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Pushing the Boundaries of Cultural Congruence Pedagogy in Science Education towards a Third Space

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1 FORUM

2 **Pushing the Boundaries of Cultural Congruence Pedagogy in Science Education**3 **Towards a Third Space**

4 Cassie Quigley

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9 **Abstract** This review explores Meyers and Crawford's "Teaching science as a
10 cultural way of knowing: Merging authentic inquiry, nature of science, and multicultural
11 strategies" by examining how they combine the use of inquiry-based science instruction
12 with multicultural strategies. In this conversation, I point to the need of specific discourse
13 strategies to help teachers and students create hybrid spaces to push the boundaries of
14 cultural congruence as described in this article. These strategies include a reflective
15 component to the explicit instruction that encourages an integration of home and science
16 discourses. My response to this work expands on their use of multicultural strategies to
17 push toward a congruent Third space that asks not only what happens to the students who
18 do not participate in science, but also what happens to science when a diverse group of
19 people does not participate?

20 **Keywords** Cultural Congruence · Third Space · Multicultural Strategies · Nature of
21 Science

22

A1 Forum response to Meyers and Crawford (2011). Teaching science as a cultural way of
A2 knowing: Merging authentic inquiry, nature of science, and multicultural strategies

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23 Meyers and Crawford article provided a thorough examination of how to address
24 the problem of supporting diverse groups of students from underrepresented populations
25 in learning science through the teaching of nature of science. This necessary article
26 outlines the need for all students, particularly those from marginalized communities
27 participating and engaging in science by understanding the nature of science (NOS). One
28 issue with the current science education NOS literature is often a broad statement of
29 students' understandings of nature of science aspects, without mention of race,
30 socioeconomic background, or gender (Walls 2009). In this way, students'
31 understandings of these constructs become generalized to refer to all students regardless
32 of context. Moreover, for all students to become successful in science, all views of
33 science must be included in the research base. As of current, because of the framework
34 from which they were generated, the worldviews of many students, and marginalized
35 students in particular, are viewed as something that needs to be overcome or changed.

36 Through examples of their own research, Meyers and Crawford call of the use of
37 inquiry-based practices in combination with multicultural strategies. Specifically, they
38 posit the use of culturally congruent instructional strategies with explicit instruction in
39 nature of science. In this article, they set the stage with the first section titled, "Inquiry as
40 Participation in Scientific Culture." Here, they adopt a meaning of inquiry as proposed by
41 the National Research Council (NRC) as constructed in an authentic context and
42 encourage the framing of inquiry as communities of practice. Here, the authors lay the
43 foundation for moving beyond the current methods of NOS instruction and provide a
44 framework for how to "support students in navigating the cultural divides between their
45 everyday life-words, school, and school science." (p. 9) Next, Meyer and Crawford
46 provide the background into why schools rarely emulate actual science practices and they
47 highlight the opportunities for schools to become cultural homes where students can
48 shape their ways of knowing if supported to do so. While I agree with Meyers and
49 Crawford's demands for changes in science education, I argue that in addition to the goal
50 that they outline for science educators of getting marginalized students participating in
51 and engaged with science that we should also look at how science will continue to suffer
52 without the participation of diverse populations in it. Therefore, I suggest that not only
53 should cultural congruence with inquiry-based practices be incorporated but also that a
54 different space *altogether* should be created in our science classrooms. This space, in
55 which Gutierrez (2008) calls a Third Space, is a theoretical framework used to describe
56 pedagogical practices that combine the worlds of students (first space) with the worlds of
57 school science (second space) to construct a space where student feel comfortable
58 dialoguing in science and no long see the two spaces (home and school) as in opposition
59 to each other.

60 As Meyer and Crawford describe in their article, the language practices of school
61 science are largely responsible for distancing marginalized students from science while
62 providing support for more privileged students. Equitable instruction and assessment
63 practices for diverse students involve consideration of their cultural experiences and local
64 discourse, which enable them to connect with science and maintain their identities. By
65 allowing students to maintain these identities, there is support for their funds of
66 knowledge, which include the knowledge students' gain from their culture, communities,
67 familial, and linguistic backgrounds they bring with them to school. Studies, such as the
68 one Meyer and Crawford describe in their article that focus on congruence, pay close

69 attention to the funds of knowledge that students bring to the classroom. Funds of
70 knowledge include the knowledge students' gain from their culture, communities,
71 familial, and linguistic backgrounds they bring with them to school (Gonzalez, Moll, and
72 Amanti 2005). Meyer and Crawford describe specific instructional congruency
73 approaches such as the linguistic scaffolding and use of everyday language in the
74 classroom to access and encourage funds of knowledge in the classroom.

75 Along the same line, congruent Third Space (Moje, Tehani, Carillo, and Marx
76 2001) promotes the use of these strategies with a concentration on how to integrate
77 discourses. Congruent Third Space centers on three discourses often present in urban
78 classrooms: *instructional discourse* (pedagogical discourse or the discourse type the
79 teacher uses to teach students such as question and answer techniques, instructions prior
80 to a lesson or language used to reinforce classroom rules), *scientific discourse* (the
81 discourse spoken in science settings such as scientific vocabulary, words and actions used
82 to describe scientific processes-observation, inference, experimentation, or discourse
83 techniques often reserved for science such as argumentation), and *everyday discourse*
84 (the language that is spoken in everyday settings such as in the lunchroom, around the
85 dinner table or phone conversations with friends). Using this framework of congruent
86 Third Space, this educational focus is shifted to include achievement *and* equity by
87 creating a space that allows/values/prioritizes instructional and everyday discourses to
88 support and not compete with scientific discourse. In this way, one discourse is not
89 privileged and allows students to bring their funds of knowledge into the classroom. For
90 example, when Bianca (as described in Meyers and Crawford's article) is *allowed* to
91 show her scientific knowledge both through the use of scientific words and through using
92 non-academic, or everyday language (her funds of knowledge) and provides examples
93 from her homes she is demonstrating her understanding of the nature of science.
94 According to Third Space theory, these spaces are created when scientific, everyday, and
95 instructional discourses are combined through authentic integration *by the student*.
96 Authentic integration occurs when it is initiated and/or confirmed by the students; it is
97 asserted during these moments that students understand scientific concepts and are able to
98 assimilate into their everyday discourse. In the case of Bianca, through the description of
99 how scientists' views can differ, she integrated scientific understanding into her everyday
100 discourse and used appropriate contextual examples (based on a conversation with her
101 dad and brother) to initiate her own meaning making of academic knowledge.

102 103 **Including the Reflective Component for Student to "Talk Science"**

104
105 Science education is a social activity that occurs within institutional and cultural
106 frameworks. From this perspective, science education should include the role of social
107 interaction in teaching and learning science. It also means making the role of social
108 interaction necessary for learning. Human beings cooperate; communication is one of the
109 necessary processes for cooperation, and because we cooperate we have formed larger
110 scale organizations like families, schools, churches, community centers, gyms, university,
111 and Internet chat rooms. Knowledge sharing occurs through these communities. In this
112 way, our lives provide us with ways for making sense of the world through languages,
113 pictures, belief systems, values, and specific discourse types. However, how this
114 knowledge sharing occurs, the way we learn and what we believe and value is dependent

115 on both time and space and specific to our ever-changing culture. When students share
116 their knowledge with their teacher, learning is occurring. Similarly to the way Meyers
117 and Crawford describe how Paula struggled with the way school science was different
118 from what she was observing at home—learning is happening. Moreover, it is telling us
119 much about their culture at that specific moment, one defined by time and her space.
120 Through the explicit-instruction of NOS aspects, the authors were able to understand
121 Paula’s understanding of NOS through conversations with her.

122 Moreover, Meyer and Crawford describe explicit instruction in NOS as involving,
123 “deconstructing science and framing science content matter within its epistemological
124 framework.” (p. 23) While I agree with this statement, I argue that including the
125 reflective component could also provide an other opportunity for students to practice
126 integrating discourses of home and school and would attend to the “both/and” approach
127 the authors highlight throughout their article. Science educators have discovered explicit
128 reflective instruction is crucial for both teachers and students to develop understandings
129 of NOS aspect. Explicit reflective instruction “should be planned for instead of being
130 anticipated as a side effect or secondary product” (Akindehin 1988, p. 73), meaning
131 forethought into the types of questions going to be asked and how the aspects are going to
132 be explicitly taught are essential to effective NOS instruction. The reflection component
133 of explicit reflective instruction includes providing students with opportunities to reflect
134 on the class activities from the different NOS aspects. This reflection piece is critical for
135 students and teachers to develop an understanding of how science is a way of knowing or
136 their epistemology of science. By explicitly and reflectively teaching certain aspects of
137 NOS, teachers can ensure that the same detail is give to NOS aspects as is given to the
138 traditional science content which is critical for students to become both scientifically
139 literate and active citizens in their community.

140

141 **Beyond Border Crossing**

142

143 Meyer and Crawford spend time with the ideas of cultural border crossing and
144 encourage multicultural education strategies in the science classroom. They employ
145 Erickson’s (1993/1996) idea of students’ ability to negotiate differences in cultural
146 understandings and they apply them to the challenges in for diverse groups in science
147 classrooms. While I find cultural border crossing important for science educators to
148 understand, I worry that encouraging cultural border crossing often requires assimilation
149 of culture. In this way, science competes with the students’ worldviews, and school
150 science encourages students to abandon their ways of knowing. Therefore, the challenge
151 is to consider how science teaching and learning might look if the students were
152 supported in becoming fluent in school science while encouraging their ways of knowing
153 and not abandoning them. For example, Lugones (1987) examines her shift from her own
154 world of an African-American woman to the often-hostile world of science as a medical
155 doctor. In her ethnography, she describes her successful border crossing and uses the
156 metaphor “world-traveling.” She observes flexibility and playfulness are required as she
157 shifts from her mainstream world to the scientific world, where she is an outsider. She
158 insists this is achieved because she is playful, which allows her to be a different person in
159 a different world without losing herself. Interestingly, she attributes this successful
160 crossing into the scientific community with being fluent speaker of science, agreeing with

161 the norms of that culture, being humanly bonded with people of that culture, as well as
162 having a sense of shared history. She describes these as the ingredients for successful
163 border crossing into the science world. Throughout this study, Lugones discusses how
164 she felt at ease in both cultures. Although Lugones attempts to provide a framework for
165 other students to become comfortable in the science world, this type of border crossing is
166 difficult and places extreme demands on the student. By suggesting it is the student who
167 needs to conform to the cultural norms of science, the student is forced to leave their
168 funds of knowledge out of science. I am reminded that if science educators continue to
169 ask students to leave their funds at the door, what knowledge is science omitting?

170 Additionally, Lugones, as a medical doctor, is able to become fluent in the
171 language of science, but if students have difficulty relating these new scientific terms into
172 their language and are not allowed to call on their previous cultural experiences, it can
173 lead to isolation of the students. The fact is that there *is* a scientific language and Lugones
174 is able to successfully navigate both worlds; however, I argue when reconstructing
175 spaces, students are not forced to live in two worlds, but rather their language and
176 knowledge should be validated and in this Third Space. Although Lugones is able to
177 successfully transition in and out of scientific and local discourse, Brown (2006)
178 discovers many African-American students have extreme difficulty with this technique.
179 He identifies how students' assimilation into the science classroom reflected their
180 interpretation of science itself in relation to their academic identities. The results
181 demonstrate students experience relative ease in appropriating the epistemic and cultural
182 behaviors of science, whereas they express a great deal of difficulty in appropriating the
183 discursive practices of science. They describe discursive practices of science as "unique,"
184 "intensive," and "distant." When students discuss management techniques for integrating
185 scientific discourse into their daily language, they remark that their ethnic identity plays a
186 role in their ability to become scientists as they point to their own lack of discipline and
187 patience as reasons why it was difficult to become scientists. They explore issues of self-
188 efficacy from a perspective grounded in their beliefs of their own ethnic identity. This is
189 related to Discursive Identity or the identity that is defined by the symbols that serve as a
190 subtext to their primary meaning (Brown 2004). For example, a student from the southern
191 states may be expected to say "y'all," to denote a plural form of "you," while an
192 Australian student may have an "idea-r," rather than an "idea." Discursive Identity needs
193 to be examined to further explore how language is used to maintain identity, as Third
194 Space reconstruction may be able to create the space for students to incorporate these
195 identities in the classroom. Moreover, the implications of these findings reflect the
196 broader need to place greater emphasis on the relationship between students' identity and
197 their scientific literacy development. Brown's study touches on the need further inquiries
198 into the areas code switching (the switch of one language into another language for
199 various reasons) and the transition from specialized languages into everyday languages.
200 Ultimately, Third Space reconstruction needs to attend to these issues to ensure an
201 authentic integration of first and second space.

202

203 **Understanding Funds of Knowledge Home Language to Understand Congruence**

204

205 The first space of discourse describes the home discourse used by the students. I
206 utilize the concept of first space similarly to Moje and Hinchman (2004) to mean "the

207 everyday world that is close or common to people” (p. 41). Because I am conceptualizing
208 this space as an everyday world of students, I am including studies that originate in their
209 home, incorporate funds of knowledge, and emphasize local knowledge. Thus, I
210 encapsulate the capital “D” of Discourse as Gee (1996) did, by including knowledge,
211 language, and culture. Here, I argue first space is marginalized in schools while the
212 second space, or instructional space, is dominant. This first space, along with
213 instructional discourse is used to reconstruct Third Space.

214 As Meyer and Crawford attest, it is critical to examine not only knowledges and
215 Discourses themselves but also the funds in which these knowledges and Discourses are
216 generated. Funds help to make visible the construction of knowledges and Discourses and
217 enable us to understand how students learn. In contrast to schools, households rarely
218 function alone. They are connected to other homes or social institutions such as churches,
219 community centers, or even local restaurants. In marginalized communities, these
220 networks are how these people survive—instead of relying on a plumbing company to fix
221 their water pipe, they call their uncle, who performs the task in exchange for a meal
222 rather than money the company requires (Moll 1992). In this way, these social networks
223 are relational, serving critical functions in families, and solving problems through
224 political actions in the community. Although the connections between these networks are
225 diverse, they are mutually beneficial. Velez-Ibanez (1988) demonstrates the complexity
226 and interrelatedness of these relationships by studying a Mexican community. He
227 documents through interactions with family members that these networks provide
228 essential knowledge and skills to the Mexican community. These networks of exchange
229 are based on a simple but critical premise: people are competent and have knowledge,
230 and their life experiences give them that knowledge. What is noteworthy is this simple
231 premise led to much research in the area of first space of discourse. Unfortunately, there
232 is still little understanding of the importance of this knowledge in science classrooms.
233 Much science education literature conflates funds of knowledge with prior knowledge.
234 However, the danger in this is prior knowledge is often confused as static in that it is
235 knowledge *prior* to gaining new and truthful scientific knowledge. While on the one
236 hand, not legitimizing funds of knowledge can isolate students. On the other hand, it
237 excludes a crucial body of knowledge from entering the classroom and informing science
238 education. If we do not allow certain knowledge in the science classroom, what
239 knowledge are we missing?

240 First space researchers stimulate other educators to study what counts as science
241 and how that science is taught in our schools. It foregrounds the challenges marginalized
242 students face, while building theory that leads to funds of knowledge research. By
243 analyzing the first space of people’s home, community, and peer networks and their
244 languages, they document the funds of knowledge and languages that shape the
245 experiences and academic success of these students. Furthermore, it enables teachers to
246 use knowledge of their students’ ways of knowing in the classroom. Importantly, this
247 research points to the necessity of viewing classrooms as constantly changing cultures.
248 This research also looks at the relevance towards, students’ lives. By rethinking the ways
249 we look at classrooms and learning to include a dynamic viewpoint of culture as
250 described by Meyers and Crawford, it leads to research working in language practices of
251 marginalized students as a silenced discourse that is often devalued in the educational
252 community. Funds of knowledge researchers provide a framework for teachers and

253 students as co-creators of curricula and knowledge in the classroom without removing
254 culture from the classroom. As our schools become increasingly complex, we face the
255 challenge of creating science classrooms that allow students to become active participants
256 in their education. When considering this complexity, researchers need to address
257 urbanization and globalization connection students' funds of knowledge. In some cases,
258 these effects increase the connection to their home language and knowledge through e-
259 mail, Internet, and transportation. In addition, these globalizing effects suggest that
260 students access a wide variety of possible funds of knowledge. By thinking of funds of
261 knowledge in this manner, they are not longer a hindrance to the curricula—they are the
262 backbone to creating it. In this way, it is critical that teachers, educators, and curricula
263 developers understand not only the ways to access students' funds of knowledge but
264 encourage students to participate in the creation of the curricula. By listening carefully to
265 the way students learn their funds of knowledge; we are giving credence to the intended
266 function of funds of knowledge. In this way, we are including different types of
267 knowledge systems, which not only promote equity but also hold promise for the future
268 of science.

269

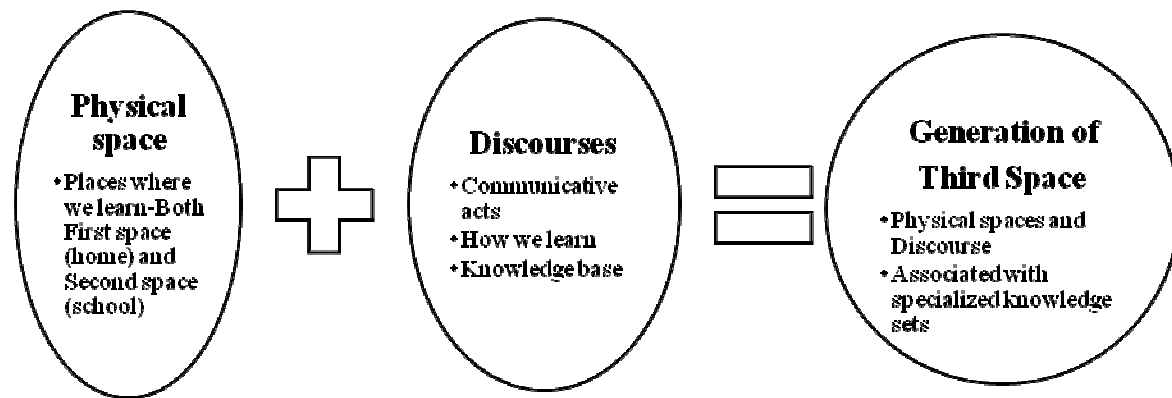
270 **Rationale for Congruent Third Space Construction**

271

272 Science has a specialized system of words that require a particular set of language
273 dependent on concepts and themes. These ideas are not readily made available to the
274 students and can be difficult as they encounter new ways of talking, reading, and writing.
275 In general, school science requires students to integrate the practices of prediction,
276 observation, analysis, and presentation with science reading, writing, and language use.
277 This ability to 'talk science' has served as a gatekeeper to the sciences for many students'
278 access to academic success.

279

280 Gutiérrez (2008) believes language and literacy learning can be improved by
281 adding a congruent Third Space, one that is not physical but communicative: language;
282 the social organization of learning; and, curriculum and pedagogy. She sees these spaces
283 as overlapping and related. As described previously, Third Space research originated with
284 funds of knowledge and centers on bringing in the funds of knowledge into the classroom
285 with discourse types that are inclusive of this knowledge and home language (See Figure
286 1). In this figure, I describe how congruent Third Space is generated. The first circle
287 represents the physical spaces where we learn. These are the first spaces (home or other
288 community networks such as church, community centers, or neighborhoods) and the
289 second spaces (here, school). The second circle represents the capital "D" Discourses at
290 play during the physical spaces. Again, capital "D" Discourse is inclusive the words we
291 speak, how we speak the words and the knowledge represented by those words.
292 Communicative acts are required for learning and this second circle represents those acts.
293 The last circle represents the generation of congruent Third Space. This occurs when the
294 physical spaces of home and school containing these Discourses are blended in a manner
295 that creates a space that is congruent with the physical spaces and the specialized
knowledge sets of the first space (home) and the second space (school).



296
297 *Figure 1. Generation of Third Space. Physical Space with Discourses generates Third*
298 *Space.*
299

300 Additionally, whereas these researchers focused on new language learners I am focusing
301 on scientific discourse as both a discipline and a language to be learned, how the teacher
302 constructs this congruent Third Space, the girls' connection to science and how the
303 discourse is documented during these times.

304 In the past, the focus of NOS research has not been in marginalized areas.
305 However, through the introduction of scientific literacy into educational research, the
306 focus of urban education research has shifted to how learning science occurs in these
307 areas. Educational research suggests marginalized students need strong links between
308 home and school. This creates an environment for mainstream values and equal
309 acknowledgement of the significance of home cultures that contribute to a learning
310 environment.

311 Studies of discourse in science offer a range of views and provide examples of
312 learning in science classrooms. These discourse studies of classroom interaction revealed
313 how science is framed, who gets to speak in regard to science, and how issues of
314 language use encourage or hinder science learning. Yet, even as science is made
315 available to students through appropriate discourse techniques, many of the studies found
316 limited participation of students talking science. This demonstrates a continual problem
317 for science education and a call for discourse studies in science education with attention
318 on congruence.

319 In addition, the majority of the science discourse research continues to be focused
320 on one particular space: either scientific or instructional discourse. However, in order to
321 understand how students integrate this knowledge in their daily lives and truly teach
322 science to all, we must include the other aspects that contribute to authentic science
323 learning through congruence. The paucity of research that includes attention to
324 congruence demonstrates the complexity needed to address the needs in urban settings.
325 Still, complexity is not a reason to avoid this important research. Future research is
326 needed about how these models of congruence are applied in urban schools and to learn

327 what it means to do science, be a part of the scientific community, and using the students'
328 local knowledge to so.

329 In conclusion, I am encouraged by the work of Meyers and Crawford. It provides
330 a strong outline of how to promote NOS understandings in diverse settings. Meyers and
331 Crawford describe how NOS aspects lend themselves to connecting marginalized
332 students to science through inquiry-based practices that integrate multicultural
333 educational aspects. I ask that we extend this view to include explicit-reflective
334 instruction as a part of inquiry instruction to encourage the instructional approaches
335 Meyers and Crawford outline. Moreover, it is my hope that science educators will
336 continue to access students' funds of knowledge while encouraging integrating discourse
337 practices to encourage students' understandings of NOS. In this way, I imagine Bianca
338 becoming an active participant in the science community, blending her knowledge from
339 everyday experiences with the knowledge of science. I imagine her talking science but
340 more importantly adding to the knowledge base of science. I imagine a science that is
341 richer, more real, and truer because Bianca participated.

342

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374 County, CA.

375 **Author Biography**

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