The Black Cultural Ethos, Students' Instructional Context Preferences, and Student Achievement: An Examination of Culturally Congruent Science Instruction in the Eighth Grade Classes of One African American and One Euro-American Teacher

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ABSTRACT: The Nation is ill-equipped to meet the future demands for scientists to sustain scientific disciplines and the scientific literacy required in this technological era. In response to this state of affairs, reforms promote quality science for all but provide little guidance on how to achieve it. This study describes an approach that uses cultural contexts as conduits for science learning.

With respect to Black Cultural Ethos (BCE), the study investigated eighth graders' self-reported preferences regarding learning contexts, the nature of the contexts in which instruction actually occurred, and any patterns in student achievement. The quantitative and qualitative findings indicated that more students, particularly African Americans, experienced enhanced achievement in culturally congruent contexts that aligned with their preferences.

When demographic realities, national needs, and democratic values are taken into account, it becomes clear that the nation can no longer ignore the science education of any students. Race, language, sex, or economic circumstances must no longer be permitted to be factors in determining who does and who does not receive a good education in science, mathematics, and technology. (American Association for the Advancement of Science, 1989, p. 214)

As denoted in the above quote, quality science education for all students is urgently needed. The Nation is inadequately equipped to meet the future demands for a sufficient number of scientists to sustain scientific disciplines and the scientific literacy required of this increasingly complex technological era. In response to this state of affairs, science education reform efforts like the National Science Education Standards (NSES) (National Research Council (NRC), 1996) promote quality science for all, but provide little guidance on how to achieve this aim. For example, Teaching Standard B of the NSES (NRC, 1996) emphasizes the importance of responding to diversity and getting all students involved in science, but does not provide suggestions as to how to address it so that student involvement is maximized (Rodriguez, 1997). With regard to "science for all", this study addressed the NSES oversight by investigating achievement with respect to culturally congruent science instruction. More specifically, the study examined achievement with respect to the Black Cultural Ethos (BCE).

In brief, BCE, a construct posited by a notable African American psychologist,
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consists of several dimensions. These dimensions capture what Nobles (1980) described as a derivation of West African beliefs, values, and traditions that characterize the way blacks perceive, interpret, and interact with the world. As discussed later, the authors acknowledge the association among race and culture due to the physical segregation of ethnic communities in American society, but view culture and race as distinct social constructs. The study targeted culture and addressed two objectives.

First, with respect to Black Cultural Ethos (BCE), the study examined eighth grade students' self-reported preferences for instructional contexts. That is, the study investigated the kinds of conditions under which students preferred instruction to occur. Second, with respect to the students' self-reported preferences, BCE, and the nature of the contexts in which instruction actually occurred, the study investigated patterns, if any, in student achievement. These objectives emerged from an earlier examination of the study's data (Parsons, 2005). The previous results focused upon means as indicators of African American and Euro-American student achievement and showed that the achievement gap between the two groups decreased more in science instructional contexts culturally congruent with BCE. This examination looks at achievement in relation to how well the students' preferences corresponded with instructional contexts that incorporated and did not incorporate BCE. Although the two teachers' receptivity to BCE and the challenges presented in teaching in a way contrary to their typical approaches are important issues, they fall beyond the purview of this piece. These complex teacher-related issues are thoroughly examined and discussed in additional articles.

Overview of the Achievement Problem

The issue regarding the achievement of minority and Euro-American students is the topic of much speculation, debate, and research. Analysis of student achievement on state and national assessments has resulted in a renewed focus upon African American students (Taylor, 2002). Based on the 2000 United States (US) Census, the National Center of Educational Statistics (NCES) reported that of the 57.3 million school-aged children (children 3-17 years old, 18 and 19 year olds who have not graduated from high school), 28% were African American (NCES, 2000). In regards to geographic clustering, African American children represented a substantial population throughout the 100 largest school districts in the United States (U.S.). African Americans made up 85.1% of the Detroit City School District, 78% of the Atlanta City School District, 75.6% of the Baltimore City Public School System, 75% of the District of Columbia Public Schools, and 74.5% of the Memphis City School District (NCES, 2000). In all US locales, the achievement of African Americans substantially trails the achievement of their Euro-American counterparts (Hrabowski, 2002).

The difference in the success rates of African American and Euro-American students is not an event isolated to one region of the Nation. The achievement disparity is observed in school districts and counties across the country (Seiler, 2001). Furthermore, the achievement differences do not vary with respect to economic status: Disparities exist across lower, middle, and upper income levels (Hewson, Scantlebury, & Davies 2001; McWhorter, 2000). Additionally, achievement differences persist across the education level of parents. Achievement differences are present for African American and Euro-American students of college-educated parents as well as for students whose parents have less than a high school education (Kober, 2001).

Disparities in student achievement are also present at all levels of education. From pre-school to college, African American students are performing at a lower level than their Caucasian peers. Research conducted by the U. S. Department of Education showed that only 57% of African American children entering kindergarten could recognize letters in comparison to 71% of Caucasian children (Kober, 2001). The study also reported that African American students trailed their white counterparts in early math skills such as
recognizing numbers and shapes, understanding relative orders of objects, and performing simple addition and subtraction problems (Kober, 2001). The difficulties experienced at the pre-school and kindergarten levels further confound achievement disparities in subsequent grades. Reports of the National Assessment for Educational Progress (NAEP) indicated that African American students from low socioeconomic backgrounds were academically two years behind other students, specifically Caucasian children, by the time they entered fourth grade (Robelen, 2002). The disparities in success between African American and Euro-American students increase as children matriculate through the education system (Seiler, 2001).

In 1999, only one in every 100 African American high school seniors could read and comprehend specialized text (i.e., a newspaper's science section) while one in every 12 Euro-American students could successfully complete this same task (Haycock, 2001). This study also revealed that one in every 10 Euro-Americans compared to only one in every 100 African Americans could easily solve an elementary algebra problem (Haycock, 2001). Finally, the research found that by the end of high school (Grade 12), a number of African American students acquired reading and mathematics skills equivalent to those of their Euro-American counterparts in the grade eight (Haycock, 2001).

Naturally, the underachievement of African Americans in school affects their future prospects. Effects are especially evident in college admissions and degree conferrals. Of the students in college, African Americans were half as likely as whites to earn a bachelor's degree by the age of 29 (Haycock, 2001). The NCES reported that during the 2000-2001 school year African American students accounted for only 11% of the associate's, 9% of the bachelor's, 8% of the master's, 5% of the doctoral, and 7% of the professional (M.D., D.D.S., J.D.) degrees obtained. The achievement disparities between African Americans and Euro-Americans in general education are also present in science education and science.

Underachievement of African Americans in Science

Atwater (2000) asserts that a number of factors influence African American students' status in science. Such aspects include, but are not limited to, “teacher expectations, teacher interactions with black students and communities, science curricula, and schooling practices” (Atwater, 2000, 155). Due to the numerous inequities and inequalities in these areas, African American students are treated as possessing an inferior knowledge base, are placed in low academic tracks, and are denied access to competitive science instruction. Consequently, these factors impact African American students' science achievement and possible career selection.

In regards to achievement disparities in school science, the NAEP (2000) reported statistics that highlighted the magnitude of the achievement differences between African American and Euro-American students. For fourth, eighth and twelfth grades, a 36, 40, and 31-point difference in assessment scores was observed, respectively. Such differences in achievement impact students' selection of college majors. When the statistical information of degree conferrals in engineering, agricultural, life, and physical sciences is reviewed, the limited success of African Americans is apparent (NCES, 2002).

For 2002, Euro-American students obtained an average of 78% of the associate level science degrees while African Americans received an average of 7% of such degrees. On the bachelor's level, Euro-Americans were conferred 74% of the science degrees whereas African Americans obtained only 7%. Euro-American students were awarded 62% of the master's level science degrees compared to 20% for African American students. As with the other degree levels, the percentage of Euro-Americans who obtained science-related doctoral degrees differed greatly from the number received by African Americans; forty-eight percent of science doctorates were conferred on Euro-American students and one percent to African American students. As expected, the differences in degree conferrals in
the sciences are reflected in subsequent job procurement.

Using the most recent data available, the National Science Foundation (NSF) (1999) reported that Euro-Americans held 82% of all science and engineering related occupations while African Americans accounted for only 3.4%. More specifically, in the life sciences, Euro-Americans were employed at 83% versus 2% for African Americans. Euro-Americans and African Americans filled 85% percent and 3% of the physical science positions, respectively. The statistics were very similar for engineering; Euro-Americans occupied 82% and African Americans held only 2.8% of the engineering jobs. Since the participation of African Americans in science has been low for several decades, it is unlikely the statistics of this group's representation differs for 2005.

If successful strategies are not implemented to alleviate the disparities in achievement and to adequately educate African Americans in science, a significant percentage of the U. S. population will be unable to productively contribute to an increasingly technological workforce. To address the low success of African Americans, some scholars employ culture as the grounding of various approaches (Gay, 2000; Irvine, 1990; Lee, 2004; Shade, 1997). We contend that culturally-based strategies should begin early in the schooling and educative processes so that African Americans can succeed in school science, the first gateway to participating in the scientific enterprise.

Culture: The Conceptual Foundation of the Study

Culture has a significant impact on an individual's worldview. Mintzes and Wandersee (1997) state that, "Our perceptions of objects and events in the natural world are strongly dependent on our store of prior knowledge.... we view the world through a pair of 'conceptual goggles' (44)." These conceptual goggles are heavily influenced by culture.

As characterized by Gutierrez and Rogoff (2003), culture is not a biological trait but a dynamic repertoire of practices. This repertoire is developed, refined, and transformed through an individuals' prolonged participation in cultural communities. Rogoff (2003) used cultural communities to refer to a coordinated group of people who share some common traditions and understandings that span across several generations. Although culture is associated with race in the U.S. due to the physical segregation of ethnic groups into separate communities, in this paper culture is not a race-dependent or race-determined construct. The degree to which the community's repertoire of practices is enacted through the lives of individuals regardless of their classificatory membership in a racial/ethnic group depends upon many factors. Such factors include but are not limited to an individual's response to the effects of race in a racially-stratified society and to the degree in which an individual involved in, committed to, and affiliated with the community. For the sake of clarity in presenting ideas in this paper, the dynamic nature of, and the individual variability within a racial/ethnic group with respect to culture are not emphasized but are understood to exist. Considering that culture includes practices that emerge from prolonged participation in particular communities and the pervasiveness of ethnic and racial segregation in American society, what occurs in US schools, in general, and in science classrooms, in particular, is inherently cultural.

Culture-School Science Connection and the Marginalization of African American Students

The U.S. school system is based upon practices that emanate mostly from Anglo-European-American communities (Banks, 1988). Examples often referred to as Western, include the following: rigid adherence to time, treatment of time as a valued commodity, acting to control one's destiny, and working to achieve individual status through the accumulation of material and symbolic possessions. In the literature, scholars contend that school science generally aligns with the previously listed practices (Aikenhead, 1998; Kelly, Carlsen, & Cunningham, 1993). In accordance with the contention that school science heavily reflects the culture of Anglo-European-American communities, Jegede and
Aikenhead (1999) surmised that to learn school science is to acquire the culture of school science. Distinctive ways of knowing and interacting as well as norms, beliefs, and values are required in learning science, therefore, Aikenhead and Otsuji (2000) characterized this process of acquiring the culture of school science as cultural “border crossing”.

In the classroom, the culture of science and its medium of science instruction may coincide with the cultures of some students and conflict with those of others. Jegede and Aikenhead (1999) contend that when the culture of school science aligns with the students' cultures then school science supports those cultures and enculturation occurs. That is, the students experience smooth border crossing. According to Powell (1997), these students rise to prominence within the community of school science because the school science community affirms them; their cultures serve as capital (Carter, 2003). Conversely, when attempting to cross the border into school science, some students experience symbolic violence (Bourdieu & Passeron, 1977). The culture of school science is at odds with the students' cultures (Jegede & Aikenhead, 1999) and the students' culture is viewed as deficient (Powell, 1997). In order to be successful, these students must assimilate by abandoning or marginalizing their own cultures. If they do not assimilate, the school science community denies them affirmation. These students are then relegated or elect to function in the margins, thereby, restricting their participation in school science.

As surmised in Hodson (1999), Costa (1995) examined in-depth students' transitions into school science and generated five student types: potential scientists, other smart kids, “I don't know” students, outsiders, and insider outsider. For the potential scientists, the students' worlds of family, community, and friends were congruent with the milieus of school and science. In the case of other smart kids, congruency existed between their worlds and school but not science. The personal contexts of the “I don't know” students were inconsistent in many ways to the contexts of school and science. For the fourth type, the outsiders, the worlds of family, community, and friends were discordant with both school and science. Only African American students populated the last type- the “inside outsider” group. For this student type, the culture of school was considered irreconcilable with the students' home and community cultures but the students' home and community cultures were potentially commensurate with the culture of school science. From this perspective, the underachievement and marginalization of African American students in school science is viewed as a support issue; institutions insufficiently support their interest in the physical world. One way in which teachers can support and include African American students in school science is to facilitate their “border crossing” experiences.

Unfortunately, research suggests that teachers do not view science as a cultural phenomenon and tend not to see the cultural difficulties their students may experience in their classes (Aikenhead & Otsuji, 2000). “If science teachers are not aware of the cultural aspects of Western science, and are not aware of the differences between scientific and other cultures (those of their students), then teachers will not make good culture brokers and the science curriculum will be less accessible to their students” (Aikenhead & Otsuji, 2000, 277). Some of the strategies that use culture to address the underachievement of African Americans in subjects other than science target teachers as cultural brokers. Heretofore, the implementations of culturally-based strategies in science are scarce but still can prove useful in making school science more accessible to culturally diverse students. This paper focuses upon culturally congruent instruction.

**Culturally Congruent Instruction and BCE**

Culturally congruent instruction addresses the mismatch between institutional norms and values and those of the homes and communities of ethnic minorities. The aim of culturally congruent instruction is not to replicate the students' home and community cultures but to incorporate them into what occurs in schools and classrooms (Au & Kawakami, 1994; Lee, 2004). By doing so, the students are affirmed and their home and
community cultures are treated as capital rather than deficiencies. This study focused upon culturally congruent instruction with respect to BCE in the subject area of science.

Boykin (1986, 1994) conceptualized BCE by articulating nine dimensions: spirituality, affect, harmony, orality, social perspective of time, expressive individualism, verve, communalism, and movement (see discussion in Parsons, 2000). This study examined five of the nine, but only three are discussed in this article: communalism, verve, and movement. The researcher selected these dimensions to examine because their incorporation into instructional contexts results in observable changes. According to the literature on the enactment of culture in the classroom (Bowers & Flinders, 1991; Monroe & Obidah, 2003), it was also likely that teachers working with African American students were experientially familiar with the manifestations of these cultural values.

Boykin, Jagers, Ellison, and Albury (1997) described communalism in their efforts to conceptualize and measure it. Communalism esteems the interdependence of people. Social bonds and relationships are of utmost importance. In order to establish and maintain this social orientation, individuals’ devotion to the group (e.g., racial group) overrides their pursuit of individual rights and privileges. Sharing rather than self-centeredness and greed is promoted and affirmed.

Human interaction and the maintenance of social relationships often involve verve. Verve captures a preference for high physical stimulation. According to Boykin and Allen (1999), this stimulation consists of two components: intensity and variability. Intensity and variability contribute to an environment’s liveliness. An environment with high intensity and variability is likely to sustain loud noise levels, and several different or multifaceted events. In situations encompassing BCE, movement often accompanies verve. Movement, an orientation identified by several authors (Gilmore, 1985; Hale-Benson, 1986; Morgan, 1990), expresses the integration of rhythm associated with music and dance into everyday life. Its most obvious manifestation in the classroom is mobile, singing, playful students.

When enacted in classrooms, communalism, verve, and movement result in very lively, noisy, and active environments. As they participate in a range of diverse, highly stimulating learning opportunities, students move around to engage each other socially. The activeness of students and the building of social relationships are readily apparent in the more frequent interactions between and among students.

In the vein of culturally congruent instruction, Boykin and colleagues examined the effect of BCE upon the academic achievement of African American students (Allen & Boykin, 1991; Allen & Butler, 1996; Boykin, 1982; Boykin & Allen, 1988; Boykin, Allen, Davis, & Senior, 1997; Dill & Boykin, 2000). These studies altered the context of learning such that the culture that acted as capital for African American students in their surroundings outside of school became a valued currency within the classroom. Findings from these studies indicated that the context in which the learning tasks were performed influenced achievement: African American students performed more tasks correctly within the culturally congruent environment.

In their study on communalism, Dill and Boykin (2000) found that fifth grade African American students working in a context featuring communalism recalled significantly more text than students assigned to contexts emphasizing peer tutoring or individual learning. They also reported African American students’ beliefs about communalism correlated with positive attitudes toward task engagement. When investigating the influence of verve upon third, fourth, and sixth grade African American and Euro-American students’ performances on tasks of color matching, word recall from a read-aloud story, letter identification, and pattern reproduction, researchers cited improved and stagnated performance for African American and Euro-American students, respectively (Boykin, 1982; Boykin, Allen et al., 1997; Boykin & Allen, 1999).
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Others reported similar results for first and second graders performing learning tasks that involved picture associations and reading. These students performed better in instructional contexts that incorporated movement and music (Allen & Butler, 1996; Boykin & Allen, 1988; Boykin & Allen, 1999). This study built upon the earlier work on BCE, instruction, and African American student achievement and investigated a component not addressed in the previous work. The previous research on the influence of BCE-congruent instruction and contexts did not consider how well the students’ repertoire of practices corresponded to BCE. Via a multiple case study approach, this study examined eighth graders’ instructional context preferences in relation to BCE and explored influences upon science achievement when the preferences were congruent with the instructional context.

Research Design

Context

Eighty elementary, 27 middle, and 16 high schools made up the urban district in which the study was conducted. The district located in the southeastern U.S. served .26% American Indian, 4.2% Asian, 6.5% Hispanic/Latino, 26.6% African American, 60% Euro-American, and 2.5 % Multi-Racial populations in 2002-2003. The superintendent overseeing all research in this school district, the second largest in the State, presented three prospective schools for participation in the study.

The three schools met the criteria for involvement: a large enrollment of African American students from low-income backgrounds. The low-income criterion was stipulated because such communities are often perceived to be somewhat isolated from mainstream America but committed to BCE (Boykin, 1994). Only one researcher, the first author, conducted the study consisting of extensive data collection, therefore, one school was selected. The researcher used school enrolling approximately equal percentages of African American and Euro-American students, the racial/ethnic groups targeted in this study. For 2002-2003, 45% of the participating school’s student population was classified as Euro-American and 40% as African American of which 37% of the students received free/reduced lunch. All the 8th grade science teachers at the school volunteered to participate in the study using the pseudonyms Ms. Vince, Ms. Ham, and Ms. Ness. Only the findings pertaining to Ms. Ham and Ms. Ness are included in this article.

Ms. Ness, a Euro-American female teacher, received her teaching degree from a predominantly white university in the southeastern U.S. At the time of the study in 2002-2003, she had completed 11 years teaching middle school science. The highest degree attained by Ms. Ness was a bachelor’s degree. Ms. Ham, an African American female teacher who also studied at a predominantly white university in the southeastern U.S., had 20 years of teaching experience, and a master’s as her most advanced degree. To efficiently investigate these teachers’ instructional contexts and to examine student achievement within these contexts, each teacher was treated as a case study.

Data Collection

For each case study, at least two days per week, the classroom instruction was videotaped and observational field notes were taken. Teachers provided lesson plans and summaries; and participated in at least three, 50-minute, semi-structured interviews about their instruction. Additionally, the students enrolled in the participating classes completed a pretest and posttest comprised of publicly released multiple choice and open-ended items taken from the NAEP (1996, 2000) and Third International Mathematics and Science Study (TIMSS) (1998) databases. During the administration, the proctor read aloud the test items as a way to lessen the impact of varied literacy development of students. The administrations of the pretest and posttests were also audio taped to monitor discrepancies (e.g., explanation given for a test item during one administration but not at another); no discrepancies were found. At the beginning of the study, the students also completed a
The Preference Questionnaire.

The questionnaire elicited the students' preferences regarding instructional strategies and instructional contexts. The strategies included methods that typically require students to be visibly inactive (e.g. watching filmstrips) and those in which students are usually visibly active (e.g. hands-on activities). The preferences for instructional contexts were presented as dichotomies. A BCE cultural value (e.g. working with others) was presented on the preference questionnaire as one extreme and its opposite (e.g. working alone) as the other extreme. Two items on the preference questionnaire targeted the students' preferences for verve; one item pertained to communalism, and one item related to movement. Questionnaire items "c", "e", "f" were not used in the interventions presented in this article. To check the validity and reliability of the questionnaire, the students completed a feedback sheet on an actual class session that incorporated BCE-related practices (see Appendix B). The students in one class completed the feedback sheet two months after the completion of the preference questionnaire. A comparison among the students' responses on the feedback sheet showed 85.5% (59 confirmations out of 69 instances) correspondence with the students' responses on the dichotomy portion of the preference questionnaire.

Four students, two African Americans and two Euro-Americans, were also randomly selected and interviewed six months after the completion of the feedback sheet (see Appendix C for interview guide). As a prompt, the researcher described two different versions of the same lesson (Parsons, 2003). One version incorporated BCE and the other version did not. The preferences the students voiced during the interviews were compared to their responses they provided eight months earlier on the preference questionnaire. Three of the four students' interview responses directly aligned with the responses given on the preference questionnaire. Based upon the results obtained by comparing the students' answers on the preference questionnaire to their responses for the feedback sheet and the interviews, the preference questionnaire was considered reasonably valid and reliable. As determined by the students' responses on the questionnaire, the students' self-reported preferences were viewed in relation to their scores on the NAEP-TIMMS-based tests and the contexts in which instruction took place.

Testing.

In the first study, Ms. Ham taught the concept of force for eight days and electricity for five days to a class of 18 students, 8 African American and 10 Euro-American. For the pretests and posttests that contained the same items, the students responded to the seven questions on force and three items pertaining to electricity. Fifty-four school days passed from pretest to posttest administrations. In the second case, Ms. Ness also taught the topics of force and electricity; she taught force for 11 days and electricity for five. Twenty-two students, 12 African American and 10 Euro-American, responded to the previously mentioned test items on force and electricity in two separate sessions. The force and electricity posttests were administered 45 and 60 school days, respectively, after the administration of the pretest. Two scorers used the NAEP and TIMSS scoring guides to independently score the students' responses to the open-ended items on the pretests and posttests. The inter-rater agreement ranged from 88% to 94%.

Intervention.

For Ms. Ham and Ms. Ness, the case studies involved an intervention, thus, only part of their cases documented their usual instruction. Factoring in the teachers' time constraints and their years of teaching experience, the intervention included a short reading on BCE, a discussion of lesson plans devised by the researcher that incorporated BCE, and the implementation of the BCE-incorporated lesson plans by the teachers. The researcher structured the BCE-incorporated lesson plans so that several activities
occurred simultaneously (verve), that students moved around the room (movement) and
that group work was requisite to solving the problems (communalism). In the discussions
of the BCE-incorporated lesson plans with the teachers, the researcher encouraged them
to allow students to socialize and interact freely while completing the tasks (verve and
communalism). Ms. Ness participated in the intervention when she taught electricity but
taught the topic of force in her typical manner. Conversely, Ms. Ham participated in the
intervention when she taught force but taught the topic of electricity in her usual fashion.
The possible novelty effect of the intervention was addressed in the larger study by the
third teacher, Ms. Vince, who was not involved in an intervention, and her instructional
context was determined to incorporate BCE. The change in students’ mean scores for Ms.
Ham and Ms. Ness’s classes for the intervention were compared to the change in students’
means for Ms. Vince’s class (Parsons, 2005). In addressing the two objectives of the study,
the data from the various sources were analyzed and the findings compared across the
different sources.

Data Analyses

The study's data were both qualitative and quantitative. Therefore, the researcher
conducted both types of analyses. In order to ascertain how the cultural nature of the
instructional contexts in the non-intervention and intervention differed and that the
intervention incorporated BCE, the researcher interpretatively analyzed the qualitative
data (Erickson, 1986). The qualitative data included videotapes, observational field notes,
and verbatim interview transcripts. The quantitative analyses of the students’ pretest and
posttest scores followed the examinations of the qualitative data.

Qualitative Analyses.

For the purposes of scrutinizing the instructional contexts with respect to the
aforementioned BCE values, the researcher reviewed the videotapes and field notes
numerous times. The researcher then took two steps to check credibility, or how accurately
the researcher’s interpretations represented the research situation (Guba & Lincoln,
1989).

First, during two 50-minute, semi-structured interviews, the teachers viewed video
clips of their teaching and responded to a set of questions about the segments. The
researcher selected for each teacher video clips totaling 38 minutes; these clips which were
taken from 7 videotapes for Ms. Ham and 11 videotapes for Ms. Ness. The video clips
featured each type of instructional strategy employed by the teachers. Ten clips comprised
the 38 minutes of video addressed by Ms. Ham in the interview and 15 segments made up
the 38 minutes of video discussed by Ms. Ness in her interview. With respect to BCE, the
researcher interpreted the video segments and then compared these interpretations with
those posited by the teachers in their interview responses. The second step involved the
interpretation of the video clips by two individuals unfamiliar with and not affiliated with
the study.

The two independent interpreters were given copies of the video clips used in the
teachers’ interviews and were asked to label and discuss the teachers’ and students’
roles (see Appendix D). Indications of the inactivity or activeness of the teachers’ and
students’ roles are partial gauges for an instructional context that incorporated BCE. For
example, a BCE-incorporated instructional context will feature highly active students (e.g.
students moving around, students interacting with each other) and a less active role for
teachers. The interpreters were not informed of which clips illustrated the teachers’ natural
instruction and which clips showed the instruction for the intervention. If the teachers
altered their instructional contexts to implement the BCE-incorporated lesson plans then
the interpreters’ evaluations for the clips showing the non-intervention and intervention
would differ. The assessments of the two independent interpreters were then compared
to those of researcher and teachers’ interpretations. Out of the 168 interpretive instances,
disagreements in interpretation existed in only five of them.

Four of the disagreements occurred in interpreting events in the non-intervention where the teachers instructed in their usual manner; two of these disagreements pertained to teacher roles and two related to the student roles. In one instance regarding the teacher's role, one interpreter indicated that the teacher was acting as an evaluator by assessing students' answers; the other interpretations indicated that the teacher was monitoring the students' behaviors. The first interpretation implies student inactivity and the second implies student activity. In the second case involving teacher roles, one interpretation was that the teacher was demonstrating by showing examples of students' work. Other interpretations of the same event were that the teacher conveyed information about the students' work. In both sets of interpretations, the teacher assumed an active role whereas the students attained a passive one. With regard to student roles, the interpretations differed in that one interpreter concluded that in an event the students were practicing a skill while others indicated that the students were following the teacher's directions.

The last disagreement in interpretation occurred in the examination of teacher roles in the intervention when the teachers implemented the BCE lesson plans. One interpreter stated that for an event, the teacher acted as a moderator; the others described the teacher's role as a facilitator. Even in light of these five disagreements, data triangulation resulted in a clear consensus regarding the nature of the instructional contexts.

Quantitative Analyses.

With respect to the non-intervention (contexts not incorporating BCE) and to the intervention (contexts incorporating BCE), the researcher examined the students' preferences. In examining the students' self-reported preferences with respect to verve, communalism, and movement, the researcher used the students' responses to the dichotomy part of the preference questionnaire to determine congruency scores. Of the four items that ascertained, the students' preferences for the previously mentioned BCE values, students who indicated a preference for BCE in all four items received a congruency score of "4" for high congruency with BCE; for 3 items a "3" for moderate congruency; for 2 items a "2" for low congruency; for one item a "1" for poor congruency and for no items a "0" for no congruency with BCE. For each student, the congruency score was then viewed in relation to (a) change in the test scores from pretest to posttest and (b) the nature of the instructional contexts.

First, because of the small sample size, the researcher calculated arithmetically the change in each student's test score from pretest to posttest. The change in a student's score was noted in percentage points. For example, if a student got 50% of the items correct on the pretest and 70% on the posttest then the change in the student's score was listed as 20 percentage points. A percentage point change of 50 or more was classified as "good," 31-49 as "average," 1-30 as "poor," and 0 or less as "no improvement." Second, the researcher viewed the quality of score changes (i.e. good, average, poor, and no improvement) in relation to the instructional contexts. For example, each student had two score changes. One score change was for the force test in either the intervention (BCE context) or non-intervention (non-BCE context) and the other for the electricity test also in either the intervention or the non-intervention. When viewing the students' congruency scores, score change, and instructional contexts in relation to each other, the researcher analyzed frequencies and looked for patterns. These patterns comprised the findings.

Findings

Two sections make up the findings. The first section presents the overall patterns for all the students. In the second part, the researcher disaggregated the data for African American and Euro-American students and reports any patterns for the two groups separately.
Patterns for All Students

Of the 40 students involved in the intervention and non-intervention, 13 students (32.5%) received a high congruency score of four. Within this group of students whose preferences had high congruency with BCE, 54% experienced no to poor improvement in the BCE-incorporated context contrasted to 100% in the non-BCE context. In the BCE-incorporated instructional context, 46% had average to good improvement with no students experiencing this quality of improvement in the non-BCE instructional context (see Figure 1). Similar patterns existed for the remaining congruency groups.

Thirty percent (12 out of 40) of the eighth grade participants comprised the moderate congruency and the low congruency groups with student congruency scores of 3 and 2, respectively. As in the high congruency situation, fewer students experienced none to poor improvement and more students improved at the quality levels of average to good in the BCE versus the non-BCE context (see Figures 2 and 3). Two students' preferences were classified as having poor congruency with BCE and one student was labeled as not congruent. For the poor congruency students, one student improved at the level of poor and the other at the level of average under the BCE condition; in the non-BCE situation, one student experienced no improvement and the other improved at the level of poor. The student whose preferences were not congruent with any of the BCE values experienced no improvement in the BCE context but the student improved at the quality level of poor in the non-BCE instructional context. When examining the percentage of students experiencing varied improvement in the BCE and non-BCE contexts across congruency scores, patterns also emerged (see Table 1).

As the students' preferences went from highly congruent to moderately congruent with BCE, the percentage of students experiencing no to poor improvement in the BCE context increased and the percentage of students experiencing improvement at the quality levels of average to good decreased. That is, as the students' preferences became less congruent with BCE the students' scores showed less improvement in the BCE context. Likewise, in the non-BCE context, a decrease in the percentage of students experiencing no to poor improvement and an increase in the percentage of students experiencing improvement at the average to good levels accompanied a decrease in congruency scores. That is, when the students' preferences were less congruent with BCE more students experienced a higher quality of improvement in the non-BCE context.

In sum, when the change scores for all students were viewed with respect to their preferences, BCE, and nature of the instructional contexts, several general patterns emerged. These patterns are plausible support for the following assertion: the correspondence of students' instructional context preferences to BCE and the nature of instructional contexts with respect to BCE influence achievement. Does this influence impact African American and Euro-American students differently?

Patterns for African American and Euro-American Students

When examining the African American and Euro-American students' changes in scores with respect to their preferences and the instructional contexts, no distinctive patterns emerged. With regard to preference and congruency with BCE, the percentage of African American and Euro-American students varied at each level (see Table 2). When the percentages of students experiencing greater improvement in the intervention or non-intervention were examined by race, the percentages were the same: 32.5% (13 out of 40) for the intervention and 15% (6 out of 40) for the non-intervention. Two and a half percent (1 out of 40) for both groups experienced no change in scores in either the intervention or the non-intervention. As indicated by these results, the nature of the changes in African American and Euro-American students' scores was similar with regard to student preferences, BCE, and the nature of instructional contexts.
Conclusion

This study consisting of two cases involved non-intervention and intervention situations. The science instruction of two eighth grade teachers, one African American and one Euro-American, did not incorporate BCE in the naturalistic setting so the contexts were altered to reflect verve, communalism, and movement. With respect to the students' self-reported instructional context preferences, the change in achievement of 40 eighth graders, 20 African Americans and 20 Euro-Americans, in the BCE and non-BCE contexts was examined. Even though the generalizability of this study's findings is limited to the two science classes taught in an urban area of the southeastern U.S., the results contribute to the existing literature and present insight on providing quality science education for all students. With regard to the earlier research on BCE-congruent instruction and cultural border crossing into school science, the study's findings are informative.

The achievement patterns for African American students in the BCE contexts reported in this study are similar to findings in the earlier research on BCE congruent instruction. In the culturally congruent research previously described, the academic performance of African American students in grades 1-6 improved when the instructional conditions incorporated communalism, verve, and movement. In comparison to contexts that did not incorporate BCE, a higher quality of improvement was observed in the BCE contexts in this study. These kinds of results on culturally congruent instruction are not limited to African American students but have been cited in the work involving other ethnic minorities (Au & Jordan, 1981; Au & Mason, 1983; Mohatt & Erickson, 1981; Tharp, 1989a; Van Ness, 1981). Unlike the earlier research on culturally congruent instruction, in this study BCE congruent instruction also influenced the achievement of Euro-American students.

This deviation from the findings of earlier work is possibly explained by the students' self-reported instructional preferences. In this study, BCE was not treated as a race-dependent or race-determined construct. BCE was viewed as a repertoire of practices acquired through prolonged participation in a cultural community. Many of the Euro-American students indicated a preference for BCE. If Euro-American students held instructional context preferences similar to their African American counterparts, then it is reasonable for the change in performances of the two groups in the BCE context to be similar. The explanations posited for the enhancement effect of culturally congruent instruction sheds additional light.

When addressing the question of why culturally congruent contexts enhance learning, some contend that the incorporation of culture directly enhances learning in several ways. The incorporation of culture makes cues more discernible, activates cognitive processes such that relevant components of a task are identified, and heightens the salience and meaningfulness of the situation to individuals so they become more attentive and motivated (Boykin, 1994; Tharp, 1989b). To this list of reasonable explanations for the successfullness of culturally congruent instruction, the authors add the alleviation of symbolic violence—the defamation, devaluing, and subsequent exclusion of norms, beliefs, and practices that do not correspond with institutionalized ones. Mitigating symbolic violence leads to the affirmation that Powell (1997) attributed to student prominence within a community with a distinctive culture or repertoire of practices.

Symbolic violence results from the enactment of cultural capital that is "institutionalized, i.e. widely shared, high status cultural signals (attitudes, preferences, formal knowledge, behaviors, goods, and credentials)" (Lamont & Lareau, 1988, 156). The power of cultural capital exists in the form of symbolic imposition (Bourdieu & Passeron, 1977). That is, the set of institutionalized cultural norms and practices are considered superior and are used to influence, shape and regulate behavior via access (i.e., inclusion or exclusion); these cultural norms and practices then become authoritative. With the passing of time and continual subjugation of other cultural norms and practices, the institutionalized ones are perceived
as neutral and unconsciously/consciously serve as standards by which other cultures are evaluated. Subsequently, messages that devalue and delegitimize other cultures are conveyed and corresponding actions ensue. Whenever the cultural norms and practices that are devalued constitute who individuals are because they do not know or do not elect other ways of being and comprise how they define themselves, in part or whole, then they oppose and resist symbolic violence. The authors assert that this resistance and its correlates (e.g., reconciling competing cultures, assimilating, etc.) detract from learning. The authors also contend that learning is further detailed when teachers oppose the students’ cultures. In American classrooms that include students who knowingly or unknowingly commit to BCE, instances of opposition on the parts of teachers are evident (Carter, 2003).

When students enact movement, teachers take disciplinary action to get them back to their seats or some other stationary position instead of incorporating movement as a part of the lesson. Teachers demand “classroom voices,” focused time-on-task, and traditional styles of interacting in lieu of excitement and liveliness that is often accompanied by loudness and socializing. Instead of encouraging students to value what benefits groups over individuals, teachers taut and enforce individuality. Such instances of opposition can be reduced in occurrences and in intensity when the culture students bring with them is first viewed as cultural capital, i.e., valued currency to be used in development; culturally congruent science instruction achieves this goal and facilitates cultural border crossing into school science.

In conclusion, culturally congruent science instruction addresses an area in which the science education reform efforts are silent. This study elaborated upon one conceptualization of diversity and provides a strategy of how to address it so that all students are involved. Culturally congruent science instruction is not the only approach to attain the goal of science for all and is limited in that it does not address the symbolic violence emanating from racism, but this study’s findings in conjunction with the results of previous research indicate that it is a promising avenue. More research conducted on a larger scale that involves more teachers and students is needed to further articulate the extent of that promise.

References


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Erickson, F. (1986). Qualitative methods in research on teaching. In M. C. Wittrock (Ed.) (3rd ed.), *Handbook of research on teaching* (pp. 119-161). NY: McMillan.


BCE and Student Preferences


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Third International Mathematics and Science Study (1998). Publicly released items at http://isc.bc.edu/


**Appendix A**

**Student Preference Questionnaire**

**Note:** Please be as honest as possible. Only Dr. Parsons will read your responses and your responses will not affect your grade in this class.

**Name:**

1) Look at the ways to teach science which are listed below. Please let me know what you think or how you feel about each way.

a) watching filmstrips:

b) reading from the textbook:

c) doing worksheets:

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d) doing hands-on activities:


e) doing creative tasks like making posters or writing stories:


f) using concept maps, circle maps or summaries that give you the "big picture" and/or pulls together the ideas of the topic you might be studying:


2) What kind of setting do you prefer for learning: (please circle only one from the pair)
a) quiet -or- noisy
b) calm -or- lively
c) routine (same from day to day) -or- variable (differs from day to day)
d) working alone -or- working with others that you choose
e) one thing occurring at a time -or- several things occurring at once
f) strict time schedules -or- flexible time schedules
g) sitting in place for a 50 minutes -or- moving around

3) Comments (anything I should know):


Appendix B

Student Feedback Sheet

Name: ________________________________

In this lesson, you did several things. You did some activities in groups (activities) and then you combined with other students to discuss what was happening in the activities (group work). You shared your group answers to the whole class and then the teacher shared information about the science concept (whole class). You read a section from the textbook (reading) and took notes (note taking).

Directions. In the space provided please answer the questions below. Be honest; this information will help us improve science teaching.
BCE and Student Preferences

1. (a) What part of the lesson did you like the most? Look at the description above and write the word in the parenthesis that indicates what you liked the most.

(b) Why did you like this part the most?

2. (a) What part of the lesson did you like the least? Look at the description above and write the word in the parenthesis that indicates what you liked the least.

(b) Why did you like this part the least?

3. How did you feel about moving from station to station to do the activities?

4. How did you feel about working in the group of four in order to decide a group answer?

5. Please share anything that you would like for us to know about this lesson.

Appendix C

Interviewer: What I'm going to do is read two different versions of the same lesson. Here's a copy so you can read along. Then I'm going to ask you which version you prefer a teacher use when teaching you science, why you selected that version and what you liked most about it. I'll also ask what you didn't like about the version you didn't choose.
BCE and Student Preferences

Appendix D

Interpretation Task

View the entire video to get familiar with the context. Then examine the clips listed below for Ms. Ness. For each clip, respond to the following questions. Submit electronically before meeting. DO NOT DISCUSS.

1) What is the teacher's role in the educative event? What is she doing? What is her goal? What is her function in reaching the goal?

2) What are the students' roles in the educative event? What are they doing? How must they function in order to achieve the teacher's goal?

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Author Note

Eileen Carlton Parsons, Department of Mathematics, Science, and Technology Education, North Carolina State University; Crystall Travis, graduate student in the Department of Mathematics, Science, and Technology Education, North Carolina State University; Jamila Smith Simpson, graduate student in the Department of Mathematics, Science, and Technology Education, North Carolina State University.

Eileen Carlton Parsons is now at The University of North Carolina at Chapel Hill.

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Correspondence concerning this article should be addressed to Eileen Carlton Parsons, School of Education, The University of North Carolina at Chapel Hill, CB#3500, Chapel Hill, North Carolina 27599. Email: parsons@conninc.com
Table 1 The percentage of students experiencing no to poor and average to good improvement by congruency scores and context

<table>
<thead>
<tr>
<th>Congruency Scores</th>
<th>Percentage of students with no to poor improvement BCE</th>
<th>Non-BCE</th>
<th>Percentage of students with average to good improvement BCE</th>
<th>Non-BCE</th>
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<tr>
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<td>100</td>
<td>46</td>
<td>0</td>
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<tr>
<td>3</td>
<td>58</td>
<td>83</td>
<td>42</td>
<td>17</td>
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<tr>
<td>2</td>
<td>67</td>
<td>83</td>
<td>3</td>
<td>17</td>
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Table 2 Number of students (percentage of total) by race and congruency score

<table>
<thead>
<tr>
<th>Congruency Score</th>
<th>Percentage of Black Students</th>
<th>Number of White Students</th>
<th>Total Students</th>
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<td>4</td>
<td>6 (46%)</td>
<td>7 (54%)</td>
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</tr>
<tr>
<td>3</td>
<td>8 (67%)</td>
<td>4 (33%)</td>
<td>12</td>
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<tr>
<td>2</td>
<td>5 (42%)</td>
<td>7 (58%)</td>
<td>12</td>
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</tr>
<tr>
<td>0</td>
<td>0 (0)</td>
<td>1 (100%)</td>
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Score Changes for High Congruency Students

![Score Changes Chart](chart.png)
**BCE and Student Preferences**

**Figure Captions**

Figure 1. Change in students' scores in the BCE (intervention) and non-BCE (non-intervention) instructional contexts for students whose preferences were highly congruent with BCE.

Figure 2. Change in students' scores in the BCE (intervention) and non-BCE (non-intervention) instructional contexts for students whose preferences were moderately congruent with BCE.

Figure 3. Change in students' scores in the BCE (intervention) and non-BCE (non-intervention) instructional contexts for students whose preferences had a low congruency with BCE.

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