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ABSTRACT

Intending teachers in two science education methods classes (Fall Quarter, n=27; Spring Quarter, n=21) read and discussed a qualitative study describing science teaching and learning in a culturally diverse middle school. The two primary participants in the qualitative study were a white female veteran life science teacher and a white male first-year earth science teacher. The study consisted of two case studies which detailed the two teachers' decision-making and their multicultural students' reactions in two science classes located in one American public middle school situated in the Deep South. Data were analyzed for emerging categories. One central insight emerging from the data is the assertion that intending teachers' case study analysis of science teaching in multicultural environments holds much promise in engaging intending science teachers in the process of better preparing them to teach in similar contexts. (Author/ZWH)

Pre-teacher Case Study Analysis Of Teaching Life And Earth Science In Multicultural Middle School Classes

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Abstract

Intending teachers in two science education methods classes (Fall Quarter, n=27; Spring Quarter, n=21) read and discussed a qualitative study describing science teaching and learning in a culturally diverse middle school. The two primary participants in the qualitative study were a white female veteran life science teacher and a white male first-year earth science teacher. The study consisted of two case studies which detailed the two teachers' decision-making and their multicultural students' reactions in two science classes located in one American public middle school situated in the Deep South.

During the Fall Quarter 1992, the intending science teachers reacted to multicultural science teaching scenarios. They then discussed the life science teacher's case study. This was videotaped for later analysis. Following that, they wrote down their reflections on the experience. During the Spring Quarter 1993, the intending students explored their own ethnicity and background (including their socioeconomic status) in a small group activity before discussing the earth science teacher's case study. Following that, they watched a twenty minute video of the earth science teacher being interviewed by the instructor for their class and then discussed the issue further before writing down their reflections. The discussions were videotaped for later analysis.

Data were analyzed for emerging categories. One central insight emerging from the data is the assertion that intending teachers' case study analysis of science teaching in multicultural environments holds much promise in engaging intending science teachers in the process of better preparing them to teach in similar contexts.

> Regardless of the debate, all would agree that ... science teachers must be able to instruct students from diverse cultural and linguistic backgrounds. It is reasonable to assume, therefore, that the place for science teachers to acquire the requisite knowledge and skills for this task is in their science education programs. Mary Atwater (1989, p.17)

Spurred on by findings in previous research studies that demonstrate the teacher is the most important factor influencing students' views of science and the learning of science (Yager & Penick, 1990; Simpson & Oliver, 1990) science teacher educators place much emphasis on the quality of their science teacher education programs. "Revitalizing Science Teacher Education," the theme for the AETS conference in which this paper is presented, signifies the science teacher educator community's unremitting commitment to make science methods classes relevant for intending teachers.

Traditionally, competencies specifically addressed toward the teaching of multicultural populations have not been selected for inclusion in the curricula for science methods courses. Instead, general topics such as safety in the laboratory, unit planning, content review, and micro-teaching dominate the teacher education programs curricula while multicultural education is relegated to the rhetorical position of being infused throughout the curriculum.

This study in science teacher preparation investigates intending teachers' reaction to the inclusion of multicultural education as a topic in the science methods curriculum. The technique used to include multicultural education in the curriculum is a pre-teacher analysis of two white middle school teachers' teaching practice in a public school characterized by student cultural diversity (McGinnis, 1992). The reflections of the intending teachers concerning multicultural education and the use of case studies in teacher education programs to study it are

probed for insights toward revitalizing teacher education.

Background of the Study Site and Participants

The study site of this investigation in teacher education curriculum reform is a Middle School Science Teacher Education Program at a major American research university in the Deep South. The intending science teachers in this study were college students enrolled in the Fall Quarter Life Science Methods Course (n =27) and the Spring Quarter Earth Science Methods Course (n =21) for middle school majors. Eight of the pre-teachers were in both classes. The instructor for both courses was the principal investigator of the case studies used and the author of this paper.

Multicultural Curriculum Innovations

In both the life science and the earth science education courses, one week of instruction (consisting of three hours of class meeting times conducted over two days) during the middle of the quarter was devoted to the multicultural topic. In each course, a case study of the teaching practices of a teacher of the science being studied (life science or earth science) was read and discussed by the intending teachers. The case studies were taken from a larger study of science teacher decision-making in culturally diverse classrooms (McGinnis, 1992). Variations in the implementation of the case study teaching technique are provided below:

Life Science Methods

During the Fall Quarter 1992, the intending teachers reacted to multicultural science teaching scenarios in a small group activity. Selected scenarios are presented in appendix A. The purpose of this activity was to alert the students to the importance of being aware of cultural diversity in their teaching. They then discussed the life science teacher's case study in a large class setting. [Interested readers are referred to previous studies for more detailed information on the case studies (McGinnis, 1992; McGinnis, Yeany, Best, & Sell, 1993a; 1993b)]. This activity served to place the study of

multicultural education in a science context, teaching middle school life science, for which the intending teachers were preparing themselves.

Earth Science Methods

During the Spring Quarter 1993, the intending students explored their own ethnicity and background (including their socioeconomic status) in a small group activity. This activity is presented in appendix B. The purpose of this activity was to alert them that diversity exists in every class and that this was one way of encouraging students to share their backgrounds. They then discussed the earth science teacher's case study in a large group setting. This activity served to place the study of multicultural education in a science context, teaching middle school earth science, for which the intending teachers were preparing themselves. After that, they watched a twenty minute video of the earth science teacher being interviewed by the instructor for their class and then discussed their reactions in a large class setting. This activity was designed to augment the written case study by bringing the participant science teacher to their classroom in an engaging media manner. The question protocol used in the video interview of the earth science teacher can be found in appendix C.

Data Sources

The intending middle school science teachers wrote their reflections concerning the life science teacher's case study during the final 30 minutes of the instructional week devoted to the analysis of the case study. Their reflections were guided by instructor created questions. Those questions are presented in appendix D. The intending teachers' reflections were collected for analysis. In addition, their comments relating to the case study were obtained at the end of the quarter in a take home assignment. This is presented in appendix E. Ongoing comments made to the instructor in both formal and informal settings concerning the case study were also documented by the instructor

throughout the quarter. The class meetings were videotaped for later analysis.

The intending teachers wrote their reflections concerning the earth science teacher's case study during the final 30 minutes of the instructional week devoted to the analysis of the case study. The question they responded to was an open-ended item. This item is contained in appendix F. The intending teachers' comments were collected for analysis. In addition, their comments relating to the case study were obtained in a class assignment asking them to share their reactions to the case study in a three page paper. Refer to Appendix G for that assignment. Ongoing comments made to the instructor in both formal and informal settings concerning the case study were also documented by the instructor throughout the quarter. The class meetings were videotaped for later analysis.

Data Analysis

Data were analyzed through application of analytic induction and the constant comparison method to produce grounded theory (Glaser & Strauss, 1967; Erikson, 1986). Two analytic categories which emerged were the intending teachers' evaluation of the teacher participants' teaching performances in the case studies and the benefits the intending teachers perceived of using case studies to look into how science teaching is actually conducted in selected multicultural classrooms.

Category One: Intending Teachers' Evaluation of Mrs. Guide and Mr. Green's Teaching Performances With Multicultural Populations:

The intending teachers' initial comments reflected value judgements of the participant science teachers' performances that were featured in the case studies. The intending teachers' indicated that they thought successful science teachers who teach multicultural populations know their science content, enjoy teaching science, have control over their classrooms, are conscientious in their duty to teach science, are comfortable with students and demonstrate no prejudice due to student ethnic

or cultural differences, and can motivate students to learn science. While students overwhelming felt positive toward Mrs. Guide, many expressed reservations about Mr. Green.

Sample intending teacher evidentiary comments include the following:

Mrs. Guide

African American Female (AAF): It's easy to see that she is comfortable and confident with her instruction of culturally diverse students and the diverse strategies she uses for her instruction. She's very pleasant and positive about what she is doing with her students.

White female (WF): Mrs. Guide definitely had control over her class. Her students seem to enjoy her class. She also knows her material rather well.

WF: She was very concerned about her students and she enjoyed her job. She played the role of a parent somewhat. She was interested in the views of the students, and not just trying to get through the day.

WF: She seems to captivate the children's interest and keep them motivated. She is also very culturally aware and she wants her students to enjoy science and learn science despite their physical or cultural differences.

WF (graduate): Great motivator. I like her realistic approach; she tries to relate topics to students' lives. I think her varied background contributed to her success in classroom. Her students' comments are a tribute to her teaching style.

WF: I am impressed by her apparent enthusiasm and desire to teach and teach her classes well. She allows the students to discover new ideas and explanations on her own.

WF: She was very concerned about her students and she enjoyed her job. She played the role of a parent somewhat. She was interested in the views of the students, and not just trying to get through the day.

Mr. Green

WF: The observation made by Mr. Green about certain students only going to school until they were old enough to get a job, I feel is not as accurate as

portrayed here. I feel that it is a result of the subcultures in which the students come from, but Mr. Green did not mention that is something that happens to white students as well as the other students of different nationalities.

WF: I don't agree with the comments Mr. Green made about the black girls being more boisterous and standing out. You could say that same thing about boys versus girls. It almost seemed as if he was giving blacks a stereotype of being loud, where this is not true.

Category Two: Intending Teachers' Perceived Benefit From Using Case Studies To Look Into How Science Teaching Is Actually Conducted In Multicultural Classrooms.

After revealing their value judgments concerning the teaching performances of the case study teacher participants, the intending teachers expressed much joy in the verisimilitude of being transported by the case studies into what they perceived as authentic multicultural science classrooms.

Sample intending teacher evidentiary comments include the following:

Mrs. Guide

WF (White female): I liked the case study because it covered the points well and these areas are usually kept quiet and behind sort of a veil of silence.

WF: The case study of Mrs. Guide is a good one that focuses on the difficulties of teaching a class of students that are culturally diverse. By looking at the situations that arose in Mrs. Guide's class prompts the reader to think how one would handle the same problem in his own class if that problem arises.

WF: I like any study that comes from a real classroom. You can discuss theories all day, but if they do not apply to the real job of teaching,then I do not value them very much. I really enjoyed the interviews with the students.

WF: Quite honestly, there was nothing I did not like about the case study. What I particularly liked about the study was the candid remarks made by Mrs. Guide. I also liked the excerpts taken from the classroom. That provided some insight on what life science students ask in class and how they feel about the subject. For any

student studying to be a teacher, these insights are valuable.

WF: I thought the case study was very easy and interesting to read. Information was clearly summarized and presented. I liked reading Mrs. Guide's quotes, hearing what she really had to say. I liked the way it allowed me to "peek" into the life of a real life science teacher.

WF: Besides useful information about teaching culturally diverse students, the study provided much insight into what teaching on a day to day basis will be like. This case study re-enforced my ideas about cooperative learning. I believe this is the best way to deal with diverse students.

WF: I though it was an informative essay. It is always helpful to see other teachers' methods of teaching.

AAF (African American female): This was a good article--a remarkable lady (Mrs Guide). I can definitely tell from the article that she has a positive effect on her students--academically and socially.

WM (White male): I liked reading about how an experienced teacher handles diverse students.

WM (nontraditional): I like the accuracy of the case study. It presents a realistic situation with realistic problems that we will need to solve as future science teachers.

Mr. Green

WF (White female): I found Mr. Green's article and video very helpful. I learned alot [sic] about cultural diversity from this experience.

WF: It was interesting to hear the perspective of a white male in a culturally diverse middle school.

WF: Good, it helped bring cultural diversity to life.

WF: I thought it was nice to hear from an experienced teacher on how he handled the diverse students in his class. This is something I'm worried about dealing with in the future.

WM (White male): This was useful because we learned from a teacher who had to deal with this cultural diversity on a daily basis.

WF: The things that stand out in my mind after reading the case study and watching the video is that Mr. Green is a good multicultural teacher because of his fairness in grading and his ability to be friends with all of his students as well as their teacher. I can only hope that I can do the same in my classroom.

Discussion

Those who teach in science teacher education programs quickly realize that intending teachers evaluate topics in their teaching education programs by how they perceive those topics to be of immediate use in the teaching of science to students. Intending teachers indicate that they are aware that the students they will teach come from increasingly diverse backgrounds. Therefore, including the multicultural topic in their teacher education program has the potential to be evaluated as addressing a practical need: How can I teach science to those students who are of different cultural backgrounds?

The impact of the innovative multicultural activities on the intending middle school science teacher population was substantial and beneficial. A supportive community of future middle school science teachers was nurtured in which individuals felt comfortable initiating, discussing, and grappling with the sensitive issue of diversity in science instruction. The benefits of implementing this model of diversity awareness in middle school science teacher preparation are evident in the evoked voices of those involved: our nation's future middle school science teachers.

Conclusion

The catalyst for this paper was the argument that formally including the multicultural topic in science teacher education programs should be attempted. The technique used in this study found to hold much promise in teacher education programs was the use of case studies of practicing science teachers who teach

multicultural populations. This technique is easily implemented and offers the additional benefit of incorporating educational research which requires no formal training to decipher for meaning in teacher education programs.

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Author Notes

I would like to express my appreciation to Claudia T. Melear of East Carolina University for suggesting the strategy of small group heritage sharing used in this study.

Appendix A

Science Teaching Scenarios

ONE

You are a new, 1st year 7th grade life science teacher who works hard, cares for your students, wants to make a good impression, and gives out a fair amount of homework. You notice over the first few weeks of school that almost all of your students regularly do your homework and turn it in on time. You notice while going over your recorded assignments, however, that one of your female students (who does well in class assignments and on tests) has started a pattern of not turning in assignments due on Mondays. You decide to talk with her before class the next Monday. The following Monday you call her to your desk and ask if she has her homework. She doesn't answer you. Instead, she gives you a big smile. You repeat your question and she smiles even more and glances at students overhearing the conversation. What do you think or do?

[Additional instructor information: The student is a Korean girl whose family insists she work long hours during the weekend in the family fruit and vegetable stand. She expressed embarrassment by smiling.]

Appendix A (Continued)

Science Teaching Scenarios

TWO

You are the new middle school life science teacher. You like your students to be active in class, so you work hard at putting together hands-on activities. Since you have limited resources and you support cooperative student work, you allow your students to group themselves in 4-member cooperative learning teams. Your student groups compete to see which group can finish first, which group has the best answers, and which team cleans up the best. You give points to the winning teams. All is going well except for two teams in 3rd period. They just do not seem to get with it. They putter along and never seem to finish the activities. They have won zero points over the first three week period. You wonder, "What is wrong with those students? Don't they understand that their grade depends on competing?" What do you do next?

[Additional instructor information: The students are Navaho Native Americans and the school is on a reservation. The students do not enjoy competing in a public setting. They would prefer to work cooperatively.]

Appendix B

What Is Your Cultural Heritage?

Directions: Work in small groups. Select a recorder to keep notes that can be shared with the entire class.

Every member of the group should be given the opportunity to share as much or as little information as desired in the following ares:

1. Your ethnic background (including both sides of your family as far back as you can go)

2. Your social class (including your family)

3. Your educational level (including your family)

4. What science interest do you have as a result of your cultural background?

Appendix C

Video Interview Protocol

Following brief introductions of participant and interview ask the following questions:

1. What reflections concerning teaching such a culturally diverse student body science would you like to share with those interested in the topic?

2. What advice or suggestions would you give intending science teachers how to successfully teach in such a culturally diverse environment?

3. Are there any issues you would like to leave the viewer to discuss associated with teaching culturally diverse students that you find particularly difficult?

[Thank participant for his participation in the interview]

Appendix D

Culturally Sensitive Education

1. What overall comments do you have concerning Mrs. Guide's instruction of her students?

2. What issues relating to culturally sensitive education do you feel are important?

3. What issues relating to culturally sensitive education do you not feel are important?

4. Any other comments?

Appendix E

Take Home Question

The case study of Mrs. Guide, the 7th Grade Life Science Teacher who taught culturally diverse students, was used in your science methods class to focus attention on culturally diverse instruction.

Review the case study and write your reactions to it below:

(a) What did you like/dislike about the case study?
(b) What did Mrs. Guide's life science instruction prompt you to reflect on concerning teaching culturally diverse students that you will carry with you to your future classrooms?
(c) Discuss any concerns/anticipated joys that you hold relating to teaching diverse students life science.

Appendix F

Reflection on Guest Speaker

Please take a few moments to comment on the guest presenter in your science methods class this week.

Mr Green: Case study participant and video appearance discussing cultural diversity and Earth science instruction in the public schools:

Appendix G

Individual Assignment: Case Study of the Eighth Grade Earth Science Teacher, Mr. Green.

A three page reflection of the case study that includes your reaction to the issue of teaching culturally diverse students earth science is required to be included in your portfolio.