not aware of studies showing this dynamic in relation to religious expression. Of course, there is a distinction here that these students are not giving up their religious identity to fit in better, but instead hiding the part of themselves that does not fit in. Indeed, this study's examination of identity concealment and its consequences also contributes to the literature on stigma management.

Individuals with concealable stigmatized identities will often hide those identities when in contexts or around others who would negatively perceive them (Quinn and Earnshaw 2013). While this strategy might make sense on its surface, studies have shown that concealment of identities is often counter-productive in terms of forming a sense of belonging and identity to the other group (Beals et al. 2009; Newheiser and Barreto 2014). The analysis presented above also finds that concealment appears to weaken graduate students' sense of identification with science. So, rather than allowing them to blend in and form connections with others, hiding their religiosity may be undermining their sense of belonging to the scientific community.

Finally, this study contributes to research on the role of social identities in the workplace, including invisible identities (Clair et al. 2005). Many employers, including scientific ones, have an interest in increasing the diversity of their workforce. A significant part of accomplishing this goal is making sure that workers' identities are not stigmatized in the workplace. For instance, Madera et al. (2012) found that individuals who made efforts to suppress an identity at work were more likely to perceive discrimination, have lower job satisfaction, and were more likely to want to leave the job.

Funding

References

AAPOR, 2019. Response Rates-An Overview. American Association for Public Opinion Research. https://www.aapor.org/Education-Resources/For-Researchers/Poll-Survey-FAQ/Response-Rates-An-Overview.aspx. (Accessed 15 April 2019).

Allen-Ramdial, Stacy-Ann, A., Campbell, Andrew G., 2014. Reimagining the pipeline: advancing STEM diversity, persistence, and success. Bioscience 64 (7), 612–618.

Bagozzi, Richard P., Youjae, Yi., 2012. Specification, evaluation, and interpretation of structural equation models. J. Acad. Market. Sci. 40 (1), 8–34.

Beals, Kristin P., Letitia, Anne Peplau, Gable, Shelly L., 2009. Stigma management and well-being: the role of perceived social support, emotional processing, and suppression. Pers. Soc. Psychol. Bull. 35 (7), 867–879.

Bess, James L., 1978. Anticipatory socialization of graduate students. Res. High. Educ. 8 (4), 289–317.

Burke, Peter J., 1991. Identity processes and social stress. Am. Socio. Rev. 56 (6), 836–849.

Chemers, Martin M., Zurbriggen, Eileen L., Sued, Moin, Goza, Barbara K., Bearman, Steve, 2011. The role of efficacy and identity in science career commitment among underrepresented minority students. J. Soc. Issues 67 (3), 469–491.

Chowdhury, Subhasish M., Jeon, Joo Young, Ramalingam, Abhijit, 2016. Identity and group conflict. Eur. Econ. Rev. 90 (1), 107–121.

Clair, Judith A., Beatty, Joy E., MacLean, Tammy L., 2005. Out of sight but not out of mind: managing invisible social identities in the workplace. Acad. Manag. Rev. 30 (1), 78–95.

Cundiff, Jessica L., Vescio, Theresa K., Loken, Eric, Lawrence, Lo., 2013. Do gender-science stereotypes predict science identification and science career aspirations among undergraduate science majors? Soc. Psychol. Educ. 16 (4), 541–554.

Ecklund, Elaine Howard, 2010. Science vs. Religion: what Scientists Really Think. Oxford University Press, New York.

Ecklund, Elaine Howard, Scheitle, Christopher P., 2007. Religion among academic scientists: distinctions, disciplines, and demographics. Soc. Probl. 54 (2), 289–307.

Edgell, Penny, Gerteis, Joseph, Hartmann, Douglas, 2006. "Atheists as 'other': moral boundaries and cultural membership in American society. Am. Socio. Rev. 71 (2), 211–234.

Edgell, Penny, Hartmann, Douglas, Stewart, Evan, Gerteis, Joseph, 2016. Atheists and other cultural outsiders: moral boundaries and the non-religious in the United States. Soc. Forces 95 (2), 607–638.

Evans, John H., Evans, Michael S., 2008. Religion and science: beyond the epistemological conflict narrative. Annu. Rev. Sociol. 34 (1), 87–105.

Evans, John H., 2011. Epistemological and moral conflict between religion and science. J. Sci. Stud. Relig. 50 (4), 707–727.

Evans, John H., 2018. Morals Not Knowledge: Recasting the Contemporary Conflict between Religion and Science. University of California Press, Oakland.

Griffin, Kimberly A., 2018. "Addressing STEM Culture and Climate to Increase Diversity in STEM Disciplines." *Higher Education Today*. https://www.higheredtoday.org/2018/04/23/addressing-stem-culture-climate-increase-diversity-stem-disciplines/. (Accessed 30 July 2019).

Gross, Neil, Simmons, Solon, 2009. The religiosity of American college and university professors. Sociol. Relig. 70 (2), 101–129.

Harris, Gardiner, 2009. (October 6th). "For N.I.H. Chief, Issues of Identity and Culture." the New York Times D1.

Hermanowicz, Joseph C., 2005. Classifying universities and their departments: a social world perspective. J. High Educ. 76 (1), 26–55.

Hill, Jonathan P., 2014. Rejecting evolution: the role of religion, education, and social networks. J. Sci. Stud. Relig. 53 (3), 575–594.

Hirsh, Jacob B., Kang, Sonia K., 2016. Mechanisms of identity conflict: uncertainty, anxiety, and the behavioral inhibition system. Pers. Soc. Psychol. Rev. 20 (3), 233–244.

Jahn, Jody L.S., Myers, Karen K., 2014. Vocational anticipatory socialization of adolescents: messages, sources, and frameworks that influence interest in STEM careers. J. Appl. Commun. Res. 42 (1), 85–106.

Jahn, Jody L.S., Myers, Karen K., 2015. "When will I use this?" How math and science classes communicate impressions of STEM careers: implications for vocational anticipatory socialization. Commun. Stud. 66 (2), 218–237.

Johnson, David R., Howard Ecklund, Elaine, Di, Di, Matthews, Kirstin R.W., 2018. Responding to richard: celebrity and (Mis)representation of science. Publ. Understand. Sci. 27 (5), 535–549.

Karelaia, Natalia, Guilén, Laure, 2014. Me, a woman and a leader: positive social identity and identity conflict. Organ. Behav. Hum. Decis. Process. 125 (2), 204–219.

Korte, Russell F., 2007. A review of social identity theory with implications for training and development. J. Eur. Ind. Train. 31 (3), 166–180.

Lane, Kristin A., Goh, Jin X., Driver-Linn, Erin, 2012. Implicit science stereotypes mediate the relationship between gender and academic participation. Sex. Roles 66 (3–4), 220–234.

Lehman, Edward C., Shriver, Donald W., 1968. Academic discipline as predictive of faculty religiosity. Soc. Forces 47 (2), 171–182.

Leuba, James, 1916. The Belief in God and Immortality: A Psychological, Anthropological, and Statistical Study. Sherman, French, and Company, Boston.

Leuba, James, 1934. Religious beliefs of American scientists. Harper's Mag. 169 (8), 291–300.

Losh, Susan Carol, 2010. Stereotypes about scientists over time among US adults: 1983 and 2001. Publ. Understand. Sci. 19 (3), 372–382.

Madera, Juan M., King, Eden B., Hebl, Michelle R., 2012. Bringing social identity to work: the influence of manifestation and suppression on perceived discrimination, job satisfaction, and turnover intentions. Cult. Divers Ethnic Minor. Psychol. 18 (2), 165–170.

Matsunaga, Masaki, 2010. "How to factor-analyze your data right: do's, don'ts, and how-to's. Int. J. Psychol. Res. 3 (1), 97–110.

Merton, Robert K., 1942. A note on science and democracy. J. Legal Polit. Sociol. 1 (1), 115–126.

Merton, Robert K., 1957. Scientific discovery: a chapter in the sociology of science. Am. Socio. Rev. 22 (6), 635–639.

Murphy, Mary C., Steele, Claude M., Gross, James T., 2007. Signaling threat: how situational cues affect women in math, science, and engineering settings. Assoc. Psychol. Sci. 18 (10), 879–885.

Newheiser, Anna-Kaisa, Barreto, Manuela, 2014. Hidden costs of hiding stigma: ironic interpersonal consequences of concealing a stigmatized identity in social interactions. J. Exp. Psychol. 52, 58–70.

Newheiser, Anna-Kaisa, Barreto, Manuela, Jasper, Tiemersma, 2017. People like me don't belong here: identity concealment is associated with negative workplace experiences. J. Soc. Issues 73 (2), 341–358.

Nisbet, Matthew C., 2005. The competition for worldviews: values, information, and public support for stem cell research. Int. J. Publ. Opin. Res. 17 (1), 90–112.

Perez, Tony, Cromley, Jennifer G., Kaplan, Avi, 2014. The role of identity development, values, and costs in college STEM retention. J. Educ. Psychol. 106 (1), 315–329.

Quinn, Diane M., Earnshaw, Valerie, 2013. Concealable stigmatized identities and psychological well-being. Soc. Personality Psychol. Compass 7 (1), 40–51.

Quinn, Diane M., Chaudoir, Stephanie R., 2015. Living with a concealable stigmatized identity: the impact of anticipated stigma, centrality, salience, and cultural stigma on psychological distress and Health. Stigma and Health 1 (8), 35–59.

Ramarajan, Lakshmi, Reid, Erin, 2013. Shattering the myth of separate worlds: negotiating nonwork identities at work. Acad. Manag. Rev. 38 (4), 621–644.

Ridgeway, Cecilia L., 2011. Framed by Gender: How Gender Inequality Persists in the Modern World. Oxford University Press, New York.

Rios, Kimberly, Cheng, Zhen Hadassah, Rebecca, R. Totton, Shariff, Azim F., 2015. Negative stereotypes cause Christians to underperform in and disidentify with science. Soc. Psychol. Personality Sci. 6 (8), 959–967.

Robnett, Rachael D., Chemers, Martin M., Zurbriggen, Eileen L., 2015. "Longitudinal associations among undergraduates' research experience, self-efficacy, and identity. J. Res. Sci. Teach. 52 (6), 847–867.

Scheitle, Christopher P., Howard Ecklund, Elaine, 2018. Perceptions of religious discrimination among US scientists. J. Sci. Stud. Relig. 57 (1), 139–155.

Scheitle, Christopher P., Katie, E. Corcoran, Hudnall, Erin B., 2019. Adopting a stigmatized label: social determinants of identifying as an atheist beyond disbelief. Soc. Forces 97 (4), 1731–1756.

Scheitle, Christopher P., Corcoran, Katie E., 2018. Religious tradition and workplace religious discrimination: the moderating effects of regional context. Soc. Curr. 5 (3), 283–300.

Schreiber, James B., Frances, K. Stage, Jamie, King, Amaury, Nora, Elizabeth, A. Barlow, 2006. Reporting structural equation modeling and confirmatory factor Analysis: a review. J. Educ. Res. 99 (6), 323–327.

Settles, Iris H., 2004. When multiple identities interfere: the role of identity centrality. Pers. Soc. Psychol. Bull. 30 (4), 487–500.

Settles, Iris H., Jellison, William A., Pratt-Hyatt, Jennifer S., 2009. Identification with multiple social groups: the moderating role of identity change over time among women-scientists. J. Res. Pers. 43, 856–867.

Stark, Rodney, Finke, Roger, 2000. Acts of Faith: Explaining the Human Side of Religion. University of California Press, Berkeley.

Steele, Claude M., 1997. A threat in the air: how stereotypes shape intellectual identity and performance. Am. Psychol. 52 (6), 613–629.

Steinke, Jocelyn, 2013. In her own voice: identity centrality and perceptions of workplace climate in blogs by women scientists. Int. J. Gender Sci. Technol. 5 (1), 25–51.

Stets, Jan E., Brenner, Philip S., Peter, J. Burke, Serpe, Richard T., 2017. The science identity and entering a science occupation. Soc. Sci. Res. 64, 1–14.

Stryker, Sheldon, Burke, Peter J., 2000. The past, present, and future of an identity theory. Soc. Psychol. Q. 63 (4), 284–297.

Tajfel, Henri, 1982. Social Identity and Intergroup Relations. Cambridge University Press, Cambridge.

Thalheimer, Fred, 1973. Religiosity and secularization in the academic professions. Sociol. Educ. 46 (2), 183–202.

Van Sell, Mary, Arthur, P. Brief, Schuler, Randall S., 1981. Role conflict and role ambiguity: integration of the literature and directions for future research. Hum. Relat. 34 (1), 43–71.

Weitekamp, Margaret A., 2015. "'We're physicists': gender, genre and the image of scientists in the big bang theory. J. Popular Televis. 3 (1), 75–92.

Wuthnow, Robert, 1985. "Science and the sacred." pp. 187–203. In: Hammond, Phillip E. (Ed.), The Sacred in a Secular Age. University of California Press, Berkeley.