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Place-Based Education as Liberatory Praxis

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Indigenous students are severely underrepresented in higher education, and in STEM disciplines in particular. There is a need for research critiquing the hegemonic culture of STEM programs in the United States that may present challenges to students pursuing these degrees from Indigenous communities. Using Tribal Critical Race Theory and Native Student Identity Development Theory, I examine the ways in which STEM programs throughout the United States harms and excludes Indigenous students, and seek to uncover ways that we can build Engineering departments which are more inclusive of varying worldviews, with a particular emphasis on Indigenous epistemologies. Specifically, I offer Place-Based education as a particular liberatory praxis in education which is conducive to Indigenous paradigms and has transformative potential within STEM disciplines. Implications for the University of Vermont are discussed.

Keywords: Native Student Success, Place-Based Education, Indigenous Epistemology

Native American students are among the most marginalized college-going populations in existence today, and they are a population which is historically ignored and left out of diversity and inclusion initiatives at colleges and universities (Schooler, 2014). Compared with other minority groups in higher education, Native Americans have the lowest representation and retention rates, and only make up 1% of the student population in enrollment (Schooler, 2014). 19% of 18-24 year old Native American students are enrolled in college compared to 41% of the overall U.S. population (PNPI,

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2020). Additionally, 41 percent of first-time, full-time Native American students attending four-year institutions beginning in 2012 graduated within six years, compared to 62% of all student populations (PNPI, 2020). Attrition for this student population is also high, and while it is hard to aggregate for a multitude of reasons, estimates suggest that this lies somewhere between 75 to 93 percent (Smith et al., 2019). Native American students in the United States face unique educational challenges towards college access, the scope of which ranges from economic to educational.

These statistics become even more notable when examining the experiences of Indigenous students in STEM (Science, Technology, Engineering, and Math) programs. STEM programs in general suffer from problems with retention of students, with more than half of the first-year students who begin STEM programs leaving the field before graduation (Smith, 2019). Native American students are particularly marginalized in these fields. 1 in 150 students who graduate in science and engineering programs are Native American, and yet Native students make up close to 2% of the student population (Smith et al., 2014). The long history of exploitation of Native peoples in STEM programs and disciplines leads to an ethical imperative to create more inclusive cultures within these programs, to better serve Native students to be inclusive of Native epistemologies. STEM programs are often associated with high levels of social mobility and access to wealth post-graduation. With the poverty rate for Native Americans sitting at around 25.9%, access to programs which will allow them to escape poverty and help their communities is a compelling issue within higher education (Smith et al., 2014). Native students who want to practice STEM activities on and off reservations are required to become credentialed in these dominant scientific epistemologies. This operates as a form of epistemological imperialism, in that it requires for legal and normative reasons students to earn degrees in the knowledge regimes that delegitimize and threaten the cultures and practices of the very tribal communities that students intend to serve (Cech et al., 2017). If we in higher education intend to prioritize access and success for all students, a critical examination at this epistemological imperialism is warranted and necessary.

It should be noted that despite evidence which might point to the contrary, Native students are undoubtedly interested in STEM careers. Oftentimes, it is the culture and epistemology which is cultivated and centered within STEM departments that require Native students to do the work of giving up their own beliefs and worldviews in order to make space for the eurocentric

values inherent to many STEM departments. Indigenous worldviews are at times delegitimize, devalued, or otherwise crowded out of STEM curricula, leaving Native students to feel frustrated, marginalized, and silenced (Cech et al., 2017). Modern American science and science education is not acultural, but reflects often Western values, prioritizing individualistic achievement (Bang & Medin, 2010). This contrasts with the communal values of working to help people generate revenue and accomplishments which are characteristic of many Native worldviews (Smith et al., 2014). Pedagogical activities used to teach dominant STEM courses sometimes require Native students to choose between fulfilling class assignments and upholding their traditional practices and ways of knowing, thereby burdening students with additional emotional, intellectual, and spiritual work (Cech et al., 2014). Therefore, there is a need to critically examine why cultures within STEM programs seem to gravitate towards these Euro-American epistemologies of individualism, and understand ways that departments can develop programming to allow for more inclusive epistemologies which center and celebrate the ways of knowing tethered to Native American experiences.

There is opportunity in developing STEM programming that is inclusive and more conducive to Native student success. Research suggests that a number of shifts must take place to create these environments within STEM education. For one, there is a need to center community needs and relationship building within programmatic objectives (Smith, 2019). Finding ways to connect the academy to the community, and to relinquish the grasp of individualism to make space for communal worldviews may add relevance and remove unnecessary abstraction which might help Native student success (Abes et al., 2019). Another noninclusive element of STEM programming is the siloed form it takes, which seeks to separate subjects and studies into separate containers, rather than seek to show the ways that they interconnect. Indigenous educational paradigms often seek to center relationships and relationality above all others, and so using this as a central framing of curriculum is important (Abes et al., 2016).

Throughout this paper, I seek to name Tribal Critical Race Theory as a guiding theoretical framework in the ways that I seek to uplift and affirm Indigenous epistemology as a form of resistance towards colonialism in STEM disciplines. I will detail my positionality as a researcher, and discuss one possible methodology which shows promise for decentering eurocentricity within STEM disciplines at colleges and universities. I then will conclude with possible ways

to implement this kind of programming in and around programs at UVM.

Native Americans, American Indian, Alaska Native, and Indigenous Peoples

While I will be using the terms Indigenous and Native within this paper, it is important to note that no one term can encapsulate the broad experiences and contexts of this subgroup. Since the Native peoples of the Americas have existed pre-colonialism and pre-european categorization, there is no way to refer to this one subgroup in a way that encapsulates their diverse contexts and experiences. Native peoples of the Americas are not monolithic. Further, in the United States, naming is an inherently political process, and varying nations are involved with the US judicial branch in different capacities (Brayboy, 2016). There are tribes and nations existing in the U.S. who are recognized and unrecognized by the U.S. government, and whose tribes' names have been eroded by centuries of colonialism and rejection of traditional language within their culture. Indigenous refers to a group of people who have been tied to a place before any outside peoples were introduced to the lands. (Brayboy, 2016). Indigenous peoples are peoples; they are not monolithic and represent a vast array of beliefs and experiences. They should be treated as such. While racial, ethnic, and cultural identity should be addressed and central when dealing with Indigenous students, a more common way to address the experiences of these students is through an epistemological lens. Understanding that many of these students have unique experiences that also share commonality through the oppression felt by Institutional presence on land and within their immediate communities, careful understanding and consideration of their individual contexts is paramount in addressing gaps in access for Indigenous communities in Higher Education.

Positionality

I am a white, cisgender, heterosexual male graduate student located in the Northern New England region of the United States. Having grown up in the mid-atlantic in the post-industrial region of the Lehigh Valley, unceded land of the Lenni -Lanape people, I studied English Literature at a small primarily white institution (PWI) located on the rural Eastern Shore of Maryland, unceded land of the Choptank people. My interest in the connection between people and the natural environment became a central focus of my undergraduate experience. After working in admissions and traveling around

New England for a few years for a tiny liberal arts school, I enrolled at the University of Vermont to attend their Higher Education and Student Affairs Administration program, in effort to learn more about how different kinds of students are successful and college, and the ways that universities can lead to that success. It was in this program where I was able to think deeply about the liberation which can be achieved by embracing epistemologies actively ignored and destroyed by the dominant system or eurocentricity, patriarchy, and racism within the United States. Being of a humanities background and of a dominant positionality in relationship to society, I understand that I bring unique biases to the table when tackling this question of Indigeneity in the sciences. I have limited understanding of science curriculum design and no understanding of what it is like to be Native in the United States. However, my own moral and ethical alignment points me toward a utilizing of my privilege in the larger goal of collective liberation of all people. My focus for this paper is in STEM disciplines as this is an area particularly important for socioeconomic advancement in US society. The goal of my research in this area is to find ways that I might be able to more holistically advocate for culturally-inclusive paradigms and curricula in STEM programs so as to address the unique barriers faced by Indigenous students in their attainment of STEM degrees. Decolonization and indigenization of education requires a knowingness of the colonizer, a recovery of ourselves, an analysis of colonialism and a struggle for self-determination (Abes et al., 2016).

Tribal Critical Race Theory

Throughout this paper I aim to utilize Tribal Critical Race Theory as a guiding theoretical framework. Tribal Critical Race Theory (TribalCrit) originates from the multiple, nuanced, and historically and geographically located epistemologies and ontologies found in Indigenous communities (Brayboy, 2005). There are nine tenets of TribalCrit outlined herein:

Colonization is endemic to society. U.S. policies toward Indigenous peoples are rooted in imperialism, white supremacy, and a desire for material gain. Indigenous peoples occupy a liminal space that accounts for both the political and racialized natures of (their) identities. Indigenous peoples have a desire to obtain and forge tribal sovereignty, tribal autonomy, self-determination, and self-identification. The concepts of culture, knowledge, and power take on new meaning when examined through an Indigenous lens. Governmental policies and educational policies toward Indigenous peoples are intimately linked

around the problematic goal of assimilation. Tribal philosophies, beliefs, customs, traditions, and visions for the future are central to understanding the lived realities of Indigenous peoples, but they also illustrate the differences and adaptability among individuals and groups. Stories are not separate from theory; they make up theory and are, therefore, real and legitimate sources of data and ways of being. And finally, theory and practice are connected in deep and explicit ways such that scholars must work towards social change. (McKinley & Brayboy, 2005).

In short, TribalCrit asserts that white eurocentric paradigms, which are centric to western higher education, are tools of assimilation and oppression for Indigenous peoples. To combat this, perspectives and epistemologies rooted in Indigenous beliefs should be prioritized in Higher Education as a way of liberating these institutions from eurocentricity, to allow for more inclusive spaces, and to create a system which works for and uplifts Indigenous students holistically.

Historical Context; A Knowingness of the Colonizer, an Analysis of Colonialism

As stated earlier, Native students are among the most marginalized college-going student population in existence today (PNPI, 2020). The reasons for this goes back to the earliest history of higher education in America. As TribalCrit states, colonization is endemic to society (McKinley & Brayboy, 2005). Many of the earliest colleges in existence profited from the upheaval and removal of many Native nations within the modern day United States. Land-Grant colleges provided funding through the Morrill Act allowed for colleges to either build property on newly stolen Native land, or sell it for resources for institutions already in existence as part of the settler-colonial project of the United States (Nash, 2019). The history of education within the U.S. for Indigenous students has also been one wrought with epistemological violence and harm. Ever since the first boarding school established in Carlisle, Pennsylvania was intended to infamously "Kill the Indian (to) save the man", education for Native students in the U.S. has been synonymous with destroying and delegitimizing their very way of life in the project of settler-colonialism within the U.S. (Lomawaima & Ostler, 2018). Given ways that institutions of higher education have been used historically as vehicles for assimilation, it is no wonder that Native students do not enter higher education in large numbers (Abes et al., 2016).

Native students may feel pressure to adopt institutional norms through experiences of cultural discontinuity, which may contribute to senses of non-belongingness and dissonance which may negatively affect their ability to perform in school and succeed in their education (Abes et al., 2016). It is for these reasons why it is so imperative that institutions critically examine their culture and trace the sources of the knowledge that they seek to uplift. Because epistemology is so fundamental to the way education is delivered to students, these issues most likely cannot be addressed individually. Institutions instead should seek to find ways that they can fundamentally transform their cultures to create a sense of inclusivity for the most marginalized (Mills et al., 2019).

Needs of Indigenous Students; Recovery and Struggle for Self-Determination and Sovereignty

Epistemology, the study of knowledge, is the starting point for any discussion of Indigenous education (Cech et al., 2017). Through it, we can examine which histories, achievements, and perspectives are prioritized. Understanding what Native peoples believe about their knowledge origins, priorities, context, and exchange teaches us more about its contitunity. Knowing something, then, is a cultural experience that strengthens or fractures culture (Bang & Medin, 2010). To center Indigeneity in developing more culturally inclusive learning experiences, epistemology must be critically examined.

Relationality is at the heart of Indigenous paradigms (Abes et al., 2016). Many Indigenous epistemologies view the community as part of the larger ecological system; nature, animals, plants, the people who make up the community are all a part of the whole. The self is constructed partially through relationships with these others. That said, it is counter intuitive to silo, separate, and divide subjects, people, and operations within an institution. Balances intrinsic to many of these paradigms emphasizes wholeness through healthy connections with the surrounding worlds. In other words, "we are, we know, and we do through our relationships with not only other people, but also the natural and spiritual worlds" (Abes et al., 2016).

The notions of competition and individual success are often at odds with reasons many indigenous students pursue higher education in the first place - to serve their families and communities more effectively (Brayboy, 2016). Many Indigenous students will practice Home-Going behaviors during their

time as students - leaving campus on the weekends to be with their families and communities from which they are from (Abes et al., 2016). Central to this is the need for many Native students to center community and family within the context of their education. Many Native students cite the desire to return home after graduation and help their communities. This has even been true at UVM (Benay, J. Ken Maskell.)This is in many ways antithetical to western ideals and understanding of education, which often prioritizes individual achievement over collective harmony (Abes et al., 2016). Making communities healthy through the pursuit of self-determination and tribal sovereignty is rarely acknowledged within the paradigms that guide higher education discussions about recruitment, retention, and success (Brayboy, 2016). As a result, there may be dissonance experienced on the part of Native students who come into highly individualistic environments of higher education which could impact their performance, their sense of belongingness, and ultimately their willingness to persevere in their academic journey.

One of the ways in which this manifests is through the metaphor of the K-16 pipeline. The pipeline metaphor, which illustrates the journeys of students from kindergarten all the way through college in the United States, centers the experiences of one who has a continuous, isolated, and seamless experience through higher education. It others, then, experiences of those who may take time off, who might transfer to other institutions, and at times complete a degree in over the four-year limit, which is more normalized in Native cultures (Brayboy, 2016). The reinforcement of this metaphor and way of thinking about education is one of the many ways that eurocentricity and white western ideals reveal itself in Higher Educational norms. This contributes to low matriculation and graduation rates, feelings of not-belonging, and encounters with racism which Native students must bear just to exist in these spaces. To counteract this, institutions should seek to center more collectivistic orientations, reinforcing community and relationships, and deemphasizing individual achievement. While this would require a deep transformation of institutional culture, I would argue that this level of transformation is not only necessary, but would be deeply beneficial for the institution. It would seek to create learning communities that are more deeply integrated socially, allow for more innovative and collaborative research, and create deeper social experiences for their study body (Smith et al., 2014). Not only would this kind of transformation help Native students to center their own experiences and epistemologies in college, but it also helps those from eurocentric backgrounds to understand the importance of community and the collective and relation-

ship building (Abes et al., 2016). The co-generation of research is particularly important for Indigenous students as it works to affirm their worldviews and may contribute to enhanced persistence in education, specifically in highly competitive and individualistic fields like Science, Math, Engineering, and Technology (Genius et al., 2015). So, if a change like this should occur within the university, moving away from individualism towards one of communal and ecological values, STEM programs make sense as a starting place.

Defining Place-Based Education

One kind of praxis in teaching that has been studied and celebrated over the last decade includes Place-Based Education, or PBE. PBE has been a kind of praxis that has been developed through progressive educational scholars over the last century - John Dewey laid foundations for the idea in his 1938 essay, Education and Community, wherein he called for meaningful educational experiences which were practical and took students outside of a classroom context (Dewey, 1938). In their 1967 paper in The Harvard Educational Review, Newmann & Oliver put forth the ideas that one of the issues with modern American education was that learning was limited to a classroom context, preventing the random and meaningful experiences which can occur when students are brought into a place beyond the classroom, and in relationship with the immediate community (Newmann & Oliver, 1967). Further, Paulo Friere (1970) called for a problem-posing form of education, wherein students learn best within a set of problems posed to them by the teacher. These scholars saw potential in developing educational experiences which were relevant to students, allowed for relationship building with the world around them, and increased knowledge and engagement within broader society.

Put succinctly, PBE relates to teaching and learning situated in place; place has been described as any locality imbued with meaning (Semken et al., 2017). Though geographic contexts often inform the modality of PBE and make it difficult to define singularly, a number of common characteristics of PBE have been identified in literature. These include cultural studies, nature studies, real-world problem solving, internships and entrepreneurial opportunities, and induction into community processes (Smith, 2002). Environmental and social justice have also been identified as central to the ethos of effective PBE programming (Deringer, 2017). Place-based learning is used often interchangeably with terms like community-based learning, service learning, environment as an integrating concept (EIC), sustainability education, and project - based learning (Powers, 2004). The goal of these methods of teach-

ing is often to "tear" down school walls so that immediate community and environment becomes integral to all facets of student learning (Powers, 2004). Many of the features of Place-Based Ed (PBE) are located in environmental studies, service learning, local history courses, outdoor education, and work related programs. (McInerey et al., 2010). This mode of education is traceable back to Native paradigms (Semken et al., 2017). There have been many purported benefits to this way of studying - participants in PBE have reported higher levels of community and civic engagement on the part of their students (Powers, 2004). The theory behind rests upon the idea that when one has developed an attachment to one's place, and one has the skills to proceed, the individual will become a more active participant in the community, which in turn improves the communities social capital (Powers, 2004).
PBE has promising qualities when viewed in the context of Native Student development paradigms.There are already PBE curriculums in place around the country which has correlated to stronger retention and access for Native students (Emekauwa, 2004). White students in studies often understand place as the background in which activity happens, rather than the central focus of activity. Native students, their parents, and their communities, often view themselves as a part of a place and the ecological forces which make it up (Bang & Medin, 2010). PBE allows for research and curriculum to be designed and central to the specific context of the place where an institution exists. PBE has been shown to have promising results in developing a sense of place and meaning making for students (Semken, 2017).

The multi-faceted experience of Native students relates to why place-based education (PBE), culturally inclusive praxis, and other ways of approaching Native student learning in STEM is such a powerful tool. Place-based education seeks to situate the learner in the place and community of which they are apart. Central to creating more culturally-competent and inclusive STEM programs for Indigenous students will be employing perspectives and techniques which are resonant with their way of viewing the world, and seeking to intentionally decenter the white supremacist and eurocentric values which have been central to the STEM disciplines throughout the history of higher education in the United States.

Learning Outcomes and General Successes of PBE Program Implementation

Educators have found success with PBE at all levels of education for increased engagement of their students (Smith, 2002). Some of the documented strengths in learning outcomes for students include increased community engagement, more critical problem solving skills, deeper relationships between peers, and increased retention (Austin et al., 2009; Powers et al., 2004). Increased levels of place attachment and place meaning have also been documented in participants of PBE (Semken et al., 2017). PBE works well as a curricular consideration for integration of multiple disciplines into a singular context. Given the lack of theoretical foundation for PBE from one specific discipline, educators can embrace an interdisciplinary approach when engaging students with PBE (Goodlad & Leonard, 2018). That said, another potential benefit may be to develop curricula and learning experiences which allow students to synthesize information from multiple disciplines.

Success of PBE Programs for Native Students

From a theoretical standpoint, PBE has a significant connection to critical pedagogy and the implementation of TribalCrit in the classroom. PBE and critical pedagogy are mutually supportive, and a conscious synthesis of the two can effectively be implemented (Deringer, 2018). Critical pedagogy works to disrupt the status quo and problematizes the acceptance of maxims that perpetuates injustice (Gruenewald, 2003). TribalCrit shares these goals from an Indigenous perspective, seeking to dismantle structures of colonization that have plagued the continental United States for centuries, and seeks for Tribal sovereignty and self-determination (Brayboy, 2005). Further, Tribal sovereignty and self-determination historically has called for local control of education, utilizing resources unique to individual communities to characterize educational experiences. This dates back to the Self-Determination movements of the 60's and 70's (Faircloth, 2009).

On a practical level, implementation of PBE programming has proven successful in the retention and development of Native students throughout the United States and world. Over the last decade in the most rural parts of Alaska, the Alaska Rural Systemic Initiative saw substantial increase in Mathematics performance for high school students, decreased drop out rates, and consistent boosts in enrollment for first-time freshman for Native students at the University of Alaska (Emekauwa, 2004). In a study examining the

implementation for Indigenous students in Indonesia, scholars pointed to an improvement in writing ability on the part of students, learning achievement, and overall confidence (Sianturi et al., 2018). In a geology course situated on the Colorado Plateau and employing Navajo culture and paradigms, a college found increased Native student retention (Semken, 2005). Throughout various geographic contexts, the practice of situating education within place has proved to be successful in the achievement of Indigenous students.

Rurality also plays a role in the implementation for PBE for Native students, and points to some of the ways that it uniquely serves this population. PBE, or otherwise locally responsive curriculum, has always been a part of the experience of rural schools, as they are often underfunded and must rely on community resources to provide experiences (Jennings et al., 2005). A majority (54%) of Native American students live within a rural locality (Dewees & Marks, 2017). Native students are significantly more likely to attend colleges/universities within rural areas (Devoe & Darling Churchill, 2008). Rather than view a rural location as a detriment, PBE allows for geography and community capital to be celebrated and intrinsic to the success of the programming. This kind of focus within a curriculum would not contradict the communal values which are often important to Indigenous paradigms, but would support them. Things like home-going behavior would be more normalized, as in theory, a student's home and local community would be an important part of the experience.

In developing successful curriculums, educators utilized the connection to community and the cooperative learning that PBE can provide (Emekauwa, 2004). This has been documented as being particularly important for STEM fields, which often consist of knowledge which can be gatekept and inaccessible to those without access to Higher Education. Another strength was the way in which tying knowledge to place which to center Indigenous knowledge, or knowledge that originates before the colonization of the United States (Riggs, 2005). While these examples exist or have showcased promising results over the last few decades, more research is needed to fully understand the implications that centering Indigenous knowledge in STEM disciplines can have on Indigenous student success and retention at colleges and universities.

Limitations of PBE

It should be noted that educational inequalities are often reinforced by geographies of exclusion. Indigenous students often exist within a geography

of oppression that is fueled by redlining, displacement, and genocide, among other forms of oppression (Friedel, 2011). That said, it is important not to over romanticize place in the construction of young people's identities and development; why would we nurture a love of place when said place is the source of that person's oppression? (McInerney et al., 2010). Care should be taken to center critical pedagogy within implementation of PBE, and to provide critical context of these geographies of oppression.

While in an ideal sense, PBE can help students to learn much about themselves in the contexts of their environments and lived communities. However, it also might lack in its ability to showcase other cultures and knowledge of the rest of the country and world. Students can learn much about themselves by studying other cultures, places, and times. It is worth including these elements in a student's experience if it might help in their developmental journey. Providing an opportunity to link what is happening within a PBE program with history through the country and world may help to solidify learning happening within the program, and work to deepen the knowledge of students.

Place-Based educators should also be wary of the limits of local activism in this approach. One of the dangers of PBE is in the idea that solutions to varying levels of problems lie within the grasp of a particular group of local people (McInerney et al., 2010). While this can help to engage students on a deeper level and understand relevant problems within their community, it can also present pitfalls to addressing true change. Failure to connect local issues with political events and forces of regional and global dimensions could mean doom for many well-intentioned efforts to transform communities. Care should be taken in showcasing how issues play out on the microscale of a community, and also link to the systemic issues which are inherent to our society and world.

Eurocentricity and western-oriented thinking should also be examined in PBE applications. While much of what PBE stands to accomplish is complementary to Native epistemology and Indigenous student development paradigms, it is easy for dominant epistemologies to seep their way into the practice of PBE (Friedel, 2011). This can occur when there is a discrepancy between the motivations of the students for engagement in a PBE program, and the motivations of the program itself. To avoid this it's important to utilize Indigenous scholars in the development and implementation of this curriculum.

Implications for UVM

Currently, the University of Vermont (UVM) enrolls fewer than 20 students out of 13,000 who identify as Native American, Alaskan, Hawaiian, or Pacific Islander (University of Vermont, Office of Institutional Research). There is tremendous opportunity to develop and implement curricular and extracurricular programming which seeks to center the needs of the Abenaki nation on whose land the University sits. The Gund Institute at the University of Vermont, housed within the Rubenstein School for the natural environment, seems to be an ideal place for the implementation of programming which seeks to deliver communal values tied to ecological wellbeing and the support of the immediate community surrounding campus. Research themes at the Gund Institute include climate solutions, sustainable agriculture, resilient communities, and equity and justice (Gund Institute Website, 2021). PBE and culturally responsive pedagogy centered in Indigenous paradigms could address all of these issues, and the implementation of such curriculum into programming could construct culturally-responsive ways of engaging Native students.

The Gund Institute is just one piece of the puzzle though. Intentional efforts to hire more Indigenous faculty, create more opportunities to engage in the greater community of Burlington, and deliberately seek to offer courses that center Indigenous epistemology would be great ecological steps in the right direction for the increased success of Indigenous students at UVM. Recruitment and financial aid scholarships for Abenaki students also is an important piece that could aid in creating a more thriving Indigenous population within the institution. However, the transformation of a culture that values and uplifts Native epistemologies might be the first step of many toward creating a more culturally inclusive institution for Native students. Offering more courses which center Native informed Place-Based curriculum seems to be an obvious way of doing so.

Conclusion

Implementation of PBE paradigms within science programs in colleges and universities may result in heightened performance, retention, and success of Native students. More importantly, implementation of these methods with the goal of centralizing and uplifting Indigenous epistemology may contribute to increased sense of belonging and accomplishment for Native students. Such changes could revolutionize access for marginal-

ized students and create a sense of community between student groups, which might foster more creative and innovative research. More work should be done to understand the ways that PBE can allow for students to understand and tackle problems within their community and immediate environment, to transform relationships between the student body, the community in which an institution resides, and the historical relationship between higher education and the Native people of the United States. There is particular room for the implementation of not just PBE, but tying Native epistemology to STEM programs as a way of affirming the lived experience and wisdom of the Abenaki people of Vermont. Allowing for cross department collaboration between Rubenstein and other STEM programs throughout UVM, hiring of more Indigenous faculty, and through recruitment and financial aid plans which help to eliminate gaps in access for Indigenous communities could transform the University of Vermont from one known as a source of Indigenous oppression and violence, into one deliberately committed to Indigenous advancement. A liberation from eurocentricity could transform the institution, and deserves consideration.

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