Coping Strategies of Minoritized Students in STEM Higher Education

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Abstract

Previous research shows that the inherent systemic inequities present in STEM higher education impacts minority participation negatively as evidenced by phenomena like, low sense of belonging, isolation, low self-efficacy, and attrition. Thus, minoritized populations (persons who identify as Black, Latinx, Native Alaskan, Indigenous, or Asian Pacific Islander) have had to overcome many barriers to participation in STEM higher education. In addressing this participation, some research uses deficit frameworks that assume minoritized students lack coping skills (for e.g., how to balance work and classes), and these can be provided for them, for example, through intervention programs. However, there is a general lack of understanding regarding how these students cope from an assets-based lens. This study reports on the coping strategies of 31 minoritized students, and is guided by the research questions: 1) what personal coping mechanisms do minoritized undergraduate students use to navigate STEM fields? and 2) how do mentees leverage assistance from mentors in order to navigate STEM fields? The data was examined through critical race theory and mentoring frameworks. Preliminary results indicate that the participants used various forms of coping strategies including: mentoring, academic support, avoidance/distancing, family, social support, and self-care. These findings can help provide information about mental health resources to support these students, as well as the need for intentional mentoring and advising by faculty and staff. These efforts may have broader implications towards increasing minoritized participation in STEM fields.

Introduction

College students employ different mechanisms to navigate the stress that accompanies higher education (e.g., financial, academic and social pressures) (Jain & Verma, 2016). Financial pressures include affordability of tuition as well as living expenses. Academic pressures vary by field, but these involve curriculum demands (assignment, projects, internships, etc.), and the social pressures of engaging with peers, and faculty. The microcosm of the college campus can be challenging for students, where some are leaving the familiarity of home and family to join spaces where they can be isolated. Prior research suggests that being socially connected can help to alleviate stress (Achat et al., 1998). Research also shows that minoritized student populations experience more barriers to persistence in STEM higher education compared to white students and certain Asian populations due to the added stress of racism faced by these populations (Harper, 2010; Pawley, 2019). Racial stress can manifest due to phenomena like isolation, stereotype threat and microaggressions at predominantly White institutions (PWIs) (Clarke et al., 2023).

In response to stress, college students develop either positive or negative coping mechanisms (Brougham et al., 2009). Positive mechanisms can involve mentoring, sport team involvement, exercise, participation in affinity groups, etc. Negative coping mechanisms can involve the use of substances like alcohol, self-harm or self-isolation, which can cause students to spiral downward into unhealthy activities (Pierceall & Keim, 2007; Eaton & Bradley, 2008). This study seeks to add to the literature involving how undergraduate minoritized students in STEM higher education employ coping strategies to navigate

through their academic programs. Understanding how these students leverage their personal and professional networks, particularly mentors, can help inform how mentors, STEM departments, and intervention programs can assist minoritized students to persist and complete degree programs. The research questions for this study are: 1) What personal coping mechanisms do minoritized undergraduate students use to navigate STEM fields? and 2) How do mentees leverage assistance from mentors to navigate STEM fields?

Literature Review

Coping Strategies in College

According to literature, college students have to find mechanisms to deal with the stress brought on by the various aspects of college life. These include, but are not limited to fitting in socially, coursework demands, financial pressure, and figuring out one's future, finding parking, childcare, and family demands (Brougham et al., 2009). According to Brougham et al., coping can be characterized into two categories: 1) problem solving and 2) emotional. Problem solving coping involves engaging action plans like using a planner. Emotional coping involves using mechanisms like avoidance or stress appraisal. Problem-focused techniques generally yield better outcomes, however some emotional mechanisms like distancing from toxic relationships can also prove beneficial (Brougham et al., 2009). There are some reported gender differences in coping with the stressors presented in college. Women tended to use more emotion-focused techniques than men. However, when comparing emotion-focused coping strategies, college men engaged in more disengagement using substances like alcohol than women (Eaton & Bradley, 2008). Research also shows that stress levels are higher in students that use disengagement coping through use of drugs and alcohol (Coiro et al, 2017).

Minortized Students and Coping

Along with the daily stresses every college student faces, minoritized student populations may have the added layer of racial stress. Mallet & Swim (2009) reported that when faced with racial discrimination, African Americans use primarily self-focused coping mechanisms versus situation-focused coping mechanisms. Self-focused strategy includes appraisal of the harm being done. Situation-focused mechanisms include physical avoidance of the situation or person. According to the National Academies report on STEMM mentoring, minoritized students have to operate as a dual self (code switch) in order to navigate in STEMM fields (NASEM, 2009). This is due to the prevalence of a normed white culture in STEM (McGee, 2020, Harper, 2010). How do minoritized students specifically cope with racial stress? McDerrmot et al. (2022) reporting on a study of Black and Latinx college students stated that these students used five ways to cope. These included: dialogue to clear up a stereotype or misconception; being proud of who you are and what you have to offer; working hard to prove the naysayers wrong; responding rudely to racist comments; and ignoring and distancing from racist people. Another study reported that self-blame and disengagement correlated positively to suicide ideation among Black college students, whereas social support and religious involvement mitigated suicide ideation (Goodwill, 2022). In addition, social connectedness can play a role in positive coping (Huang et al., 2022). McGee also reports that minoritized students in STEM minimize racial stress through code switching. Code switching entails adopting ways of the dominant culture in order to navigate, while at the same time sacrificing parts of your personal identity (2021).

In this work, coping mechanisms of minoritized undergraduate students are examined through critical race theory and mentoring frameworks. The combination of these frameworks can help us understand the unique challenges faced by minoritized students, and how mentoring can help them navigate through racism as well as other stressors that are part of the college landscape.

Theoretical Framing: Critical Race Theory and Mentoring

We used critical race theory and theoretical work about mentoring to help frame our understanding of how minoritized students cope with the normal stressors of college as well as racial stress caused by racism. The unique challenges faced by minoritized students can be viewed through critical race theory. The tenets of critical race theory helps us to understand: 1) that racism is endemic in American society in all facets of American society, and whiteness is deemed superior to other racial identities; 2) there is little effort to address racism in this country unless there is benefit to elite white people; 3) race is a social construct, which results in groups being racialized differently by dominant white culture; and 4) scholars of color offer a unique perspective to shed light on racism and how it lands for people of color (Delgado & Stranic, 2023). Therefore, minoritized students will inevitably face racism (subtly or blatantly) at some point in their courses and daily activities in STEM and other departments because racism is baked into American society (tenet 1) (McGee, 2020). Diversity initiatives in different departments are more for optics because the status-quo of whiteness must be maintained, which manifests in the critics of intervention programs (tenet 2) (Russo-Tait, 2022). Minoritized students are racialized differently by white people due historic contexts (Cedillo, 2018). For example, a Black student from Nigeria might be more accepted than a Black American, but less accepted than a student from China (tenet 3). The dearth of minoritized scholars in academia (including STEM) results in the lack of opportunity for white people in these spaces to understand or face the truths of racism (tenet 4) (Taylor, 2020). Racism in STEM can manifest as microaggressions (Holly, Jr. & Quigley, 2022), color blindness (Harper, 2010), meritocracy (McGee, 2020), and rigor (Secules, 2021). Microaggressions are those daily seemingly minor occurrences that continuously demean minoritized populations (Franklin, 2016). For example, a Black student might be constantly interrupted by her white counterparts during a project meeting. Colorblindness ignores the historical disadvantage and present trauma faced by minoritized populations (O'Brien, 2000; Bonilla-Silva, 2016). Meritocracy emphasizes that anyone can succeed with hard work and determination, which implies that minoritized students are unsuccessful for lack of effort on their part (Pawley, 2019). Rigor maintains white/maleness in STEM departments through unnecessary workloads, inflexible requirements, and lack of recognition of contributions of diverse others (Riley, 2017). Therefore, given the phenomenon of stress faced by minoritized students, this work posits that mentoring can facilitate positive coping mechanisms in minoritized undergraduate students in STEM higher education.

Mentoring

Some college students arrive on campus already with coping skills gleaned from family or other experiences. How can colleges ensure that all students have the ability to learn and apply coping skills to ensure academic and career success? Scholarship on communities of practice (for example, the computer science department) detail that new members or outsiders can only become a part of the community when the elders of the community (i.e., faculty, advanced students) accept and indoctrinate them in the culture of the community (Wenger, 1998). This concept can be executed through mentoring. Mentoring is the

relationship between a more experienced individual and a less experienced individual. This relation serves to guide, support and help the less experienced individual navigate in either new environments or in a new role (Kram, 1984). Mentoring provides mentees with coaching, career planning and psychosocial support (Eby & Lockwood, 2005).

Other literature reported that mentoring can yield the following benefits: 1) positive self-image, 2) persistence in school and 3) career development (Eby et al, 2007; McGee, 2021). An important mentoring relationship is the faculty-student relationship. This relationship is usually formed within the bounds of the classroom, but can extend outside the classroom, and can produce the benefits stated above (Eby et al, 2007). Mentoring has been shown to yield positive outcomes for minoritized students in STEM fields (e.g., degree completion) (Mondisa, 2018; National Academies of Sciences, Engineering, and Medicine, 2020). Other research suggests that mentoring of minoritized students by white faculty can also result in the white faculty developing cultural intelligence (Johnson-Bailey & Cervo, 2007). This can further incite racial allyship work, which can support other minoritized students (Patton & Bondi, 2015)

Methods

Data Collection

Thirty-one minoritized current or previous students were recruited to participate in the study. The students were recruited from various institutions across the US, including Research-one (R1), Minority Serving Institutions (MSIs) and PWIs. This paper represents part of a larger study on mentoring practices toward undergraduate minoritized mentees. The students were nominated by their mentors. The mentees were sent a mentoring assessment survey (Bork et al., 2022), and upon completing the survey, they were invited to participate in a semi-structured interview. Participants were asked several questions including what coping mechanisms they used to navigate challenges personally and in school. They were also asked what coping mechanisms were shared with them by their mentors and support networks. Their interview data was used for this study and participants were assigned pseudonyms by the researchers.

Data Analysis

The interview transcripts were first cleaned and de-identified. Student demographics taken from the survey is shown in Table 1. There were 31 study participants. The ages of the participants varied such that 48.4% (n=15) were the ages 18-25; 29% (n=9) ages 26-30; 19.4% (n=6) ages 31-35; and 3.2% (n=1) ages 41-45. There were 61.3% (n=19) who identified as women, 32.2% (n=10) identified as men, and 6.5% (n=2) as gender queer or non-binary. There was variance across the majors as 32% (n=10) were in engineering, 16% (n=5) were mathematics and computing majors, 29% (n=8) natural sciences (e.g., biology, chemistry etc.), and the remaining were social science majors, 26% (n=8). The racial makeup of the sample were 42% (n=13) Hispanic/LatinX, 48% (n=15) Black/African American, 10% (n=3) mixed race (Black/LatinX and Black/White, LatinX/White). The transcripts were open coded, and then a priori coded according to a previously developed code book (Bork et al., 2022). Themes relevant to coping were sorted and categorized using thematic analysis (Bork et al., 2022; Creswell, 2012). These will be discussed in the results section.

Table 1

Name	Age	Academic Status	Gender	Major	Race
Ally	26-30	Professional	Female	Life sciences	Hispanic or Latino
Amy	18-25	Undergraduate: Junior	Female	Computer and information technology science	Black or African American, Hispanic or Latino
Andi	18-25	Graduate	Female	Engineering	Hispanic or Latino
Antwon	31-35	N/A	Male	Mathematical sciences	Black or African American
Ariel	18-25	Undergraduate: Senior	Female	Engineering	Hispanic or Latino
Betti	18-25	Graduate	Female	Engineering	Hispanic or Latino: Mexican
Brandy	26-30	Graduate	Female	Social sciences	Multiracial/Multicultural: Black and White
Cameron	18-25	Undergraduate: Senior	Male	Engineering	Hispanic or Latino: Mexican American/Chicano
Cassie	31-35	Graduate	Female	Social sciences	Hispanic or Latino: Mexican American/Chicano

Name	Age	Academic Status	Gender	Major	Race
Cody	31-35	Postdoc	Genderqueer	Social sciences	Hispanic or Latino: Mexican American/Chicano
Danny	18-25	Graduate	Male	Engineering	Black or African American
Faith	26-30	N/A	Female	Biology	Black or African American
Navid	26-30	Graduate	Male	Computer and information technology science	Hispanic or Latino: Mexican American/Chicano
Jay	26-30	Graduate	Male	Life sciences	Black or African American
Kristian	26-30	Alumni	Male	Life sciences	Black or African American
Liz	18-25	Graduate	Non-binary	Social sciences	Black or African American
Mary	41-45	N/A	Female	Engineering	Black or African American
Mike	26-30	Graduate	Male	Life sciences	Hispanic or Latino: Mexican American/Chicano
Monica	18-25	Undergraduate: Senior	Female	Engineering	Black or African American
Nadine	31-35	Post-graduate	Female	Mathematical sciences	Black or African American
Octavia	18-25	Graduate	Female	Social sciences	Black or African American
Patrice	26-30	Graduate	Female	Chemistry	Black or African American
Pierce	31-35	Graduate	Male	Engineering	Hispanic or Latino
Ray	18-25	Graduate	Male	Chemistry	Black or African American

Name	Age	Academic Status	Gender	Major	Race
Rene	18-25	Undergraduate: Junior	Female	Social sciences	Black or African American
Samantha	26-30	Graduate	Female	Life sciences	Hispanic or Latino
Sasha	18-25	Graduate	Female	Social sciences	Hispanic or Latino
Shawn	18-25	Undergraduate: Senior	Male	Engineering	Hispanic or Latino
Traci	18-25	Undergraduate: Senior	Female	Engineering	Hispanic or Latino, White/Non-Hispanic
Dr.Viola	31-35	Post-graduate	Female	Life sciences	Black or African American
Zoe	18-25	N/A	Female	Mathematical sciences	Black or African American

Researchers' Positionalities

The first author is a Black man who has been a student and educator in STEM fields for over 30 years in predominantly White institutions (PWIs). As a student he has had to utilize some of the same coping mechanisms cited by the participants. He has also seen many instances of negative coping mechanisms as both a student and an educator. When collecting data, he was able to provide examples for clarification to the participants, and ask follow up questions that come from his own experiences in order to obtain richer data. The second author is a Black woman who also has had to navigate STEM higher education as a student and instructor at PWIs as well. She served as a point of triangulation in analyzing and interpreting the data.

Results

There were several themes identified from the data. First, personal coping mechanisms of the mentees include: 1) disengagement/distractions, 2) self-awareness, 3) seeking a higher power, and 4) family and social community. Second, were the coping mechanisms facilitated through mentoring which include: 1) academic support, 2) affirmation/validation, 3) encouraging leisurely activities, and 4) navigating challenges due to race or ethnicity.

Mentees' Personal Coping Mechanisms

Disengagement/distraction. Some mentees disengage from the challenge at hand in order to step away from the current issue. Taking a break can allow them to gain a different perspective on how to successfully navigate challenges. For example, Anderson stepped away from a situation to clear her mind:

> *Yeah. So, in terms of what I do, I ignore my responsibilities. I pretend they don't exist for a while. I grab my dog, I take her out to a park that's two miles from my house walking, and I just forget they all exist until I come back home. I wouldn't say it's the best coping strategy because you can't just pretend they don't exist [indefinitely], but it definitely does help me clear my mind.*

Self-awareness. Some mentees reported using self-focused techniques to assess situations. Zoe, for example, recognized the importance of checking in with oneself when faced with obstacles to determine how she felt about a situation and what support there was to assist her:

> *But yeah, being mindful and making time to be with myself, so that I'm checking in and also recognizing, "Okay, you're kind of drowning in this area. What's going on? Who is your support around you? What can they do? How can you reach out to them? And then, what can you now do for yourself?"*

Family Support/Peers

Mentees also report appreciating the ability to seek out family/peer support, and being able to be honest and transparent with their support networks. For example, Amy leaned into family for guidance:

> *Yeah. Within my troubles, I go to my family first. I say, "Okay, I don't know what I'm going to do, but I need you all's help." They say, "All right, Amy, here's the issue, we're going to give you a few options and we're going to decide as a family what we're going to do."*

Anderson recalls how she enlisted the help of a classmate during a very challenging course:

> *"...I had one class where the instructor was just not helpful at all. He didn't make sense in class. He didn't make sense outside of class. And those were actually just my two lowest grades in all my transcript. Because once you get to those higher-level engineering courses, there's hardly any external help. You can find videos on calculus, but finding videos on mechanical design specifically, that's a little harder. And everyone does it differently. Everyone teaches out of different books. So that class, I definitely felt I was alone. I had one friend in that class that the only way I got through was because of her.*

Engaging with a higher power. There are some mentees that lean on their faith in a higher power as a mechanism to alleviate stress during challenging times. Zoe recalled prayer as an effective coping tool to help navigate through hard times:

> *So, for me, one is prayer. Spending time with God, taking time to evaluate…*

Support Programs. Some mentees cite the importance of support programs geared towards under-resourced or underrepresented populations as a key coping mechanism. Mentees like Shawn leveraged his connection with intervention programs to help navigate through his first year:

> *Since my freshman year, the […] Programs support me a lot. I mean my first year in college, they literally hold my hand my first year of college to understand how college works.*

In summary, minoritized students utilize various mechanisms to cope with the stressors associated with college. They lean on family and academic/social communities, faith, and utilize leisure activities in order to cope with the challenges they face while in college.

How mentees leverage assistance from mentors as positive coping mechanisms

Academic Support. Many mentees reported enlisting their mentors for assistance when faced with challenges including coursework or school related finances. For example, Pierce recognized how valuable his mentor was when he faced difficulties:

> *Yes, I remember like every, anytime I had like a hard time in a class or anything, she would always refer me to like student services or she would offer her help to sort of listen to me, or she would offer to help me find scholarships. And she actually went out of the way to find scholarships and resources for me. So, she was super helpful in that sense.*

Prioritizing Recreation/Short-Term Disengagement. Mentors helped students use problem-solving techniques like disengaging for a time in order to give their mind rest. This helped them face challenges with more clarity of thinking. For example, Viola learned from her mentor to do something fun to take a break, mentally reset, and return to the issue at hand:

"By Joe she was right." And to this day I use that technique, if I can't figure something out or if something is just I can't get it or if something is just that close, I'm on the cusp of solving it but I just can't get it, I

leave it alone. I go away, day or two, maybe three depending on how difficult of a problem it is. I leave it alone. I'll come back to it refreshed and it works.

Validation/affirmation. Mentors assisted mentees in being persistent in the face of opposition. They helped to impart drive and determination to their mentees. Mentees found this affirmation empowering. For example, Antwon's mentor's affirmations motivated him to persist in his field. He recounts his mentor telling him:

> *"Keep trying. Do what you've got to do. Don't let anybody tell you no, when it comes to certain things." So, in some ways, that kind of helped me in my field.*

Dealing with racial stressors. Some mentees shared how their mentors helped them deal with racial stress. Samantha shared an instance where another student expressed to her that they didn't believe in diversity programs. Her mentor could relate to the experience, and validated her feelings:

> *"She basically gave me a pep talk, and that wasn't okay for him to have said. I know it's not okay, but it's good to hear it from someone who I look up to. I think managing direct racism like that has been really helpful, because I don't have to explain it to her, because I know there are some people, some faculty members, who don't really believe in these diversity programs. Some of them they sneakily say it, and it's really irritating,"*

Pierce also expressed how much he valued the fact that his mentor shared a similar ethnic identity to his own, and who can relate to his unique experiences being a Latinx student:

> *It definitely, when you speak, even like the same language, we both speak Spanish. We can communicate in either English or Spanish. It's a great difference because sometimes I can't think of a word, for example, in English, So I will say it in Spanish and she understands what I mean. So that is also huge. I mean yeah, when you have somebody that knows what you're going through or has been in your shoes, then that definitely plays a big role. Because they can, I feel like they just know they have like this sense of how to approach the situation and how to make it better or, and they're able to sort of connect with you on a different level.*

Mike shared an instance where his mentor encouraged him to skip class to participate in a protest around building the border wall. His mentor recognized the importance of engaging in social justice activities in order to deal with racial stress:

Mentor straight up told us "Skip your class if you want to, go to the protest if you feel like you need to because it's affecting you guys." So, I wouldn't say... I mean it does involve my identity because some of the stuff they were writing was about the border wall.

To summarize, mentors help mentees to prioritize self-care coping skills, assist with academic support, validate their worth, and help their mentees deal with racial stress. Mentees cited these imparted coping skills as crucial to their persistence in college and career.

Discussion

Minoritized students face the same struggles as other students in college, with the additional phenomena of racial stress. This can negatively impact their participation in STEM fields. According to the results, self-awareness helps students recognize the issue at hand, how they are feeling, and what resources are available for help. The data showed instances of problem-solving coping (e.g., seeking out help to find resources) and emotional coping (e.g., disengaging) (Brougham et al, 2009; Mallet & Swim, 2009). When minoritized populations face racial stress, they can isolate themselves in order to protect themselves (Plummer & Slane, 1996). This was mirrored in some students' experiences. Though sometimes necessary avoidance can stall a mentee's academic progress. For example, a mentee might face a racist teacher, but skipping class to protect themselves can result in a failing grade. Avoidance was not a salient theme in the data. Brougham et al (2009) and McGee (2021) discussed avoidance as a negative coping mechanism. Only one mentee cited avoidance and procrastination as a negative coping mechanism. Majority of the mentees cited disengagement in order to evaluate and attack the issue at hand more effectively. Therefore, students discussed needing a one-two approach when addressing issues on campus. Introspection and careful consideration of the problem at hand, then seeking help from trusted capable others (e.g., mentors, social community) who can point them to necessary resources.

Participants reported how invaluable mentors were in helping them cope with the challenges of school. According to mentoring literature, mentors are beneficial for connecting mentees with resources necessary to help them navigate school (Bork et al, 2022). Mentoring can prove useful in providing coping skills. For example, mentors can coach students on how to prepare for classes, and how to seek out help from teachers. Mentoring can more specifically be leveraged to help minoritized students work through racial stress effectively, for example validating their sense of belonging and worth (National Academy of Sciences, 2020). Mentors can help them not see themselves as failures or incapable due to obstacles, but can help them brainstorm potential solutions while not self-blaming. This aligns with the theme of mentors validating the mentee, and mentees remembering their goal and worth (McGee, 2021). Effective mentors also can advise mentees on when and how to disengage and take a break, while still staying on course with their career goals. Students often have a hard time taking breaks or changing direction due to self or family expectations. Feelings of shame are common as they feel like they have let themselves or family down, and might never achieve their career goals. A mentor is useful in helping them come up with a plan to either alter their course or to disengage and return, while validating their worth (Byars-Winston et al, 2015). Some mentees report talking to family, going for a walk, or seeking a higher power. All these can help them to center themselves without internalizing the issues, while still achieving their goals. Other research suggests that though having a mentee of the same race and gender doesn't necessarily predict positive academic outcome, students of color and women reported feeling

more supported by a mentor of the similar race or gender (Blake-Beard et al, 2011). This correlates to the results of the study especially with regards to racial stress endured by mentees. A mentor with a similar racial/ethnic identity can be more sympathetic and be able to divulge coping strategies from their own experiences. Mentees will not always find mentors of the same race/ethnicity in STEM fields. However white faculty and staff can engage in racial allyship work towards minoritized mentees, and use their power and privilege to support them, which can mitigate racial stress (Patton & Bondi, 2015). These white faculty/staff have to be sure to validate the mentee's racialized experience and not minimize them due to colorblindness (Chan, 2018; McGee, 2021)

In summary, minoritized students approach college with resiliency in the face of inequitable and racist experiences with peers, staff and faculty. They gain this resilience through family and community (Yosso, 2005). Mentoring can help them mine this resiliency, develop their self-efficacy, increase sense of belonging, teach them new coping skills, and direct them to resources that can help them be successful in college.

Limitations

There were some study limitations. Some of the participants were already past the point of being an undergraduate, and thus they were recalling scenarios in some cases from several years prior. Most of the participants were mentored as researchers, and thus might have more interaction with the mentors as compared to students who are not involved in research. This could skew the research as these research students could be more high performing than minoritized undergraduates, who might not have regular interaction with mentors. Another limitation is that we did not delineate the experiences of men and women though literature does report differences. The gender difference warrants further research.

Conclusion

Minoritized undergraduates use several methods to cope with hostile STEM college environments. Their coping mechanisms center on centering self-awareness and resource acquisition. Self-awareness helps students identify the cause of the problem. Seeking the help of a mentor can help them avoid feelings of failure, and redirect their energies to a positive outcome (even if it involves a change in direction). Mentors whether minoritized or otherwise must recognize, acknowledge and attempt to mitigate racial stress endured by minoritized mentees. This study can inform STEM departments how to effectively guide and encourage minoritized students, which can help increase their persistence and completion.

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