



Cultural Mismatches in the Multicultural Science Classroom

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ABSTRACT

The student body in university science classrooms is increasingly diverse demographically and this change brings with it an increased chance of mismatch between professor's expectations and students' behaviors. Being aware of how cultural expectations influence teaching and learning is the first step in understanding and overcoming these mismatches in order to help all students succeed. This involves making expectations clear, particularly about homework requirements (Ludwig et al., 2011), and defining the line between collaboration and cheating (Craig et al., 2010). When possible, professors should be flexible regarding different cultures' ideas of time (Hall, 1983), family obligations (Hoover, 2017), and the social power structure (Hofstede, 1986; Yoo, 2014). At the same time, professors should maintain high expectations of all students regardless of ethnic background (Rosenthal & Jacobson, 1968). Drawing from published research as well as interview and survey data, we highlight ways for both professors and students to create an atmosphere of belonging (Walton & Cohen, 2011) and an appreciation of people from all cultures (Museus et al., 2017).

Keywords: student–teacher relationship, cultural expectations

INTRODUCTION

One might expect that cultural backgrounds would not affect the teaching of science. After all, the laws that govern the behavior of atoms, molecules, and biochemical processes are the same in all cultures, aren't they? But the teaching and learning of any subject takes place in a social context and the expectations of the professor and the students are very much a function of their culture.

In this article, we will draw on relevant research, personal experience, faculty interviews, and student survey data to give some practical advice to American instructors who teach science in classrooms that are increasing multicultural.

Three themes that will come through in this work are that faculty should:

- make expectations clear,
- be flexible with expectations, and
- have high expectations for all students (Tanner & Allen, 2007).

Who are your students?

Students in American universities are becoming more culturally diverse. Back in 1976, 82.6% of U.S. university students were White American citizens; of the remaining students, 15.4% were American students of color and 2.0% were non-resident aliens (NCES, 2015). By 2014, these numbers had changed to 55.6% White American citizens, 39.8% citizens of color, and 4.5% nonresident aliens (Figure 1; National Center for Education Statistics [NCES], 2015). The diversity among full-time professors at American universities has also increased, but at a slower rate than the students: In 1991, 87.7% of professors were White American citizens, but by 2013, 72.7% of professors were White American citizens, 19.9% were American citizens of color, and 4.9% were nonresident aliens (NCES, 1995, 2015).

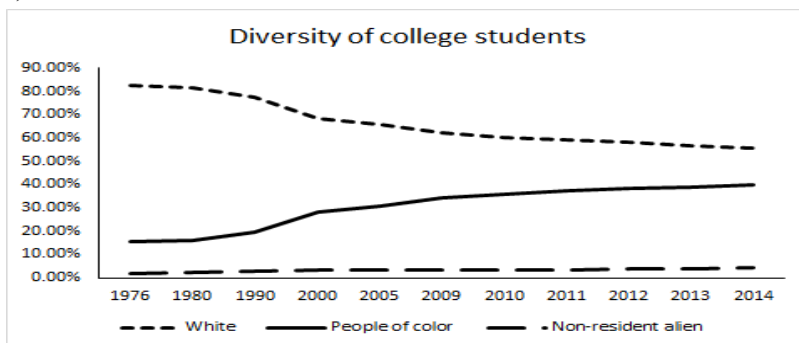


Figure 1: Increasing Diversity of the Student Body at American Universities

What should you, as a professor, be prepared to do to accommodate students from different cultures?

All instructors have course and classroom policies—some of them are explicitly stated, but many are unstated assumptions. When these unstated assumptions are a product of the instructor’s culture, there might be a mismatch with the assumptions that students from other cultures may have and the instructor’s assumptions. When there is a mismatch between the assumptions, instructors may inadvertently commit the fundamental attribution error (Ross et al., 1977), which means attributing knowledge or behavior with internal (i.e., personal) explanations rather than external factors (e.g., culture) as explanations. This error can lead to negative ramifications in an educational setting (Moore et al., 2010). An instructor may attribute the mismatch of student’s behavior and the expected behavior to internal motivations (i.e., the student’s character) rather than analyzing the role of the culture that the student came from. This misinterpretation of the student’s behavior can lead to a lower opinion of the students, and even discrimination and xenophobia toward the students and the culture that they come from (see Table 1).

Table 1: Cultural Expectation Mismatches and Corresponding Attribution Errors

Faculty cultural assumption	Expected behavior	Student behavior	Faculty perception (attribution to character)	Student intention (cultural influence)
Homework and quizzing are important.	Students will complete all homework and will prepare for quizzes.	Students do not take homework or quizzes seriously.	Students are lazy, apathetic.	Homework and quizzes are optional; the final exam is what is truly important.

Students' number one priority is their academic work.	Students will minimize any distractions due to obligations to family or society.	Students skip class or assignments when something "comes up".	Students are unfocused, not committed.	Academics are important, but students have a duty to family and to society that sometimes must take higher priority.
Assertiveness is a sign of competence.	Students will speak up in class and will come to office hours if confused.	Students are quiet in class and do not approach the professor.	Students are shy, timid.	The professor is the guru; students must remain quiet out of respect and should not interrupt.
Each individual must be responsible for their own work.	Although some collaboration is okay, each student should put work into their own homework and other work.	Students are mostly copying the homework solutions of other students and are even talking to each other during quizzes.	Students are cheaters.	All work, until the final exam, is optional and collaboration is allowed.
Punctuality is more important than completion of personal conversations.	Students will show up to class and to meetings on time. Assignments will be turned in by deadlines.	Students are late to class and to meetings. Students turn in assignments late.	Students are disorganized, poor time managers.	Relationships are more important than schedules; it is acceptable for social interactions to make one fall behind on appointments or due dates.

Critical thinking is more important than rote memorization.	Students show the ability to apply concepts to scenario and case study questions.	Students perform poorly on critical thinking questions.	Students cannot think critically.	Factual knowledge and theory are a high priority.
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Given that cultural assumptions may lead us to misinterpret the intentions of our students, what should faculty do about this situation? We will address each of the items in Table 1 below and end the article with general strategies to better value and enfold diverse students into our universities.

ADDRESSING CULTURAL MISMATCH DIRECTLY

The Value of Homework and Assessments

Although there are several educational systems worldwide, the influence of the “British system” in current and former territories of the British empire is very large. There are many international students who come out of British-influenced systems who will have very different expectations when it comes to the role of homework and final exams (de Vries, 1999). In the British system, quizzes and homework are not very important; rather the final exams often make 75% or more of the final grade (Widmann & K.C., 2013). Students coming from places influenced by the British system will prioritize summative assessment (e.g., final exams) over more formative methods of assessment (e.g., frequent homework and quizzing; Black & William, 2005; Harlen, 2005). For a typical American instructor with a classroom that includes many international students, it is important to clearly and repeatedly explain the essential role of homework and quizzing in the typical American university curriculum (Ludwig et al., 2011). Without this emphasis, students might assume, until it is too late, that missed homework or poor quiz grades will be of little consequence and that they will be able to catchup in the study period at the end of the semester. In fact, international students may not realize until too late that the typical American university has only a day or so between the last class meeting and the final exam week. This is in contrast to the British system, which may have a study period of a full week or more and have examinations spread out over 2 weeks (University of Canterbury, 2018). And so, in the American system, it is imperative for students to understand that they must keep abreast of their studies throughout the semester both for the purpose of protecting their grade, and because they

will not have as much time as they might expect to study at the end of the semester.

The Role of Family

Many American students from minority cultures have significant family expectations. In his piece in the *Chronicle of Higher Education*, Eric Hoover describes the difficulties faced by first-generation university students from Latino families (Hoover, 2017). Part of the challenge to begin higher education is the expectation for many domestic minority students that they would not move far from home so that they can continue to care for younger siblings or work to contribute to family income.

Similarly, for international students, their role in society may not allow them to focus exclusively on their studies. As an example, in our interviews with 499 students at Kathmandu University after the Nepal earthquake in 2015, we found that many students were expected to contribute to the rescue, relief, and rebuilding efforts (Joshi et al., 2018). With this in mind, administrators at the university closed the campus for 7 weeks, even though there was very little damage to the classroom buildings. As with domestic students from a minority culture, these students from a non-Western nation were expected to prioritize the needs of family and society over their studies when needed. This is in contrast to domestic students from the dominant culture and with students from Western nations. After the earthquake in New Zealand in 2011, some students at the University of Canterbury were able to return to their studies after only 2 weeks, even though the damage to the campus required classes to be held in tents erected in the parking lots (Wright & Wordsworth, 2013).

In practice, the ability of domestic students from the dominant American culture to focus exclusively on their studies is a cultural assumption that students from other cultures may not be acquainted with. As instructors, we should keep this in mind for our students who may expect absences from class or missed assignments to be readily excused when the students feel called to prioritize their role in family or society. Faculty need to make their expectations very clear, and, if appropriate, be flexible in enforcing due dates and attendance policies.

Student–Teacher Power Dynamics

Some students are from cultures that can be characterized as having large power distances between teachers and students (Hofstede, 2001). In this type of culture, there is an emphasis on respect for the instructor as the source of wisdom and a de-emphasis on the respect that an instructor might have for the independence of the learners to seek out knowledge. In practical terms,

students from a large power distance culture would be reluctant to initiate communication, to speak up in class, or to publicly contradict the instructor (Hofstede, 1986; Yoo, 2014). This reluctance is compounded if the student also faces a language barrier (Icel & Davis, 2017). If American instructors are insensitive to this cultural difference, they may be frustrated with what they see as a lack of initiative from the students, rather than seeing the students' behavior as a sign of respect. In this case, when students are reluctant to participate in class discussions or to ask questions in class or to come to office hours, American instructors may dismiss the students as apathetic or lazy, and even may penalize the students with lower class participation grades.

If an instructor uses pedagogy that relies on class participation, they should be very clear about the rationale for this technique and the extent to which it is a required component of the class. Instructors should be patient with students who are inexperienced with this level of interaction. If the requirement has an impact on a participation grade, then the faculty should give early feedback to students who are doing poorly with this portion of their grade so that they can attempt an adjustment before too much damage is done.

Attitudes Toward Time and Schedules

An individual's sense of time is deeply rooted in their culture. Polychronic people typically believe time is cyclical, punctuality is less important, relationships take priority over fixed schedules, interruptions are acceptable, and plans change often and easily (Hall, 1983). This is opposed to the monochronic culture in many parts of the world (including American universities), where time is regarded as linear, people do one thing at a time, lateness and interruptions are not tolerated, and people resist change of plans. It has been theorized that polychronic cultures arise in settings where unpredictable circumstances cause unavoidable interruptions and require frequent changes in plan (Hall, 1983). This certainly describes the conditions in Nepal in general and at Kathmandu University (KU), where one of us is an instructor (RJ) and the other served as a Fulbright Scholar (HF). Underlying causes such as poverty and political instability mean that there are frequent unexpected interruptions to the things of daily life such as the availability of electrical power, public transportation, water, access to roads, etc. (Widmann & K.C., 2013). One might imagine, a polychronic mindset would be advantageous when faced with such unpredictability. As we saw in survey data, in the wake of the 2015 earthquake, instructors and students alike at KU were able to quickly and easily change their plans and schedules to accommodate the needs of each other (Joshi et al., 2018).

Our cultural assumptions about time is perhaps one of the most challenging mismatches to address. When a student is not punctual to class, to meetings, or with due dates, it is very easy for American professors to

assume that student is disorganized, unfocused, or lacks respect for the class. But from the student's point of view, it may seem perfectly reasonable, for example, to prioritize their relationship with a peer and to continue a conversation in the hallway to its natural conclusion rather than to rush off and get to class on time. So, what should an instructor do? First off, if the instructor feels it is important to put a high priority on punctuality, this expectation should be made very clear to the class as a whole. This is especially true if being timely will have an impact on grades. If the professor will deduct points from a participation grade for missing classes or from a homework assignment for missing a deadline, then these policies should be clearly laid out in the syllabus and should be highlighted early and repeated for emphasis (Ludwig et al., 2011). Beyond clear expectations, if an instructor can be flexible and even forgiving for some amount of tardiness, this flexibility can go a long way in leveling the playing field for students who are not accustomed to our American tendency to prioritize adherence to schedules and punctuality.

Collaboration Versus Cheating

Most American faculty encourage students to collaborate and learn from each other, but we may have a cultural assumption about when "collaboration" crosses over into "cheating" that our students are unaware of. As an American teaching at Kathmandu University, one of us (HF) was surprised when students would copy each other's homework before turning it in or try to talk to each other during quizzes. When confronted about why they were doing these things, the students would simply say, "This is what students do." This makes some sense given that, at KU, homework and in-class quizzing is infrequent and generally does not carry much weight. As mentioned earlier, the only assessment that was highly secure was the final exam, and this made up 75% of the grade. Indeed, final exams are strictly monitored to prevent cheating with students spread out over more than one classroom and watched by extra "invigilators" to ensure that student cannot copy from each other.

It is no wonder then that students from another culture may be unaware that they are breaking the rules at an American university when they cross our line from collaboration over into cheating. Craig and coauthors describe a workshop exercise used to help students consider examples of student behavior and to sort into what is cheating and what is not (Craig et al., 2010). By combining this sort of workshop with clear course policies laid out in the syllabus and clear assignment guidelines, both domestic and international students can be made aware of what is acceptable collaboration and what is not acceptable.

Critical Thinking Versus Memorization

For many American science faculty, training students in critical thinking is a higher priority than the acquisition of factual knowledge (National Research Council, 2012). Many faculty assume that critical thinking will unlock the door to the application of science to solve novel problems (Facione, 1990) and that this is much more useful than rote memorization and theoretical details, which can readily be obtained through a quick internet search. This point of view is in contrast to priorities from other cultures, many of which have a higher priority for factual knowledge (Dahlin & Watkins, 2000; Li, 2003). Research in cognitive science shows that both ends of the spectrum are important and that factual knowledge is an important prerequisite to critical thinking (Willingham, 2006). Although critical thinking skills can be explicitly taught within a context (Halpern, 1998), these skills do not easily transfer to analogous contexts without the accompanying factual knowledge of the new context (Gick & Holyoak, 1983). Memorized facts allow learners to build mental schemas that can be readily utilized for critical thinking (Hambrick & Engle, 2002). Without such schemas, learners are likely to be hampered by cognitive overload (Kaakinen et al., 2003).

When American university faculty focus primarily on critical thinking, this could be unexpected by students of different cultures who are accustomed to a relatively higher focus on factual knowledge (Dahlin & Watkins, 2000). Those students might perform poorly on a quiz or test if they are surprised by critical thinking questions. Instructors might attribute the student's failure to a personal shortcoming such as not studying hard enough or an inability of the student to think critically. This mismatch of expectations might persist with unclear expectations regarding the style of the test, and students may focus their study time on acquisition of factual knowledge and theory rather than practicing the application of this knowledge in other contexts.

To address this mismatch of expectations, instructors should be explicit about the importance of application of knowledge early in the academic term. This message should be reinforced with early and low-stakes assignments and quizzes that give practice in the application of knowledge to multiple contexts. At the same time, American instructors would do well to strike a balance to value both critical thinking and rote memorization. This is especially true in light of cognitive science research that points out that factual knowledge is the prerequisite and necessary "grist for the mill" of critical thinking (Willingham, 2006). A focus on one type of learning to the exclusion of the other would hamper the learning of all students, regardless of their cultural background.

CREATING A WELCOME ATMOSPHERE

Besides directly addressing cultural mismatches, faculty can play a role in creating a campus culture that is generally welcoming to students from all cultures. Below we highlight three examples: instilling a sense of belonging, supporting cultural awareness, and giving students the benefit of the doubt (without lowering standards).

A Sense of Belonging

While all first-year university students are susceptible to difficulty transitioning into the new culture that university brings, this transition can be especially difficult for populations of students such as international students, racial and ethnic minorities, first-generation university students, and low-income students. When these students perceive any difficulty fitting in, they conclude that they do not belong at the university and their stress level, health, and grades all suffer.

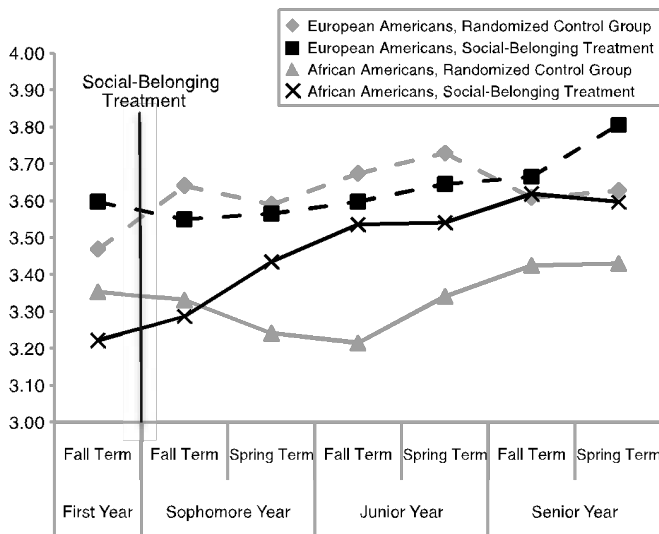


Figure 2: GPA versus semester for different cohorts of students in Walton and Cohen's (2011) study. The timing of the social belonging exercise is noted as a vertical line.

Walton and Cohen (2011) detailed a study in which a population of first-year students were asked to complete a belonging exercise meant to buttress the students' sense of social belonging (Figure 2). The students in the study were asked to read purported survey results from seniors at their

university in which the respondents discussed how at first, they felt like they didn't belong at the university, but how over time these feelings subsided and they grew confident in their feeling of belonging. The first-year students were then asked to write an essay and record it as a video, explaining what students might expect in their first year. The entire intervention duration was approximately 1 hour.

In the Chemistry and Biochemistry Department at Calvin University, we have adapted the social belonging exercise of Walton and Cohen into a plenary meeting for all students during the first week of General Chemistry. Students are given 5 minutes to reflect and write about their initial difficulties transitioning to university and how they have begun to address these difficulties. The written responses are exchanged anonymously, and then reported out to the whole group of students and discussed. This intervention is a simple way to implement the research-based methods of Walton and Cohen without a huge time commitment by the faculty or students. It is part of a multifaceted effort to increase the success of our incoming students by implementing evidence-based practices into our curriculum.

Cultural Awareness and Events

Co-curricular activities can be key in enfolded students into a sense of belonging. Students from minority cultures benefit from opportunities to interact socially with students from similar backgrounds. Research shows that people from more collectivistic nations or backgrounds naturally tend to have an interdependent sense of self, and particularly benefit from connecting with each other (Markus & Kitayama, 1991). In their survey data, Museus and colleagues (2017) measured a high correlation between university students' sense of belonging and the extent to which they had opportunity of physically connect with faculty, staff, and peers who share or understand their background. A common way to foster such opportunities is through cultural student associations or clubs for students from particular nations, regions, or cultures. A university can show its commitment to such associations through financial support and through faculty or staff sponsorship.

Students also perceive that they belong to their university community if they are given the opportunity to share elements of their culture with the student body as a whole (Museus et al., 2017). When such opportunities are championed by university faculty, students from minority cultures are more likely to feel that their customs and assumptions are valued by their adoptive community. Co-curricular events that promote the sharing of cultural elements such as dance, drama, music, fashion, and food can be compelling evidence that the campus community supports and recognizes cultural contributions from students of minority cultures. When feasible, faculty

should support these efforts by advocating for, sponsoring and attending them.

The Benefit of the Doubt

Although faculty should be aware of the struggles that students from nonmajority cultures have, they should be careful to not *expect* that all of these students will struggle. This can be a difficult balancing act. We want to anticipate how our cultural assumptions set up students for a struggle, but we do not want to paint with such a broad brush that we expect all students who do not look like us will have the struggles described in this article either. These expectations can turn into a self-fulfilling prophecy when they lead to stereotyping and, ultimately, to discrimination on the part of the faculty. This is true both with international students (Poyrazli & Lopez, 2007) and with domestic minority students (Gossett et al., 1998). If faculty anticipate that students from minority cultures will struggle, they may undermine the students' education by lowering standards (Rosenthal & Jacobson, 1968) or giving lower grades due to lower expectations (Petcovic et al., 2013). Faculty need to be sensitive and perceptive to the additional barriers that students from other cultures face, but they need to be careful to accommodate without compromising standards.

CONCLUSION

Within the last 20 years, the diversity in student population has grown much faster than that of university faculty (NCES, 1995, 2015). This change in demographics increases the occurrence of a mismatch of professors' expectations and students' behaviors. This can lead to professors committing a fundamental attribution error where they are misinterpreting students' behaviors by not fully understanding the students' intentions and cultural expectations (Ross et al., 1977). Being aware of how cultural expectations influence both teaching and learning expectations is the first fundamental step in understanding and overcoming these mismatches to help all students succeed. This involves making expectations clear particularly about homework requirements (Ludwig et al., 2011), and defining the line between collaboration and cheating (Craig et al., 2010). When possible, professors should be flexible regarding the different cultures' ideas of time (Hall, 1983), family obligations (Hoover, 2017), and the power structure (Hofstede, 1986; Yoo, 2014); however, professors should maintain high expectations of all students regardless of ethnic background (Rosenthal & Jacobson, 1968). As an academic community, it is important for both professors and students to create an atmosphere of belonging (Walton & Cohen, 2011) and an appreciation of people from all cultures (Museus et al., 2017).

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