

Colorblind and Multicultural Ideologies Are Associated With Faculty Adoption of Inclusive Teaching Practices

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Professional workshops aimed at increasing student diversity typically urge college-level science, technology, engineering, and math (STEM) educators to implement inclusive teaching practices. A model of the process by which educators adopt such practices, and the relationship between adoption and 2 ideologies of diversity is tested here. One ideology, colorblindness, downplays differences based on gender or color. The other, multiculturalism, embraces differences. Pathway modeling revealed reliable, discrete steps in the process of adoption. Independently, greater endorsement of colorblindness predicted adoption of fewer inclusive teaching practices, and multiculturalism predicted adoption of more practices. These findings inform national-level intervention efforts about the process by which educators adopt inclusive teaching practices, and suggest that interventions might consider educators' personal beliefs and approaches to diversity.

Keywords: colorblind, diversity, inclusion, multicultural, STEM education

National-scale intervention efforts encourage inclusive teaching practices among college-level educators to increase retention and enhance the achievements of people of color and women in STEM education, research, academic, and public sector careers (National Science Foundation [NSF], 2009). Students from these underrepresented groups show initial interest in STEM fields in middle and high school, but they abandon these areas in disproportionate numbers before their education and training are complete (Snyder, Tan, & Hoffman, 2006). Although social, familial, financial, and motivational factors may steer the career choices of women (Ceci, Williams, & Barnett, 2009) and

people of color away from STEM areas, one common antecedent appears to be concerns about not being accepted or not belonging in these domains (Estrada, Woodcock, Hernandez, & Schultz, 2011).

Within a classroom environment, cues of acceptance and belonging have a substantial impact on the motivations and aspirations of members of underrepresented groups (Walton & Cohen, 2007; Walton, Cohen, Cwir, & Spencer, 2012). In the present research we investigated the relationship between educators' beliefs in two different acculturation ideologies and their adoption of inclusive teaching practices following a teaching workshop.

Literature Review

We focused on the two most prominent acculturation ideologies in the United States (Wolsko, Park, Judd, & Wittenbrink, 2000). One ideology, colorblindness, proposes that differences between groups of people should not matter, and that we all should be equal in regard to treatment, opportunity, and outcomes (Rosenthal & Levy, 2010). Although espoused more strongly by majority- than minority-group members (Plaut, Garnett, Buffardi, & Sanchez-Burks, 2011), colorblind ideology can make individuals who are not in the majority feel

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unaccepted when their distinguishing aspects are valued by them but not valued by others (Markus, Steele, & Steele, 2000). The other ideology, multiculturalism, acknowledges, embraces, and makes accommodations to be inclusive of differences. Multiculturalism takes into account that all people are not the same, and equal treatment may not be beneficial for all (Knowles, Lowery, Hogan, & Chow, 2009). Multiculturalism affirms those valued aspects that differentiate underrepresented individuals' identities (Wolsko, Park, & Judd, 2006) but can make those in the majority feel excluded because they do not feel that their group is given consideration when diversity is addressed (Plaut et al., 2011).

Both colorblindness and multiculturalism arise historically from attempts to uphold American ideals of equality and fairness (Hirschman, 1983; Thomas, Mack, & Montagliani, 2004), and they may represent well-intentioned efforts to achieve social equality. As a consequence, the ideologies need not be considered mutually exclusive (Stevens, Plaut, & Sanchez-Burks, 2008). Conceptually, there is a commonality between these ideologies in the fundamental interest to be fair to groups that are not in the majority. Individuals may endorse some principles of both, and empirically, the endorsement of colorblindness and multiculturalism are at times modestly *positively* correlated among dominant group members in the United States (Levin et al., 2012; Ryan, Hunt, Weible, Peterson, & Casas, 2007).

Even though these ideologies are at times related, we chose to examine colorblindness and multiculturalism as independent factors, because past empirical research has shown very different outcomes when one ideology is adopted over the other. Colorblindness might arise from intentions to be sensitive to all students' needs, but for women and people of color who are questioning their sense of belonging, language and cues of colorblindness raise concerns. When an educator emphasizes to his or her students that race does not matter in the classroom, the assertion stands in stark contrast to reality (Apfelbaum, Sommers, & Norton, 2008). All students need do is look around to see that they really *are* present in low numbers in these environments. Therefore, when educators promote colorblindness over multiculturalism, it can actually elicit distrust (Purdie-

Vaughns, Steele, Davies, Dittmann, & Crosby, 2008), disengagement (Plaut, Thomas, & Goren, 2009), and cognitive depletion (Holoien & Shelton, 2012) in underrepresented students. Ultimately, colorblind approaches may fail to address concerns in underrepresented individuals, and, in fact, may produce feelings of not belonging.

In contrast, multiculturalism acknowledges differences. This affirms underrepresented students' concerns. Multiculturalism in turn is related to underrepresented individuals' perceiving less bias (Plaut et al., 2009), and increasing their ambition, perseverance, and success (Walton & Cohen, 2007; Walton et al., 2012). Likewise, multiculturalism embraces differences, and in doing so appreciates those differences that might be highly valued by underrepresented individuals (Markus et al., 2000). Multicultural attitudes are also associated with more positive evaluations of underrepresented groups (Wolsko et al., 2000), and inclusion (Plaut et al., 2011; Stevens et al., 2008).

Colorblind and multicultural ideologies influence not only social preferences (Apfelbaum et al., 2008; Besterfield-Sacre, Cox, Borrego, Beddoes, & Zhu, 2014) but also professional orientations and practice (Purdie-Vaughns et al., 2008). For instance, Purdie-Vaughns and colleagues (2008) showed that in corporate settings, when policies were explicitly colorblind in promotional brochures, prospective Black employees were distrustful of the company. This was particularly the case when brochure photographs of company employees showed a lack of diversity.

Colorblindness, while an ideology that ostensibly may be motivated by fairness, relates directly to the concept of colorblind racism (Bonilla-Silva, 2001; Bonilla-Silva & Embrick, 2006; Chow & Knowles, 2016). Bonilla-Silva (2001; Bonilla-Silva & Embrick, 2006). Researchers have proposed that colorblindness might be a strategy employed by members of majority group members to reinforce the status quo that benefits their group. Specifically, Bonilla-Silva and Dietrich (2011) argued that "the ideology of color-blindness is increasingly affecting even those who are at or near the bottom of the economic and social hierarchies in the United States: Blacks and Latinos" (p. 195).

Endorsements of colorblind and multicultural ideologies affect diversity-related legal (Car-

bado & Harris, 2008) and employment policies (Purdie-Vaughns & Walton, 2011). Within educational settings colorblind ideology is widely espoused and is often the basis for policy setting and social norms in regard to issues of diversity. For an example of colorblind ideology in an academic setting, Schofield (2007) found over a 4-year observation of an integrated school that educators overwhelmingly would not acknowledge race in policy setting and discipline. When asked about issues that arose from race, educators dismissed such concerns and reiterated their commitment to treating all students the same. This perspective alienated underrepresented students.

As illustrated in this review of the literature, past work has highlighted correlates of these two ideologies and student outcomes. Past work has empirically manipulated these two ideologies in the laboratory. However, research has yet to reveal how these ideologies, when personally held by educators, directly relate to whether or not educators will adopt inclusive teaching practices when prompted to do so.

Theoretical Framework

In this investigation we translated the evidence found in the empirical literature into a pragmatic identification of patterns of behavior in individuals within a national training program, the National Academies of Science Summer Institutes on Undergraduate Education. Here we report on 628 educators (faculty and instructors) who attended the National Academies Summer Institutes on Undergraduate Science Education, and in the 2014 academic year alone educated approximately 164,000 students. The Summer Institutes began in 2004, funded by the Howard Hughes Medical Institute and sponsored by the National Academies, and have run every year to 2015. The program typically is a 4-day intensive training focused on active learning, assessment, and inclusive teaching practices. Consistency of the information delivered to educators, educators' satisfaction with the workshops, and feelings of usefulness of the information conveyed at these workshops has been shown to be consistent across years of operation and across different regions in any one year (Graham, 2014).

The module that addressed inclusive teaching practices was a formally scheduled half-day ses-

sion during the workshop. The inclusive teaching practices considered in this part of the workshop were evidence-based, informed by research. Workshop curricula focused on four inclusive teaching practices: (a) inclusivity within curriculum content, (b) the use of diverse teaching methods, (c) inclusive classroom environments, and (d) taking into account biases that one might hold (Handelsman, Miller, & Pfund, 2007; Pfund et al., 2009).

The teaching practice of (a) inclusivity within curricula content emphasized the value of the inclusion of individuals of various ethnicities, races, backgrounds, and genders in their course materials such as lectures, slides, examples, readings, and tests. For instance, on slides presented to a class, the educators might include photographs of diverse people from within their field who conduct the work that they are describing; when providing illustrative examples, educators might use the names "Juan" or "Karen" rather than always using names associated with White men (e.g., "John"). These inclusions of diverse role models and examples within curriculum content can increase a sense of belonging in underrepresented students (Canes & Rosen, 1995; Dasgupta, 2011; Zirkel, 2002).

The practice of using diverse teaching methods underscored the importance of considering the method of instruction itself in terms of its effectiveness for different groups. This aspect of the module highlights how some methods have been shown to be more effective for underrepresented students than other methods. For example, mathematics courses structured to include activities that engage students in problem solving resulted in women having a sense of mastery on par with men; in contrast, in lecture-based mathematics courses, consistent with past findings, women displayed a lower sense of mastery than men (Laursen, Hassi, Kogan, & Weston, 2014). In this case the method of delivering class materials differentially impacted women. During the Summer Institute, educators were encouraged to think of various ways to present course materials, and how these might be helpful to diverse students.

During the Summer Institute educators were also asked to consider ways to create inclusive classroom environments. That is, educators were asked to consider cues that do or do not signal correspondence between the identity of

the student and the field to which they aspire (Cejka & Eagly, 1999), because these cues can convey acceptance or nonacceptance (Denson, 2009; Handelsman et al., 2007). For example, Cheryan and colleagues (Cheryan, Plaut, Davies, & Steele, 2009) demonstrated that the replacement of incidental environmental cues stereotypically associated with men (e.g., a Star Trek poster in the classroom) with gender-neutral cues (e.g., a nature poster in the classroom) increased female undergraduates' interests in computer science to be on par with male peers. Educators in the workshop were encouraged to consider the cues in their classrooms and how these cues might impact their students.

The Summer Institute curriculum also included exercises that can illuminate educators' own implicit biases, because being aware of one's own biases can trigger self-generated corrections of discriminatory or preferential behaviors (Devine, 1989; Wegener & Petty, 1997). One such exercise asked workshop attendees to consider a request from a student and how that request might be seen differently based upon the student's gender or ethnicity. Taken together, these four practices are espoused to increase cues of acceptance of diversity (Denson, 2009; Handelsman et al., 2007), and to enhance a sense of belonging to members of all groups including underrepresented groups. This sense of belonging can increase the interest of members of all groups to pursue work in the sciences and enhance their persistence and achievement (Cheryan et al., 2009; Dasgupta, 2011; Walton & Cohen, 2007).

We collected information about the implementation of these practices, as well as colorblind and multicultural ideologies of the Summer Institute attendees. Here we report on the implementation of these four inclusive teaching practices while controlling for educators' reported implementation of these practices before attending the Summer Institute. We also report on the relationship between ideologies and implementation of such practices.

We hypothesized that a process of adoption could be measured in stages to identify with some precision where along the process these ideologies might be related. We proposed that educators must first be clearly *exposed* to the teaching practice. That is to say that educators remembered the practice, felt clear about what they were being asked to do, and that colorblind

and multicultural ideologies did not impact recall for such information.

Once clearly exposed to inclusive teaching practices, we hypothesized that educators must be *persuaded* that the teaching practices were a good idea. We found support for this in the organizational psychology and education literatures. During organizational change, individuals may implement innovative practices for any combination of three reasons: they were persuaded of their value, they felt a sense of duty for the organization, or for fear of negative consequences for not having implemented them (Herscovitch & Meyer, 2002). Because of the autonomous nature of college-level educators' positions, we considered the route of persuasion as most important. Our assumption was supported in research conducted with faculty from primary and secondary schools, which concluded the degree to which educators valued a given teaching practice was a prerequisite to their implementation of that practice (Abrami, Poulsen, & Chambers, 2004). We reasoned that in this instance, with university faculty, that persuasion is a necessary step to the adoption of changes in their practices. Therefore, we asked educators whether they were persuaded that the teaching practices presented to them at the Summer Institutes were "a good idea."

We further hypothesized that being persuaded that a practice is good, and being persuaded that a practice is good for one's self, are distinct constructs and that both would be necessary steps toward adoption. Indeed, an in-depth review of the literature investigating the implementation of innovative teaching practices among educators came to the same conclusion: that the congruence between a particular practice and the educators' teaching identity is vital to implementation (Henderson, Beach, & Finkelstein, 2011). Therefore, we measured whether educators *identified* with the practices, that is, they felt that the practices were compatible with their teaching approach.

We also measured educators' *commitment* to the teaching practices. Understanding educators' commitment to the implementation of teaching practices is a necessary step toward understanding future implementation efforts (Goroizidis & Papaioannou, 2014). Without the measurement of commitment, investigations cannot parse out whether educators are "trying out" new practices or actually committed to

working through the highly variable initial successes of implementing new practices. Therefore, we measured educators' commitment to inclusive teaching. As the final outcome variable, we measured educators' *implementation* of the inclusive teaching practices, based on their self-report of use of these techniques initiated as a function of attending the summer workshop.

We hypothesized that the ideology of colorblindness would predict lower adoption of these inclusive teaching practices, because at its most fundamental level colorblindness is incongruent with inclusive teaching practices that require acknowledging differences to be implemented. In contrast, we hypothesized that multicultural ideology would predict increased adoption of such inclusive teaching practices, because of the inherent focus on acknowledging differences that is present in both the ideology and the inclusive teaching practices. We further hypothesized that educators generally would follow this process of adoption, whereby each step of adoption could predict attrition (and adoption) beginning with exposure, through persuasion, identification, and commitment, then onto implementation.

Method

Participants

On October 1, 2014 all past participants ($n = 1,179$) of the Summer Institutes from years 2004 to 2014, were approached via email to complete the approximate 15–30 min "Summer Institute Census Survey." Participants were allowed to leave the survey and return within a week without losing their place. We advised participants that we would provide a report of the findings once the data analysis was completed. The survey remained open until December 1, 2014.

Seven hundred and fifty participants logged into the survey (64% of those emailed), and of those, six declined to participate, three were retired, one was closely related to the research team for this investigation, 10 were administrators, and 40 were not currently teaching. Sixty-two respondents left the survey before the collection of the critical variables of interest. This left 628 participants in this sample (84% of those who logged on and agreed to participate),

of whom 357 were women, 248 were men, and 23 did not provide their gender. Our sample was, on average, 47.47 years old ($SD = 10.38$), and self-identified primarily as White 79.1%. Minority groups were limited in their representation; 3.8% self-identified as Hispanic/Latino(a), 3.3% Black/African American, 3.8% Asian, 5.2% reported in all other categories, and 4.8% did not provide ethnicity information. Data were not complete for gender and ethnicity because those questions were located on the last page of the approximate half-hour survey, and some of the participants left the survey before completing these items.

All educators who responded were in STEM or closely related fields, and, on average, had been teaching for 14.35 years ($SD = 9.79$). Participants from all years of the program (2004–2014) were represented. Overwhelmingly, participants reported that the last college level science course taught was within the 2014 calendar year, 593 of the 628, which is 94%. Most respondents were professors ($n = 551$; 171 non tenure-track, 243 tenure-track, and 137 tenured). Graduate students ($n = 27$) and faculty professional development personnel ($n = 28$) were also represented (22 did not report such information as it was located near the end of the entire survey). Nearly 74% of educators reported teaching introductory courses at least once every year, which is important because this is oftentimes the first exposure that undergraduates have to a particular STEM field. Educators also reported teaching elective courses (68%) and in-depth seminar courses (42%) at least once a year. As a note to our readers, all results reported are significant and in the same direction with or without the covariates of gender (male or female), race/ethnicity (White or non-White), and position (tenure-track, tenured, or nontenure track) entered into our models.

Materials and Procedure

After providing informed consent, the survey began with the following instructions:

This survey has two sections. In the first section we will ask questions related to scientific teaching. In the second section we will ask questions related to you. Please remember your spontaneous responses are important and there are no right or wrong answers.

The corresponding author can provide a complete list of the items included in the census survey upon request.

Measures of colorblind and multicultural ideologies. We conceptualized colorblind attitudes, as in previous work (Knowles et al., 2009), with an emphasis on sameness, equal treatment for all, and the idea that all have equal opportunities. We developed items based on the detailed descriptions of these constructs by Neville and colleagues (Neville et al., 2013). We measured the colorblind ideology with two items: (a) “I believe in treating every student equally as a person who has an equal opportunity to be outstanding in science,” and (b) “I believe that in an inclusive classroom educators should focus on what makes students the same and not focus on what makes students different (e.g., race and gender).”

We captured multicultural ideology with two items: (a) “I believe that we should make special efforts to be supportive of underrepresented students (i.e., female students and/or minority students),” and (b) “I believe that an inclusive classroom is achieved when we embrace the qualities that make us different.” Respondents indicated their agreement to these statements on Likert-type scales (1 = *strongly disagree*, 2 = *disagree*, 3 = *disagree slightly*, 4 = *neither agree nor disagree*, 5 = *agree slightly*, 6 = *agree*, and 7 = *agree strongly*). These items were located approximately halfway through the 30-min survey.

Principal component factor analysis, using varimax rotation, confirmed that these four items represented two distinct factors (eigenvalues >1.00). The two colorblind items loaded onto one factor (eigenvalue = 1.49; loadings .70 and .85, respectively), and the two multicultural items loaded onto a second factor (eigenvalue = 1.13; loadings .83 and .77, respectively). Colorblind items did not load on the multicultural factor and multicultural items did not load on the colorblind factor. Factor loading values ranged from $-.16$ to $.32$ for these cross-loadings.

The two items for colorblindness were averaged to create one colorblind score (mean of the scale = 5.78, $SD = 1.09$, range 1 to 7; correlation between the two items of the scale $r(626) = .22$, $p < .001$) and the two items measuring multiculturalism were averaged to create one multicultural score (mean of the

scale = 6.08, $SD = .87$, range 1 to 7; correlation between the two items of the scale $r(626) = .34$, $p < .001$). Participants’ colorblind and multicultural ideology scores were positively correlated, $r(626) = .08$, $p < .05$.

Measurement of the adoption process. Four items, presented as short phrases, assessed inclusive teaching practices that had been presented to all participants at the Summer Institutes: (a) “designing class content that represents the perspectives and contributions of people with different origins, genders, and affiliations”, (b) “implementing inclusive teaching in the classroom”, (c) “choosing diverse teaching methods to optimize learning for diverse students”, and (d) “taking precautions to reduce the influence of any implicit bias that I may hold (for example grading papers without knowing the identity of the student).”

When deciding which inclusive teaching practices in particular would be probed, we aligned our questionnaire after we evaluated information from four sources that describe the curriculum at the Summer Institutes: the *Scientific Teaching* book (Handelsman et al., 2007), a recent publication on the taxonomy of scientific teaching implementation (Couch, Brown, Schelpat, Graham, & Knight, 2015), a theoretical model of evaluation for the Summer Institutes in development under the National Science Foundation Grant Transforming Undergraduate Education in STEM (No. 1323258), and the personal experience of the survey designers as participants of Summer Institutes (ORA & MJG). The questionnaire items were located at the very beginning of the survey, immediately after a brief introduction to the survey.

Beside each short phrase were boxes to indicate endorsement of each of the following statements: (a) I was exposed to this, (b) I was convinced that this is good, (c) This is compatible with my teaching, (d) I made a decision to incorporate this in my teaching, and (e) I implemented this teaching practice in my course. The structure of the questions created a binary endorsement (endorsed or not endorsed) at each step of the process, made it possible for respondents to consider each aspect of the adoption process independently, and did not require endorsement of any stage before the next. Also included in this section, but not used in this investigation, were the items, “I was not ex-

posed to this,” “I was exposed to this but it was not clear to me,” and “my specific plan to implement this is in progress.”

To build familiarity with the scales prior to answering the questions of interest we provided participants with an example of a hypothetical participant with three practice descriptive phrases and responses. We then explained:

We will interpret these data by the boxes that you check. Please read each statement in the left column, and then please check ALL boxes that apply. If you do not check a box we will assume that you do not endorse the statements related to it.

At the bottom of each page participants were asked, “Are you sure you checked ALL boxes that apply?” with “yes” and “no” options. If participants responded “no” the survey took them back to the top of the page and in red font requested that they please check all boxes that apply. Participants were redirected in this way until the respondents indicated that they checked all boxes that applied.

Crucial to our investigation, 71% of participants recalled being exposed to all four of these practices, 16% recalled being exposed to three of these practices, 6% recalled being exposed to two of these practices, 5% recalled being exposed to one of these practices, and only 3% did not recall being exposed to any inclusive teaching practices. Overall, our participants recalled 87% of the teaching practices that had been presented. Year of attendance had a small relationship to the number of practices participants reported being exposed to, $r(626) = .08$, $p = .048$, highlighting that even those participants who had attended a decade earlier recalled the four practices at a nearly equivalent rate as those who had recently attended, justifying their inclusion in the sample. The analyses we subsequently report are significant, of similar magnitude, and in the same directions, with or without year of attendance entered as a covariate. These results are also significant and in the same direction if we include in the analysis only those participants who recalled all four of the teaching practices introduced to them.

After responding to all of the adoption process items, the survey displayed questions about the specific teaching practices that the respondent had indicated implementing. We used the same wording as in the short phrases presented in the adoption process section (e.g., choosing

diverse teaching methods to optimize learning for diverse students), and asked participants about their implementation of the method: (a) “before attending the SI [Summer Institutes],” (b) “my first semester teaching after the SI,” and (c) “my teaching now (skip this line if this is also your first semester teaching since the SI).” We collected participants’ year of attendance and last course taught, and were able to discern when (c) responses were blank that these responses should, in fact, be the same as (b) responses. We provided the following response options for all items: 1 = *not aware of this method*, 2 = *aware of this method but never used it*, 3 = *used/use this method once or twice*, 4 = *use/used this method some classes*, 5 = *used/use this method most classes*, and 6 = *always used/use this method, every class*. The words “used/use” were both presented because when asking about past practices “used” would be appropriate, and when asking about present practices, “use” would be appropriate. For this investigation we analyzed data reported from (a) before the Summer Institutes and (c) current teaching.

Results

Process Model of Adoption Analysis

We aggregated the data across inclusive teaching practices for each step of the adoption process. Participants’ scores ranged from 0 indicating no teaching practices endorsed to 4 indicating all teaching practices were endorsed at any given step of adoption. We tested the steps of adoption in a serial mediation model (Hayes, 2013) which allowed for tests of mediation pathways with more than one mediator working sequentially through each step (Process syntax, Model 6), while considering all previous steps in the model. Serial mediation modeling estimated the total and direct effects of exposure to inclusive teaching practices on to implementation of these practices, as well as the total and all possible indirect effects of exposure on implementation through the mediators of persuasion, identification, and commitment. Persuasion, identification, and commitment function as mediators in serial with persuasion affecting identification, and identification affecting commitment. Standard errors for the model coefficients are based on the HC3 het-

eroscedasticity-consistent standard error estimator. Process generates 95% bias-corrected bootstrap confidence intervals for the indirect effects using 5,000 bootstrapped samples. Confidence intervals that do not include zero indicate significant pathways from the exposure through persuasion, identification, and commitment to predict implementation.

As predicted, we found a significant serial mediation pathway and significant attrition through each step of the process (percentages of practices proceeding through each step of adoption): exposure (87%) → persuasion (77%) → identification (70%) → commitment (60%) → implementation (46%). Figure 1 illustrates these results. The bootstrapped model (5,000 iterations) revealed, as hypothesized, a significant pathway from exposure to implementation through the predicted steps, $b = .13$, $SE = .02$, lower limit confidence interval (LLCI) = .09, upper limit confidence interval (ULCI) = .17 (Table 1 and Figure 2).

Faculty Changes in Inclusive Teaching: Before and After Attendance

Regarding faculty changes in inclusive teaching practices from what they reported doing before attendance at the Summer Institute to what they reported doing currently in their teaching, there was a change in reported implementation of inclusive teaching practices from before ($M = 1.66$, $SD = 1.49$) to after ($M = 2.31$, $SD = 1.79$) the intervention, paired $t(627) = 15.88$, $p < .001$, paired t -test Cohen's $d = .67$. In our sample, 46% of practices were reported as being implemented and 42% of practices were being implemented with regularity (scored 4 or higher on our scale; 4 = *some classes*, 5 = *most classes*, 6 = *always*). Thus, most of the practices educators reported implementing (92%), were being implemented on a regular basis. The main analyses and findings reported in this investigation are significant, of similar magnitude, and in the same directions,

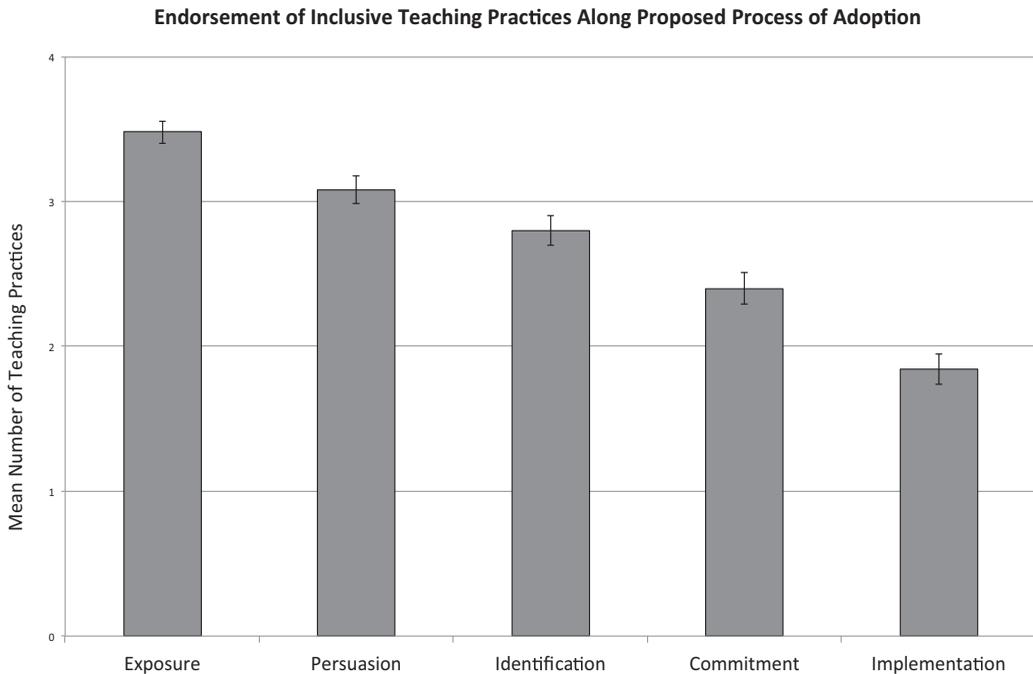


Figure 1. A descriptive illustration of the mean number of inclusive teaching practices endorsed along each step of the adoption process in our sample. The error bars represent 2 standard errors of the mean. As participants progressed down the proposed process of adoption, fewer teaching practices were endorsed.

Table 1
Serial Mediation Model of the Process of Adoption of Inclusive Teaching Practices

	Model	Persuasion	Identification	Commitment	Implementation
1	Exposure	.64***			
2	Exposure		.05		
	Persuasion		.67***		
3	Exposure			.12*	
	Persuasion			.33***	
	Identification			.50***	
4	Exposure				.09
	Persuasion				.03
	Identification				.05
	Commitment				.59***
Constant		3.12	2.79	2.40	1.84
SE		.05	.05	.05	.05

* $p < .05$. *** $p < .001$.

with or without the “before attending the SI” variable entered into the model.

Colorblind and Multicultural Analysis

Given the nonindependent nature of the data, we predicted the adoption of inclusive teaching practices in a repeated measures, mixed linear model, with step of adoption (persuasion, identification, commitment, and implementation) as the repeated factor, and as fixed factors the mean centered scores of colorblind ideology, multicultural ideology, and all possible interac-

tions. There was a main effect of step. The farther participants progressed down the adoption process the fewer inclusive teaching practices were endorsed at each step of adoption, $b = -.42$, $SE = .02$, $t = -19.30$, $df = 1,500$, 61 , $p < .001$. Critical to our hypothesis, and as predicted, there was a main effect of colorblind ideology $b = -.14$, $SE = .05$, $t = -2.62$, $df = 1,161$, $p < .009$. Those who were high in colorblind ideology reported lower endorsement along the adoption process of inclusive teaching practices than those low in colorblind ideology.

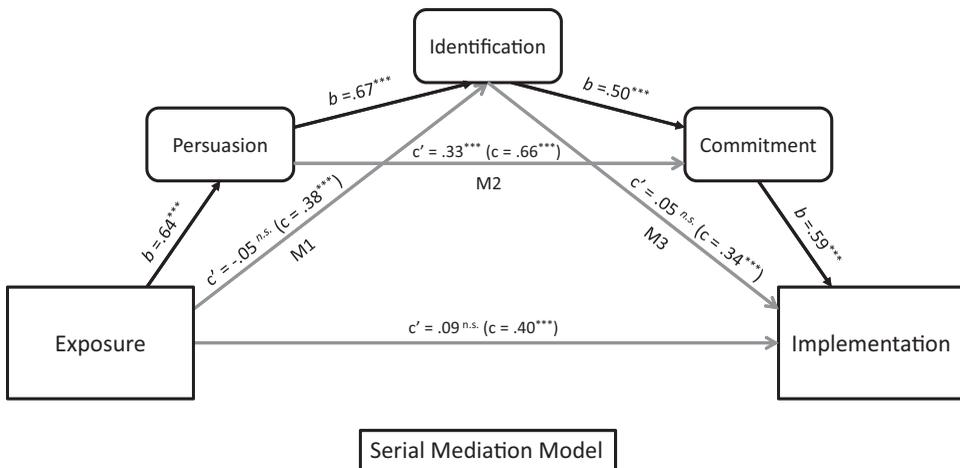


Figure 2. The serial mediation model. Exposure predicts identification through persuasion (M1), persuasion predicts commitment through identification (M2), and identification predicts implementation through commitment (M3). A pathway beginning with exposure through persuasion, identification, and commitment to predict implementation, is significant as the confidence intervals of this pathway do not cross 0, LLCI = .09, ULCI = .17. *** $p < .001$.

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Also, crucial to our main hypothesis, there was a main effect of multicultural ideology, $b = .43$, $SE = .07$, $t = 6.58$, $df = 1,161$, $p < .001$. Those with high multicultural ideology endorsed along the adoption process more inclusive teaching practices than those low in multicultural ideology. No interactions were significant.

Colorblind and Multicultural Serial Mediation Analysis

The purpose of collecting each step of the process of adoption was to pinpoint where along the adoption process colorblind or multicultural ideologies might be related. A simple interaction term in the test above does not account for all prior steps of the adoption process simultaneously; rather, it looks for a linear relationship (i.e., the farther down the more or less of a relationship). In using the serial mediation modeling technique, we could see if these ideologies were related to any given step in the process without an overarching linear relationship, while at the same time accounting for all prior steps in the adoption process. We remind the reader that this is a significant serial mediation pathway of adoption; therefore attrition or adoption at any point impacts subsequent steps in the model. That is, effects at later stages are over and above the effects at earlier stages.

Therefore, to test the factors of colorblindness and multiculturalism with our model, we again ran the same serial mediation model as described in the process model of adoption analysis. This model included the steps of the process of adoption (exposure \rightarrow persuasion \rightarrow identification \rightarrow commitment \rightarrow implementation) and the additional factors of colorblind and multicultural ideologies. Again, the bootstrapped model indicated a significant pathway from exposure to implementation through our predicted process of adoption, $b = .12$, $SE = .02$, $LLCI = .08$, $ULCI = .16$. The variable of exposure takes into account memory for materials, and recall of the materials is a necessary step in the adoption process. Importantly, the material was remembered at equal rates for those high and low in both colorblind and multicultural ideologies. More relevant to our hypotheses, we found that colorblind ideology predicted specifically at the second step of the adoption process—persuasion. Those who reported high colorblind ideology were persuaded

that fewer inclusive teaching methods were a good idea than those who were low in colorblind ideology, $b = -.08$, $SE = .03$, $t = -2.30$, $p = .022$. This was the only step where colorblind ideology showed a significant relationship.

In contrast, and also as hypothesized, individuals high in multicultural ideology were persuaded that more of the inclusive teaching practices presented to them were a good idea, than those low in multicultural ideology, $b = .38$, $SE = .04$, $t = 8.92$, $p < .001$. In addition, as illustrated in Figure 3, higher multicultural ideology predicted identifying with more inclusive teaching practices in the third step, $b = .10$, $SE = .05$, $t = 2.06$, $p = .039$, and being committed to more inclusive teaching practices in the fourth step, $b = .13$, $SE = .05$, $t = 2.81$, $p < .005$.

Discussion

The adoption of both colorblind and multicultural ideologies may be motivated by a desire to be fair to members of traditionally disadvantaged groups. Indeed, consistent with past research (Levin et al., 2012; Ryan et al., 2007), we found that endorsement of these two ideologies had a weak but positive correlation in our sample ($r = .08$). However, these two ideologies independently predicted intentions to adopt inclusive teaching practices in different directions, above and beyond science teachers' previous instructional approaches.

After participating in an intensive training program with a module devoted to inclusive teaching practices, the STEM educators in our sample reported, on average, implementing more inclusive teaching practices than they had before attending the Summer Institute. Moreover, reports of implementation of such inclusive practices were related to educators' personal ideologies concerning diversity. Independently, stronger endorsements of multicultural ideology predicted higher reports of implementation of inclusive teaching practices; stronger endorsements of colorblind ideology predicted lower reports of implementation of inclusive teaching techniques. We acknowledge that these relationships between educators' diversity ideologies and the adoption of inclusive teaching practices were based on participants' self-reports of their classroom practices. Such self-reports, partic-

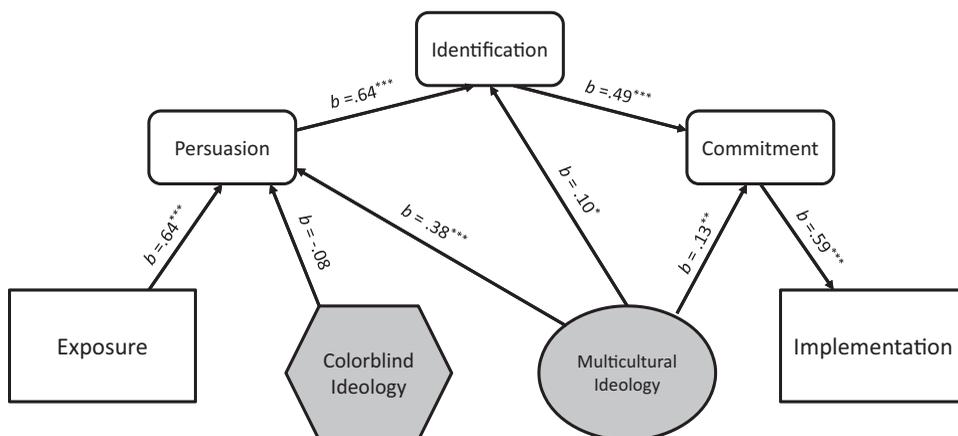


Figure 3. The serial mediation model, and where along the process of adoption ideologies are related, while accounting for all prior steps in the adoption process. Illustrated is the significant pathway with the hypothesized process by which adoption occurs. Arrows indicate locations along the pathway where colorblind and multicultural ideologies predict attrition or adoption. This is a significant pathway of adoption; therefore attrition or adoption at earlier points impacts subsequent steps in the model. * $p < .05$. ** $p < .01$, *** $p < .001$.

ularly in the context of participation in the educator training program, may reflect motivations to appear in socially desirable ways on the survey rather than representing their actual adoption of inclusive teaching practices. We note, however, that program participants who more strongly endorsed colorblind ideologies reported *less* adoption of inclusive teaching practices, suggesting that a general desire to report greater use of the teaching techniques discussed in the workshop does not fully account for the pattern of results we observed.

Because of the potential limitations of self-report data, future research might incorporate more direct measures of educators' actual behavior in the classroom (e.g., through classroom observation, peer reports, or analysis of videotaped examples of classroom teaching). Nevertheless, for some aspects of our work, self-reports may still represent the most appropriate measure. For example, participants reported on whether or not they felt such teaching practices were a good idea, and it was at this stage of persuasion, which does not require classroom verification, that we saw differences between these two ideologies. Moreover, beyond a more direct focus on the ways educators teach, the current work might be extended by examining the impact of these specific practices on their

students. For example, students from underrepresented groups would be expected to experience a stronger sense of belonging in the classroom and discipline when teachers adopt more inclusive teaching practices.

We further acknowledge that the design of the current study prevents making causal assertions about the effects of colorblind and multicultural ideologies on the adoption of inclusive teaching methods. Endorsements of the ideologies were not manipulated, but were measured cross-sectionally: ideologies, reports of past teaching practices, and the current implementation of inclusive teaching practices were assessed in the same survey. We do see strength, however, in the use of pathway modeling that illustrated mechanisms of adoption, and the relationship of ideologies with the process of adoption, specifically at the stage of persuasion. Future work that uses longitudinal designs, experimentally alters or primes colorblind and multicultural ideologies, and includes direct observations of teaching practices would help triangulate the hypothesized causal relations and the robustness of the findings.

Another limitation of the current work involves the nature of the sample of teachers who participated in the study. These educators self-selected to participate at two points. First, these are individuals who took personal time to attend

the Summer Institutes. Thus, these educators are likely highly motivated to improve their teaching practices, and possibly more so than the general population of college educators. Second, among those who self-selected to attend the Summer Institutes, only a subset of workshop attendees self-selected themselves into the study by completing the survey. Overall, the sample in our analyses represented 54% of the 1,179 attendees of the Summer Institutes. Because the educators who “doubly self-selected” themselves into our sample of participants may be distinctively motivated or conscientious, they may represent a “best case scenario” for demonstrating support for the hypothesized divergent relationships between colorblind and multicultural ideologies and the self-reported adoption of inclusive teaching practices. The generalizability of the current findings to educators who may have more limited motivation, time, resources, or opportunity to attend the Summer Institutes workshop thus remains to be determined.

Conclusion

Understanding the influences that may facilitate or interfere with greater participation of members of traditionally underrepresented groups in science, generally, and in STEM, in particular, is of timely and significant practical importance. In the *Improving Undergraduate STEM Education* report (NSF, 2015), it states:

the engagement of people from groups that have traditionally been underrepresented in STEM is still alarmingly low in several fields, indicating that the full and diverse talent of the Nation is not being fully utilized to advance the economic and scientific agenda of the country.

The orientations and efforts of science educators are particularly critical because of the cascading effects on generations of students who will decide to pursue (or not to pursue) careers in science because of their sense of belonging in their classroom experiences (Estrada et al., 2011). As we noted earlier, based on estimates from our sample, the 628 educators who attended the Summer Institutes, in the 2014 academic year alone, educated approximately 164,000 students. This investigation translated research on colorblind and multicultural ideologies to understand potential psychological factors moderating the adoption-inclusive teaching

techniques in science. The present research addresses a timely national issue, diversity in STEM careers, and helps to bridge basic theory and application in ways recently called for by leadership of the National Institutes of Health (Collins, 2013) and the NSF (2012).

Practical implications for this work we suggest are in raising awareness of the heterogeneity within educators in regard to ideologies about diversity. Future workshops might consider both highlighting that not all educators share the same approaches to diversity, and also review with participants the literature about how these particular ideologies affect underrepresented students. Once educators are aware of the ideologies and their impacts on students, they can make informed decisions about what inclusive teaching practices they might wish to adopt moving forward. It is worth noting that Whites are less comfortable with multiculturalism, in part, because Whites feel that they are excluded from the multicultural perspective (Plaut et al., 2011). However, this does not have to be the interpretation of multiculturalism. Future interventions can explicitly communicate that the majority’s heritage is also to be embraced. Stevens et al. (2008) emphasized that, in practice, being explicit about the inclusion of Whites in the multicultural perspective is essential to all feeling a sense of belonging.

Broadening diversity in STEM has been identified as a key component to the success of the United States’ collective future, as noted by the National Science and Technology Council Committee on STEM Education (Neville et al., 2013). The endorsement of a colorblind ideology, in principle, is not congruent with the adoption of inclusive teaching techniques that would help achieve this goal. We found support for this even among our group of well-intentioned educators who took personal time to attend the Summer Institutes. Although endorsement of a colorblind ideology may not be motivated, at least consciously, by intentions to exclude members of traditionally underrepresented groups, it may lead to less effort to include members of these groups. This may perpetuate disparities in representation, but not in a way that can be directly attributed to racism or sexism (Bonilla-Silva, 2001; Dovidio, Gaertner, & Saguy, 2015).

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