Science education reforms that positively influence the success of all students must be equitable, systematic, and socioculturally adaptive (Barba, 1997; Kahle, 1998; Tobin, Elmesky, & Seiler, 2005). These reforms often involve the promotion of rigorous standards-based curricula, effective teaching strategies, and new policies that enhance learning in science education (Warren, Ballenger, Ogonowski, Roseberry, & Hudicourt-Barnes, 2000). In many culturally and linguistically diverse schools, the implementation of quality science instruction resulting in equal achievement for all students is lacking (Atwater, Freeman, Butler, & Draper-Morris, 2010; Banks & Banks, 1995; Borman et al., 2005; Seiler, 2001; Tobin, 2006). Inequitable “opportunities to learn science” (Oakes, 1990, p. iii) have been identified as contributing to the disproportionate science achievement in these schools.

Improving student achievement in science education is a priority for public schools throughout the nation. For example, the American Recovery and Reinvestment Act (ARRA) of 2009 provided a historic investment in
education reform to raise student achievement in public schools (U.S. Department of Education, 2009). This legislation earmarked more than four billion dollars through state education agencies to improve learning and academic performance in schools. Through the competitive grant program that is known as Race to the Top Fund, particular importance was given to traditionally underrepresented student populations (i.e., African American, Hispanic and Native American) in science, mathematics, and technology education (U.S. Department of Education, 2009). In this program, the participants (i.e., states and public schools) must develop conditions for equitable reform. An important implication of the ARRA legislation was the acknowledgment that equity was central to improvements in public education (U.S. Department of Education, 2009). This law helped refine the understanding that equitable, systemic, and sociocultural applications of effective instructional practices would close the achievement gap, increase graduation rates for underrepresented students, and prepare all students for college and careers (U.S. Department of Education, 2009).

Research on systemic and equitable science teaching and learning can provide explanations that equip administrators, teachers, and policy makers with tools to overcome challenges found in culturally diverse classrooms (Kahle, 1998; Hewson, Kahle, Scantlebury, & Davies, 2001; Rodriguez, 2001). Borman and colleagues (2005) identified critical factors, or “drivers,” and associated indicators that contributed to meaningful reform in science programs across the nation. Transforming a school context where achievement disparities exist is possible as stakeholders understand the multiple influences that contribute to equitable educational success.

**Definition of Systemic Equity Pedagogy**

Systemic equity pedagogy (SEP) describes a systems approach to implementing equitable teaching and learning practices in science education programs at the school level. SEP considers specific drivers and indicators (or practices) that classroom teachers engage collaboratively in contribute to school-level organizational processes and outcomes associated with high student proficiency and college-readiness. SEP embodies the collective demonstration of equitable program practices in the classroom setting.

The definition of equity pedagogy developed by Banks (1995) is used here. Banks (1995) defined equity pedagogy as “teaching strategies and classroom environments that help students from diverse racial, ethnic, and cultural groups attain the knowledge, skills, and attitudes needed to function effectively within, and help create and perpetuate, a just, humane, and democratic society” (p. 152). Similar to Banks, Zirkel (2008) described equity pedagogy as “pedagogical innovations” directed toward the purpose of establishing equitable learning experiences for all students by challenging conditions within the educational environment (p. 1157). Zirkel (2008) further stated, “One focus of equity pedagogies is to develop and use teaching techniques and methods that can address different learning styles and to develop pedagogical approaches that facilitate the educational achievement of lower-performing students” (p. 1157). An understanding of the complete applicability of equity pedagogy is still emerging. This research on SEP demonstrates the ability to operationalize and organize equity pedagogy to inform program and professional practices in a culturally diverse context.
Attainment of High Science Achievement apart from Formal Reform Initiatives: An Incomplete Picture

In 2010, the research group Policy Research Initiative in Science Education (PRISE), developed a predictive variable related to measures of student outcomes in science. Referred to as the Student Aggregate Science Score (SASS), SASS incorporates an aggregate of performance indicators used by the state of Texas to measure high school success in science and college readiness (Stuessy & Bozeman, 2011). Instead of viewing science achievement as a reflection of student performance on a single high-stakes state-mandated test, SASS includes multiple school-level measures. Stuessy and Bozeman (2011) state the following:

These measures include: (a) percentage of students passing the 10th grade science examination (SSE), (b) percentage of students taking a college entrance examination (CEET), (c) percentage of students passing or exceeding the criterion on a college entrance examination (PEET), (d) percentage of students completing an Advanced Placement course (APDE), and (e) overall state accountability (SR) (p. 5).

Together, these measurements configure into an algorithm for SASS (see Equation 1) and describe the quartile rank for schools in this study (Stuessy & Bozeman, 2011).

\[ \text{SASS} = [(1.5) \times \text{SSE} - 0.5] + \text{CEET} + \text{PEET} + \text{APDE} + \text{SR} \]  

(1)

According to Stuessy and Bozeman (2011), analysis of SASS is “used to determine the relationships of school support practices and teacher characteristics to positive student outcomes in science” (p. 1). Furthermore, this analysis allows researchers to identify specific teaching and learning practices that associate with positive student outcomes.

Analysis by the PRISE Research Group revealed that approximately 2% of culturally diverse high schools in Texas “were identified as being well prepared in science and ready for college” (Stuessy & Bozeman, 2011). Table 1.1 illustrates the distribution of high school science achievement by diverse student enrollment in the state of Texas. Evidence of present and inequitable science achievement signals a real achievement gap in many Texas high schools. This startling result contradicts a climate of sweeping science education reform efforts nationwide. Alternatively, this evidence may represent the transformation that may occur when all students can experience equitable teaching and achieve in their science classrooms. At the core of this transformation is a focus on educational equity (Borman et al., 2005).

Prior research concerning schools under formal systemic reform campaigns identified policy drivers and practices (or indicators) contributing to positive academic outcomes (Borman et al., 2005). Some schools have experienced positive academic gains and even closed the achievement gap without the advantage of any formally coordinated systemic reform initiative. These schools, such as the 2% of high schools in Texas, have not been studied. Furthermore, there has been no application of identified policy drivers and corresponding indicators to inform others about potential factors contributing to the high academic achievement in science education and college readiness in similar schools (Chenoweth, 2008; Stuessy &
Therefore, the need exists to explore the associations between science teacher practices in high schools and their exceptional science achievement and college readiness.

Table 1.1

_Distribution of Texas High School Minority Student Enrollment Proportion and Science Achievement and College-readiness_

<table>
<thead>
<tr>
<th>Quartile Category</th>
<th>Quartile Category</th>
<th>Quartile Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th Quartile SASS</td>
<td>28 (7.5%)</td>
<td>2.04%</td>
</tr>
<tr>
<td>3rd Quartile SASS</td>
<td>41 (11.0%)</td>
<td>3.00%</td>
</tr>
<tr>
<td>2nd Quartile SASS</td>
<td>127 (34.1%)</td>
<td>9.27%</td>
</tr>
<tr>
<td>1st Quartile SASS</td>
<td>176 (47.4%)</td>
<td>12.85%</td>
</tr>
<tr>
<td>4th Quartile SASS</td>
<td>66 (22.5%)</td>
<td>4.82%</td>
</tr>
<tr>
<td>3rd Quartile SASS</td>
<td>73 (24.9%)</td>
<td>5.33%</td>
</tr>
<tr>
<td>2nd Quartile SASS</td>
<td>77 (26.3%)</td>
<td>5.62%</td>
</tr>
<tr>
<td>1st Quartile SASS</td>
<td>77 (26.3%)</td>
<td>5.62%</td>
</tr>
<tr>
<td>4th Quartile SASS</td>
<td>81 (37.5%)</td>
<td>5.91%</td>
</tr>
<tr>
<td>3rd Quartile SASS</td>
<td>56 (25.9%)</td>
<td>4.09%</td>
</tr>
<tr>
<td>2nd Quartile SASS</td>
<td>45 (20.8%)</td>
<td>3.28%</td>
</tr>
<tr>
<td>1st Quartile SASS</td>
<td>34 (15.7%)</td>
<td>2.48%</td>
</tr>
<tr>
<td>4th Quartile SASS</td>
<td>158 (32.3%)</td>
<td>11.53%</td>
</tr>
<tr>
<td>3rd Quartile SASS</td>
<td>152 (31.1%)</td>
<td>11.09%</td>
</tr>
<tr>
<td>2nd Quartile SASS</td>
<td>108 (22.19%)</td>
<td>7.88%</td>
</tr>
<tr>
<td>1st Quartile SASS</td>
<td>71 (14.5%)</td>
<td>5.18%</td>
</tr>
</tbody>
</table>

*Note.* Minority student enrollment proportion (MSEP) (Stuessy & Bozeman, 2011).

The study of systemic efforts reveals that specific drivers influence the process of reform in schools experiencing academic challenges in mathematics and science education (Borman et al., 2005; Hewson et al., 2001; Kahle, 1998). Borman et al. (2005) accurately describe drivers as “prescribed approaches…developed [as] a model of systemic reform” (p. 5) and indicate that some of the favorable
outcomes science programs experienced due to these drivers were not limited to high science achievement scores on standardized tests. Other results in schools targeted by systemic reform included promoting equitable teaching practices, meeting curriculum standards, reducing the achievement gap, and developing students prepared for college (Borman et al., 2005; Edmonds, 1979; Hewson et al., 2001; Kahle, 1998; & Rodriguez, 2001).

A study of SEP has not yet been conducted in highly diverse high schools demonstrating high science achievement and college readiness. While studies on the science achievement of culturally diverse students are well-documented in the research literature, they primarily involve systemic reform initiatives that intrinsically promote equitable practices (see Borman et al., 2005; Kahle, 1998; Hewson et al., 2001; Kim et al., 2001; Rodriguez, 2001). Also, these studies typically focus on schools of different grade levels (i.e. elementary, middle, and senior high) primarily in urban communities. This study distinguishes its focus by concentrating on high schools located within a variety of communities (e.g., rural, suburban, urban, low and high socioeconomic statuses).

The following research question addressed the gap regarding indicators of SEP associated with high science achievement and college readiness for students in schools having large culturally diverse student populations: How do data from 10 highly successful, highly culturally diverse high schools inform the development of a comprehensive SEP rubric?

**Conceptual Framework**

Researchers have identified factors driving student achievement in science by analyzing meaningful systemic reform initiatives (Borman et al., 2005; Hewson et al., 2001; Rodriguez, 2001). As no evidence exists to support the role of a single action producing academic success in complex school systems, one can assume that various tactics are involved in the process of improving science education. In early 2000, assessing the impact of systemic reforms in science education led the National Science Foundation (NSF) to develop six “process and outcome reform drivers” based on a model used for monitoring program support of large school systems (Borman et al., 2005, p. 6). This framework refers to the NSF Six-Driver Model (National Science Foundation, 1999). Borman and colleagues (2005) assert major educational movements in science and mathematics packaged in the form of systemic reforms associated with these drivers have the potential to improve teaching and learning nationwide. Additionally, a driver-based model incorporating attributes of successful reform initiatives may be a way to assess programs, ensure all students attain high academic achievement and add highly skilled individuals to the workforce (Borman et al., 2005).

In this study, I modified and extended the NSF’s Six-Driver Model to include a total of eight drivers believed to undergird the implementation of SEP at the micro-level of a school system, which is the campus and classroom. To develop a model for SEP, I selected five drivers originating from the NSF Six-Driver Model (i.e., Standards-based Curriculum & Instructional Materials, Reform-based Practices in Science, Convergence of Resources into Science Programs, Stakeholder Support, and Student Performance Indicators). These drivers describe factors that influence both content area programs and school-level practices. Next, three drivers were added including Professional Development, Professional Culture, and Culturally Responsive Teaching to highlight significant attributes commonly cited in the
Research literature on school improvement efforts for culturally diverse students in science. Together these eight drivers contribute to a model that describes and informs the processes and outcomes by which SEP exists.

Borman et al. (2005) indicate the NSF Six-Driver Model divides into two functional groups which are processes and outcomes. Since the SEP model is a modified and extended version of the NSF Six-Driver model, these two groups remain. In the SEP model, process drivers describe important mechanisms that support conditions conducive to equitable teaching and learning. Outcome drivers represent the products that sustain and enact equitable teaching and learning. Process drivers are standards-based curricula and instructional materials, reform-based policies, and convergence of resources into science programs and stakeholder supports. Outcome drivers are professional development, professional culture, culturally responsive teaching, and student achievement indicators.

**Descriptions of the SEP Eight Drivers**

The following definitions provide an understanding of SEP drivers. An explanation of each driver is provided based on literature resources and descriptions of general and widespread practices standard in a public high school science program.

**Standards-based curricula and instructional materials.** In Borman’s (2005) study, aligning curriculum resources and instructional activities with academic standards in science functions as a model to produce quality lessons for student mastery of knowledge and skills. The standards-based curricula used by schools in this study are based on the Texas Essential Knowledge and Skills (TEKS) for Science.

**Reform-based policies in science education.** At the school level, principals are driving forces in implementing reform-based policies in science education (Borman et al., 2005). Principals interviewed in Borman et al. ‘s study on systemic reform summarized the indicators of successful reform-based policies. These indicators included policies on enhancing the role of professional development and determining ways to address positively school demographic factors such as student ethnicity, language use, and socioeconomic status. Borman and colleagues (2005) state, “most importantly, school vision, attitudes, and guiding principles [for] supporting a culture of reform” were policies developed as part of facilitating meaningful transformation (p. 41).

**Convergence of resources.** The NSF’s Six-Driver Model recommends merging all “fiscal, intellectual, [and] material” resources to support systemic reform improvements in science education (NSF, 1999). Decades earlier, Edmonds (1979) operationally defined this approach as equitable and thus effective for educating all students, especially those who are ethnically diverse and from low socioeconomic backgrounds.

**Stakeholder supports.** Borman et al. (2005) define stakeholders as “district personnel, principals, teachers, and other school staff, students, parents and guardians, and individuals from businesses, faith-based organizations, and government and community agencies” (p. 49). Support for schools to achieve academically extends beyond the ability of an individual teacher or single school administrator.
Numerous stakeholders participate in various ways to assist schools involved in systemic reform to meet high academic goals (Borman et al., 2005).

**Student achievement indicators.** Student achievement indicators include tools and procedures schools use to monitor student academic performance. These devices typically include the use of both formative and summative assessment strategies, including standardized tests, benchmark assessments, student portfolios, and project-based learning activities.

**Professional development.** School leaders can facilitate change in science education programs and directly benefit student achievement by providing ongoing, relevant, and high-quality professional development for science teachers (Kardos & Johnson, 2007). Ongoing professional training provides
science teachers with support in critical areas of content knowledge and pedagogical skill. Sato, Roehrig, and Donna (2010) also determined that ongoing professional development contributes to the retention of science teachers, especially those new to teaching science.

**Professional culture.** Professional culture describes “established modes of professional practice among teachers, their norms of behavior and interaction, and the prevailing institutional and individual values that determine what teachers do and how they do it” (Kardos & Johnson, 2007, p. 2086). A healthy professional culture supports teachers’ sense of belonging, connectedness with others, and attitude toward their practice which promotes science achievement and college readiness (Stuessy & Bozeman, 2011; Kardos & Johnson, 2007; Ruebush, 2012). Borman et al. (2005) state that a “strong, nurturing culture within a school fosters the development of teacher leadership, and, in turn, should produce positive results in student outcomes” (p. 198).

**Culturally responsive teaching.** Descriptions of teaching as social (Tobin, Elmesky, & Seiler, 2005) and cultural (Stigler & Hiebert, 1999) activities emphasize the consideration of relative and responsive approaches to educating ethnically diverse student groups. According to Ladson-Billings (1995) and Gay (2002), instruction that enhances academic competence incorporates the students’ cultural background in learning experiences and meets the social and emotional needs of students demonstrates pedagogy that is culturally relevant and culturally responsive. Nurturing academic competence occurs as teachers improve their content knowledge and use of effective teaching strategies in science (Schroeder, Scott, Tolson, Huang, & Lee, 2005). Content integration and assessment strategies that incorporate students’ cultural backgrounds into the teaching experiences are appropriate techniques for demonstrating equity pedagogy (Banks & Banks, 1995).

**Methods**

**Research Design and Participants**

The PRISE research group, located in the College of Education and Human Development at Texas A&M University, collected data to inform the development of the SEP rubric. The participants in this study were science teacher liaisons within the high schools selected by purposeful sampling. Each of the ten participants was identified by his or her respective school principal as the “science liaison.”

**Research Context**

This research effort involved high schools with proportionally large culturally diverse student populations located in rural, urban, and suburban communities throughout Texas. The ten high schools met the criteria for inclusion in this study because of high performance in science and large culturally diverse student populations (i.e., student enrollment proportion greater than 75% African American, Latino, and Native American students).

**Selection of Participants**

The PRISE research group selected these ten high schools using the SASS indicator (Stuessy and Bozeman, 2011). Campus principals in each of the ten high schools were contacted using formal letters,
telephone calls, and school visits to request their participation. After meeting face-to-face with each high school principal, we were granted access to conduct our study with the science liaisons.

**Data Collection**

This study involved the use of structured interviews for qualitative data collection. PRISE researchers conducted ten 60-minute structured interview sessions with science teacher liaisons at their high school campuses. Each one-on-one interview was recorded using a digital audio recorder, and field notes were taken. The instrument used to collect data was the 29-item Science Program Interview (SPI) document. The SPI focuses on four elements within a high school science program: organization, curriculum, instructional priorities, and vision (Stuessy & Bozeman, 2011). The purpose was to collect data that described particular equitable teaching and learning practices (or indicators) within high-achieving high school science programs. This information revealed science teachers’ perspectives toward implementing these practices. Additionally, the interviews provided views on the instructional practices used to meet the needs of culturally diverse student populations. The science teacher liaisons’ interpretations were used to inform the list of indicators within the SEP rubric.

**Data Analysis**

I obtained data for this study from several sources: electronic audio recordings, verbatim interview transcripts, peer-reviewed journal articles and other scholarly literature, and the Science Program Interview instrument. I proceeded through several stages involving triangulation and analyzing the qualitative data. Following these steps, I analyzed the Science Program Interview transcripts and other scholarly literature to develop a comprehensive SEP rubric. I conducted assessments for content validity by allowing various experts and practitioners in the field science education (i.e., science teachers, principals with supervisory duties of science programs, research scientists, doctoral students, and a university professor) to complete a four-scale Likert survey. Each respondent provided feedback on indicators (or practices) considered “very important, important, of little importance, and unimportant.” At the conclusion of this process, indicators determined “of little importance” or “unimportant” did not remain as part of the SEP rubric.

**Developing the SEP Rubric**

Whereas the NSF model maintained only six drivers in its framework, the SEP rubric includes two additional drivers, Professional Culture, and Culturally Relevant Pedagogy, for a total of eight drivers. Culturally Relevant Pedagogy was added as a driver to emphasize the important role a multicultural approach to science education has in teaching racially, ethnically, and linguistically diverse students with equity. Incorporating Professional Culture as a driver in the SEP rubric is important because, like school culture, it “influence[s] the creation of social ties and relationship and is likely the critical element enhancing or curtailing effective teaching and successful student outcomes” (Borman et al., 2005, p. 7).

The first step was to determine the eight drivers of the SEP rubric. To characterize factors of systemic academic improvement in science education programs, I analyzed the NSF Six-Driver Model simultaneously with other scholarly literature on science education reform (National Science Foundation, 1999; Borman et al., 2005). In the first stage, I conducted content analysis by identifying keywords and
phrases within Borman and colleagues’ (2005) written descriptions of each driver (see p. 6). According to Hsieh and Shannon (2005), content analysis is “a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns” (p. 1278). I recognized words and phrases to develop a conceptual illustration or theme for each driver represented in the SEP rubric.

In the second stage of analysis, I identified categories for the SEP rubric. I reviewed questions from the Science Program Interview (SPI) repeatedly and applied content analysis to recognize themes coinciding with the eight existing SEP drivers. Creswell (2007) describes this process as “[taking] the significant statements and then group[ing] them into larger units of information, called ‘meaning units’ or themes” (p. 159). A total of thirty themes identified did align contextually with the SEP drivers. The emerged themes best describe both educational and administrative aspects to managing public school science programs or departments.

In the third stage of analysis, I identified indicators of the SEP rubric. I used the SPI instrument to collect qualitative data from science teacher liaisons at each high-achieving high school in the study. Interview responses were audio recorded and transcribed verbatim to a conduct content analysis. The content analysis process involved identifying and highlighting specific words or phrases that aligned with each category theme. I also noted explanations of instructional practices and procedures corresponding to each category and its respective driver within the SEP rubric along the margins of each transcript. I then generated a list of instructional practices and procedures gathered from each science teacher. This list represents operational strategies related to implementing equity pedagogy. A comprehensive list of 127 indicators that align with both categories and drivers within the SEP rubric was identified.

Results

This section provides a summary of the research results. Results of the study show indicators of a comprehensive SEP rubric. Together, 127 indicators, 30 categories, and eight SEP drivers produce a model framing equitable teaching and learning practices associated with high science achievement and college-ready performance. Figure 1.2 illustrates the process that guided the development of the SEP rubric. Indicators within the SEP rubric are specific practices gathered from verbatim interview transcripts
with science liaisons. Based on the data from the SPI, each high school science program in the study differed in its methods of implementing specific practices.

![Figure 1.2 SEP Process Map. Process schematic of SEP drivers, categories, and indicators.](image)

Science programs in these schools collectively illustrate the important role of reflective practice when teaching science in a culturally diverse context. There are at least five critical elements teachers consider as part of reflective practice in these high schools. Reflective practice must be student-centered, curriculum-focused, incorporate achievement data, involve shared conversations, and be part of ongoing teacher collaboration (e.g. observing colleagues in other classrooms, modeling instruction, and meeting with other teachers in the science program). Most evident among these science programs is the notion that reflective practice is an intentional process in their day-to-day efforts to serve culturally diverse students in their schools.

High school science programs engage in formal and informal approaches to implementing teaching and learning practices identified as indicators within the SEP rubric. Formalized methods are characterized as official and often structured or planned professional experiences. These experiences entail clearly defined expectations, occur at designated times and locations, and have identified roles and responsibilities. Informal approaches, on the other hand, often occur without significant prior planning or scheduling. These methods do not typically follow a prescribed plan of action for professional practices within some of these science programs. A science program’s use of either formal or informal approaches varies according to the size of the high school and science program, the availability of resources (i.e., fiscal, human, material), and the expectations of the campus principal or district.

Indicators within a comprehensive SEP rubric possess action verbs at the beginning of each explanation. The use of action verbs coincides with the imperative manner in which most science teachers carried out their professional practice and aligned with the practices and behaviors science liaisons described during
structured interviews. This aspect of the study highlights the significance of teacher behavior in relationship to teacher efficacy. The notion that teacher ability influences student performance is widely recognized and connected to conceptions of teacher effectiveness.

The indicators within the SEP rubric are action-oriented to underscore behaviors that are “intended or enacted attempts” to facilitate quality science education for all students (Provenzo, 2009, p.3). Provenzo states, “as a verb, ‘reform’ refers to intended or enacted attempts to correct an identified problem…its goal is to realize deep, systemic, and sustained restructuring” (2009, p.3). Under the SEP rubric, the indicators described within these ten high-achieving science programs capture the essence of systemic practices influencing equitable outcomes in the science education of culturally diverse student groups.

There is much more to learn concerning the association of SEP indicators with the science achievement of highly successful, highly diverse high schools. Based on this study, science programs in these select high schools implement a variety of systemic and equitable educational practices that support the academic achievement of all students, regardless of their cultural background (i.e., gender, race, ethnicity, language, and socioeconomic status). The SEP rubric lists these key practices as indicators aligned with categories and then drivers.

### Summary and Conclusion

Promoting equitable science programs no longer needs to be an elusive target for schools. Through the use of qualitative research, this study has provided explanations for the research question by identifying indicators of a comprehensive SEP rubric. Designing the SEP rubric, an equity metric, is a complicated process (Kahle, 1998). However, the potential usefulness of such an instrument could allow education practitioners and researchers alike the opportunity to better understand facets of operationalizing the systemic plans for equity pedagogy all schools. Additionally, this tool establishes the basis for developing culturally responsive science classrooms and teachers.

Developing science programs that meet the academic needs of all students involves a multidimensional process embedded in cultural responsiveness. The SEP rubric may be considered a visual representation of the culmination of that process. Possessing eight interrelated drivers, 30 categories, and 127 indicators, the SEP rubric represents both the depth and complexity of the process involved in designing a comprehensive and equitable science program practices. The implication for the science programs in this study is that cultural responsiveness incorporates the cultural attributes of students. This guiding principle influences the way these programs function and contribute to achievement and college readiness outcomes.

Both science teaching (Atwater et al., 2010; Brown, 2007) and science classrooms (Brown, 2007) make up essential components in the process of developing science programs that exhibit SEP. These culturally responsive science programs accommodate students’ cultural characteristics in their curricular, instructional, and assessment practices (Atwater et al., 2010). To this point, the SEP rubric shows how these programs accommodate learning for their students. Through formal and informal approaches, as well as pedagogical and non-pedagogical practices, multiple strategies must be engaged in the teaching of
culturally diverse student groups. Likewise, culturally responsive science classrooms are manifest through effective teaching and fostering a classroom environment supportive of cultural diversity.

Developing Culturally Responsive Science Classrooms

Culturally responsive science classes result when teachers within these science programs engage a variety of student-centered and inclusive practices that foster science learning for culturally and linguistically diverse students (Brown, 2007; Nichols, Rupley, & Webb-Johnson, 2000). According to Montgomery (2001), culturally responsive classrooms function to “specifically acknowledge the presence of culturally diverse students and the need for these students to find connections among themselves and with the subject matter and the tasks the teacher asks them to perform” (p. 4). Brown (2007) indicates that teachers in culturally responsive classrooms exhibit two important aspects. First, they maintain an active and positive belief in students’ ability to learn (Brown, 2007). Secondly, they use “instructional strategies and teaching behaviors … [that] engage the students and lead to improved academic achievement” (Brown, 2007, p. 60).

Finally, designing the SEP rubric was complex because no one action can lead to the type of program-wide success observed in science programs in this study. SEP describes a systems approach to implementing equitable teaching and learning practices that associate with high student achievement and college-readiness. The definition of equity pedagogy developed by Banks (1995) embodies the significance of the SEP eight-driver model and comprehensive rubric. SEP takes into account numerous factors and indicators in the process of influencing equitable teaching and learning. For equity pedagogy to become systemic, equitable teaching and learning practices must transfer beyond a single classroom and into multiple classes. Additionally, this version of equity pedagogy must also become intertwined in the operational and procedural routines that guide the way school-level science programs function. In this way, SEP can influence science programs through collective school-level practices.
References


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Special acknowledgments go to Dr. Carol L. Stuessy, Director, PRISE-II Research Group and Associate Professor of Science Education at Texas A&M University.

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Portions of this paper presented at The Urban Education Collaborative | UNC-Charlotte 2014 International Conference on Urban Education in Montego Bay, Jamaica on November 7, 2014.