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Inclusion and Problem-Based Learning: Roles of Students in a Mixed-Ability Group

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Abstract

The literature on the use of problem-based learning in K–12 settings has traditionally focused on gifted and average students. However, mainstreaming is placing increasing numbers of students with special needs in general education classrooms. This case study examined how members of a small group in a mainstreamed seventh grade science class interacted with and supported each other as they engaged in a problem-based learning (PBL) unit. The group included one mainstreamed and two average students. We used conversation analysis and coding to analyze interview and video data of all 10 class sessions. Results indicated that each group member filled a unique role—group manager, task guidance provider, and task performer—and helped each other overcome individual difficulties. Results suggest that mainstreamed groups have the potential to effectively engage in PBL, and that PBL may increase the motivation and social confidence of students with special needs. We suggest types of scaffolds that could support mainstreamed students during PBL units.

Introduction

In a landmark report, the Carnegie Council on Adolescent Development (CCAD) (1989) noted that major changes needed to be made to both the curriculum and culture of middle schools to ensure success of young adolescents as they progressed throughout life and work in the 21st century. Due to middle school students' lack of critical reasoning skills, the Council suggested an increased use of inquiry-based methods in middle schools (CCAD).

Problem-based learning (PBL) is an inquiry-based instructional approach in which students work in small groups to solve an ill-structured problem, defined as a problem with no clear solution or solution path (Jonassen, 2003). PBL was formalized in medical education and is now used in other university and K–12 settings (Barrows & Tamblyn, 1980; Chin & Chia, 2005; Gallagher, Stepien, & Rosenthal, 1992; Reiter, Rasmann-Nuhlicek, Biernat, & Lawrence, 1994; Torp & Sage, 1998). In PBL, students (a) collaboratively determine what they know and need to know, (b) individually research content and/or conduct scientific tests, (c) communicate the research results among themselves, (d) collectively determine a solution to their problem, and (e) present their solutions to classmates and/or community representatives (Hmelo-Silver, 2004).

PBL and Middle School

PBL may be an effective way to structure middle school curricula because it exhibits all three characteristics of effective middle school curricula: "challenging, integrative, and exploratory" (National Middle School Association, 1995, p. 20). PBL is challenging in that it involves solving ill-structured problems but is also integrative because it incorporates cross-disciplinary content (Hmelo-Silver, 2004). For example, a PBL unit regarding river pollution involves disciplinary knowledge related to chemistry, biology, social studies, economics, and business. In a PBL unit, knowledge is not used in isolation but must be integrated as part of a whole solution, which is especially important in a middle school context (Toepfer, 1992; Vars, 1998). In addition, because PBL involves group work, it may allow students to explore and further develop their areas of strength by completing tasks that more closely suit their talents (Torp & Sage, 1998; Wood, 1992).

PBL may also help to counter motivation problems, which may be behind many issues of middle school performance (Anderman & Maehr, 1994). Having students solve real-world problems may help shift their goals from grade-related goals to task goals, which could increase student motivation (Anderman & Maehr). Also, in PBL students are co-constructors of knowledge; when middle school students are positioned as co-constructors of knowledge they have been found to have higher motivation (Meece, 2003). This is particularly important in middle school science, because students who are not turned on to science by seventh grade will likely not pursue science later in school (National Science Teachers Association [NSTA], 2003). As PBL is an inquiry-based, multidisciplinary approach that allows students to make decisions, it fits NSTA's goals for science instruction in the middle school context.

Research on PBL in middle and high school settings has been primarily limited to gifted (e.g., Gallagher et al., 1992; Torp & Sage, 1998) and average populations (e.g., Chin & Chia, 2005; Saye & Brush, 2002). In these contexts, PBL has positively affected students' problem-solving skills (Gallagher et al.; Kolodner et al., 2003), self-directed learning skills (Hmelo-Silver, 2004; Sungur & Tekkaya, 2006), and content knowledge (Dods, 1997). Some researchers have investigated how gifted and/or average middle and high school students interact during PBL, and have suggested methods by which teachers can promote student success. These methods include addressing misconceptions, promoting reflection, and providing conceptual and metacognitive support to students as they are working (Lepper, Drake, & O'Donnell-Johnson, 1997; Saye & Brush, 2002; Simons & Ertmer, 2006).

A few researchers have explored the use of PBL among middle school students with special needs in self-contained classrooms (Belland, Ertmer, & Simons, 2006; Bottge, 2001), suggesting that these students received affective and academic benefits from PBL (Belland et al.; Bottge) and effectively solved the presented problem (Bottge). In this paper, *students with special needs* refers to students who are eligible for special education services due to learning, emotional, or other cognitive disabilities (Individuals with Disabilities Education Act, 2004).

According to the National Center for Education Statistics (2005), half of all students with special needs in America spent at least 80% of every school day in mainstreamed classrooms (general education classes serving students with special needs alongside their average peers). Though some authors debate the merits of inclusion (Lipsky, 2005; Peetsma, Veergeer,

Roeleveld, & Karsten, 2001; Rea, McLaughlin, & Walther-Thomas, 2002), it is likely that inclusion will continue into the near future (Putnam, Spiegel, & Bruininks, 1995). Thus, it seems appropriate to explore the use of PBL in a mainstreamed classroom in order to develop a stronger understanding of how mainstreamed students respond to PBL.

Why Might PBL Benefit Mainstreamed Students?

PBL incorporates cooperative learning. Thousand and Villa (1999) argued, "Cooperative learning is the most important instructional strategy supporting inclusive education" (pp. 96–97). The use of cooperative learning in the inclusion classroom can positively influence motivation (Johnson & Johnson, 2002; Vaughn, Hughes, Moody, & Elbaum, 2001), social skills (Putnam, 1998b), peer acceptance (Piercy, Wilton, & Townsend, 2002; Slavin, 1983), and achievement (King-Sears, 1997; Slavin) among students with special needs. Mallory and New (1994) theorized that cooperative learning raises the motivation and self-confidence of students with special needs by enabling them to feel that they belong. Additionally, a cooperative learning program raised the reading and writing achievement of mainstreamed students and their average group mates significantly more than a lecture and discussion approach (Stevens & Slavin, 1995).

PBL increases students' problem-solving skills. Agran, Blanchard, Wehmeyer, and Hughes (2002) as well as Wehmeyer, Palmer, Agran, Mithaug, and Martin (2000) argued that students with special needs must develop their problem-solving skills in order to succeed in life. Given that PBL can increase the problem-solving skills of university, gifted, and average students (Barrows & Tamblyn, 1976; Gallagher et al., 1992; Hmelo, 1998; Pedersen & Liu, 2002–2003; Stepien & Pike, 1997), mainstreamed students may benefit from PBL in similar ways. Additional research is needed to test this idea.

PBL increases students' self-directed learning skills. Students with special needs also need the opportunity to develop self-directed learning (SDL) skills in order to succeed academically and personally (Wehmeyer et al., 2000). SDL skills refer to students' abilities to initiate appropriate actions to gain knowledge or skill (Gibbons, 2002). PBL has been shown to increase the SDL skills of advanced students (Blumberg & Michael, 1992; Evensen, Salisbury-Glennon, & Glenn, 2001; Lohman & Finkelstein, 2000). Mainstreamed students may not benefit from PBL in the same way, but this cannot be known without further investigation.

PBL and Mainstreamed Students

To succeed in inquiry and PBL activities, students must be able to do two key things: plan and carry out inquiry tasks, and work collaboratively in small groups (Hmelo-Silver, 2004; Krajcik et al., 1998; Stepien & Pike, 1997; Torp & Sage, 1998). Few researchers discuss the ability of special education students to plan inquiry activities. However, in one study of average students and students with special needs with an IQ of at least 80 (i.e., most students with learning disabilities and emotional/behavioral disabilities), researchers (Mastropieri, Scruggs, Boon, & Carter, 2001) investigated why some liquids float and some sink when placed in water. Students with special needs performed as well as the average students, suggesting that they may be able to carry out the inquiry tasks central to PBL effectively.

An important part of success in PBL is effective small group interaction, defined as group work in which (a) all group members contribute to solving the problem, and (b) time spent off-task by individual group members is minimal (Johnson & Johnson, 1996). Mainstreamed students have been shown to work effectively in small groups (Beaumont, 1999; Gillies, 2003; Okolo & Ferett, 1996; Pomplun, 1997). Pomplun asked small groups that included mainstreamed students and those that included only average students to perform a science inquiry assessment. When mainstreamed groups included students with physical impairments or learning disabilities, group members interacted with each other the same as members of average groups (Pomplun). When mainstreamed students were required to help group mates and accept responsibility for the completion of the group task, they engaged in more productive interactions and asked more open-ended questions related to the topic than students who were not required to do so (Gillies). In Okolo and Ferett's study, mainstreamed students participated in group work similarly to their average peers, except that they conveyed new information to group mates less often.

To manage the process of group work, members of PBL groups often assume specific roles such as scribe, discussion leader, or task organizer (Duek, 2000; Hmelo & Ferrari, 1997; Lindblom-Ylänne, Pihlajamäki, & Kotkas, 2003) and/or divide research tasks among group members (Dahlgren & Öberg, 2001; Kuech, 2004). However, research

results regarding how successful university and secondary students are in PBL group interaction are inconsistent. In a PBL unit in a European law school, all group members participated equally in discussions about the central problem (Lindblom-Ylänne et al.). In one study in a medical school context, the majority of group interactions were related to the problem (Visschers-Pleijers, Dolmans, de Leng, Wolfhagen, & van der Vleuten, 2006). In another, members of PBL small groups did not always stay on task and interact effectively during PBL group work, especially when they became confused or lost track of their group's discussion (de Grave, Boshuizen, & Schmidt, 1996). Similarly, average members of PBL small groups in secondary contexts do not always interact effectively (Kyza & Edelson, 2005; Simons & Ertmer, 2006), especially at the beginning of units (Goodnaugh & Cashion, 2006).

Purpose of this Study

Effective group interaction is fundamental to student success in PBL. As such, it is important to understand how members of mainstreamed groups interact to determine (a) the potential for the use of PBL in a mainstreamed classroom, and (b) the types of support mainstreamed and average students may need during PBL. We designed this exploratory case study to examine how members of a mainstreamed group managed the processes involved in PBL. Specific research questions included:

1. What difficulties did members of a mainstreamed small group face during a PBL unit?
2. What roles did each member of a mainstreamed small group fill during a PBL unit?
3. What methods did the group members use to support each other's efforts?

Method

Design

We chose a case study design (Merriam, 1998) to address our research questions because we wanted to present an in-depth description of how the members of one mainstreamed small group worked together during a PBL unit. We approached our interpretation of the group members' actions from an ethnomethodological framework (Garfinkel, 1967). A primary goal of an ethnomethodological approach is to uncover systematic patterns in human interactions through a close analysis of the actions and conversations of participants. Once systematic patterns are uncovered, ethnomethodological researchers attempt to explain why the participants act the way they do. We were interested in determining systematic patterns underlying small group interactions in a mainstreamed group, and theorizing why such patterns were present.

Setting and Participants

School. This study took place at Taft Middle School (TMS), which has 36 teachers and approximately 600 students (Note: all names have been changed). TMS is located in a small, low-SES, rural community in the Midwest: 45% of the student body received free or reduced-price lunches, compared to state and national averages for small town schools of 36% and 28.6–32.2%, respectively, for the years 1994–2004 (Cruse & Powers, 2006). TMS benefited from a federal grant that funded a one-to-one laptop initiative and provided PBL support from professors and graduate students from a large, Midwestern university.

Class. Twenty seventh-grade science students participated in the unit. Most students were average though two were mainstreamed learners eligible for special education services. The teacher, Mrs. Smith, holds a Master's degree, and has two years previous experience facilitating PBL units, 15 years experience facilitating inquiry units, and 16 years experience as a middle school science teacher. Most students had already participated in PBL units in Mrs. Smith's class and in other classes during the year of the study as well as the previous year. Both Mrs. Smith and Mr. Thomas, a teaching assistant from the local university, provided support to students (e.g., answering questions during the unit).

Unit. Data were gathered during a two-week PBL unit entitled "Genes, Dreams, and Reality: The Human Genome Project," which followed a teacher-led instructional unit on genetics and its role in human development. Mrs. Smith asked each team of three to four students to assume the perspective of a different stakeholder group such as doctors or religious leaders. The central problem asked students to assume a position on the human genome project (HGP) based on their stakeholder perspective, outline a plan for promoting their positions, and argue their positions during a debate at the end of the unit. Mr. Thomas served as "judge" during the final debate, in which he awarded the winning group $3,000,000 to further their position/cause. In preparation for the debate, students developed a promotional brochure outlining their positions.

On the first day of the unit, Mrs. Smith explained unit goals and facilitated a whole-class discussion about

several major issues of the HGP (e.g., "Would you want yourself or a loved one to be tested for a gene … that increases your risk for a disease, but does not tell you if you will definitely have it?"). During this discussion, students responded from their own perspectives. On subsequent days, students worked in small groups and assumed the perspectives of their assigned stakeholder groups—they pursued learning issues to understand how members of their stakeholder groups perceived the HGP and what they could do with the grant to further their goals in relation to the HGP. At the end of each day, students responded in journals to open-ended questions regarding that day's work and plans for future days. Near the end of the unit, students began creating their brochures, other promotional materials such as posters, and arguments to use in the debate to defend their decisions. On the last day of the unit, students debated and the grant winner was decided.

Sample. We used purposeful sampling (Patton, 2002) because we were interested in learning how a group that included a mainstreamed student engaged in PBL group work. Only two of the eight groups included a student with special needs. We chose one group based on the teacher's perception that its members would not struggle with behavioral problems. The group we chose included three students—Jill, Michelle, and Sean. Jill and Michelle were average students, while Sean had been diagnosed with learning disabilities and attention deficit hyperactivity disorder (ADHD); he performed at the third-grade reading and mathematics levels. The teacher paired Jill and Michelle with Sean because she predicted that they would be patient with and helpful to him. Video evidence appeared to confirm this prediction. The group was assigned the role of lawyers of mothers who do not know the identity of their children's fathers.

Data Collection

Videotaped class sessions. We videotaped each class session during the two-week PBL unit. During whole-class discussions, the entire class was videotaped and Mrs. Smith wore a microphone. During small-group work, the camera and a microphone were focused on the selected group of students. The first author transcribed verbatim all whole-class dialogue and all intelligible portions of the group's dialogue (most of the dialogue).

Interviews. Two prompted, retrospective interviews, of approximately 30 minutes each, were conducted with the students. The first interview was with all three; however, because Sean said very little during the first interview, an additional interview was conducted with him alone. In each interview, a 19-minute video that contained scenes from the class sessions was used to prompt participants' recollections of how they approached the problem, when they were confused during the unit, and how they addressed identified confusions.

Post-survey. Each student in the class completed a survey at the end of the unit. The survey included two open-ended items: "What did you like the best about this unit" and "What would help the teacher to improve the unit?" It also included 15 Likert-type items that were not used in the analysis of this paper. The Likert items investigated perceptions of the unit (e.g., "I would enjoy working on another unit like this again"), the investigation process (e.g., "I usually found the information I needed"), and the open-endedness of the unit (e.g., "There are many approaches we could have taken during the debate").

Data Analysis

We used two analysis strategies: coding and conversation analysis. To assess the overall interactions throughout the unit, we coded video and interview transcripts in a two-step process using coding schemes based on the literature review. First, the first author reviewed all transcripts, modifying the coding schemes as necessary to account for the patterns that developed from the data. Second, we applied these coding schemes to the entire set of transcripts. The coding schemes for the video and interview transcripts contained 63 and 52 codes, respectively, and were used to code passages in terms of categories such as stage of the unit (e.g., problem definition), decision-making processes (e.g., majority rules, negotiation), and who assigned tasks to whom. Passages could be coded twice and coded segments could overlap.

For each code, we (a) selected characteristic segments of the transcripts to which the code was applied, (b) found the corresponding video clip, and (c) performed conversation analysis on the video. Conversation analysis involves analyzing, at a micro level, interactions between two or more people, and is performed on either video and a corresponding transcript, or a transcript that contains detailed information about pauses, voice inflection, and facial expressions (Have, 1999). In our study, we reviewed video of selected interactions and the corresponding segment of the transcript, and noted the context, what other things were occurring, and what gestures or facial expressions were manifest among the participants.

The two analysis methods complemented one another as conversation analysis focuses on a microanalysis of interactions, while coding focuses on larger groupings of interactions. We developed assertions based on the themes generated from our analyses (Erickson, 1986; Stake, 1995). Then, we checked the accuracy of assertions against interview, video, and survey data using the constant comparative method (Glaser & Strauss, 1967).

Results

We organize the results by assertions, or generalizations developed from the data (Erickson, 1986; Stake, 1995). Our three major assertions are as follows: that each group member (1) primarily concerned him/herself with one level of thinking about solving the problem, (2) filled a specific role during the unit, and (3) served to counterbalance each other's shortcomings to solve the problem. For each assertion, we provide evidence from interviews, group video, and the survey, and our interpretations of the data.

Assertion 1:
Each Group Member Primarily Concerned Him/Herself with One Level of Thinking about Solving the Problem

One way to consider the strategy that the group used to analyze and solve the problem is that of the macro-strategy (overall strategy to solve the problem) and micro-strategies (ways to complete certain tasks, such as identifying benefits and drawbacks). In this section, we discuss each group member's perceived difficulties, and then present what he/she appeared to focus on during the unit. Each group member appeared to have specific problems in understanding micro-strategies and/or macro-strategy. These difficulties are illustrated in Figure 1, where we characterize the focus of each group member during the unit. Of note is that neither Jill nor Michelle's difficulties appeared to result directly from working with Sean.

Jill

Jill's difficulties. In response to video clips in which students appeared to be confused during the initial days of the unit, Jill noted that the sources for her confusion were diverse. In this period, she, like the rest of her group members, was confused about how to get started and what she was supposed to do. She was confused about the overall task, how their stakeholder role (lawyers of single mothers) impacted the questions they needed to address, and how to go about answering the questions (macro-strategy and micro-strategies).

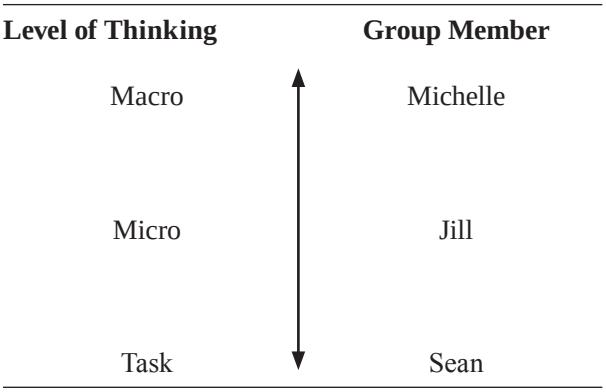

Figure 1. Students' level of thinking about the problem

Throughout the interview, as she was shown video clips in which she appeared confused, Jill tended to pinpoint the source of her confusion as the overall task rather than the procedures for getting things done. When asked why Michelle seemed to be the manager when the group was drawing up its plan of action on Day 4 of the unit, Jill noted, "Well, I was really confused, 'cause I didn't exactly know what we were going for and what we were trying to find out. So she looked like she knows what she's talking about." However, on the same day, Jill was able to perform tasks such as formatting the information to be placed in the brochure.

Jill's level of thinking about the problem. Throughout the unit, Jill seemed to focus almost exclusively on micro-strategies and on making sure she understood specific content she encountered. Jill did not seem concerned with the macro-strategy; she noted in the post-survey that the unit could be improved if the teachers gave "a little bit more of a push of what to do."

Jill often appeared to be unable to determine what new tasks needed to be performed to help them toward their solution. When prompted by Mrs. Smith or Michelle to accomplish a task that was part of the overall problem solution process, Jill tended to lay out a concrete strategy to complete the task. For example, on Day 5, Sean had completed his assigned task and was waiting for something else to do. Jill was trying to finish the brochure. Mr. Thomas noticed that Sean was unoccupied, and came to discuss possible tasks Sean could perform to help his group. Mr. Thomas

suggested that the group create a poster to use in the debate:

Mr. Thomas: Are you going to show any posters…? *(To Jill)* Have you talked about that as a group?

Jill: Well, uh, no, not really, 'cause we were tryin' to finish this.

Mr. Thomas: Okay, okay, well you might want to *(pause),* you're pretty close to finishing here.

As illustrated in this passage, Jill explained to Mr. Thomas that she had not thought about creating a poster because she was focused on finishing the brochure. She presumably knew that Sean did not have anything to do because he was sitting next to her. However, no one had mentioned creating a poster before Mr. Thomas. When class resumed the next day, Jill worked with Sean to create a poster.

Jill often expressed confusion about the macro-strategy and sought help from Mrs. Smith and Michelle. On many occasions when she appeared to be confused about a question about the macro-strategy, Jill simply repeated the same question, as in the following example:

Michelle: Anyways, let's move on. Okay, what do we need to know?

Jill: *(Smiles)* Okay, what do we need to know?

Michelle: We need to know like…

Sean: Which one are we doing *(referring to benefits or drawbacks),* uh?

Jill: Do we care?

Michelle: How much, how much, how long it would take to get this stuff [better technology for paternity testing]?

Jill: Well we don't know because we don't have the technology yet. *(Pause) (To Mr. Thomas)* Okay, so we're kind of confused on what we need to know. 'Cause we're like, we're trying to use the three million dollars to help find dads.

It is interesting here that Jill told Mr. Thomas that her group was confused about what they needed to know, whereas Michelle seemed sure that they needed to know how long it would take to develop better technology for paternity testing. However, in the conversation, Jill dismissed the learning issue by saying, "we don't know because we don't have the technology yet." Jill's dismissal of the learning issue did not seem to follow logically from Michelle's comment. If better technology for paternity testing already existed, group members knew what it was, and it were accessible to everyone, then the question of how long it would take to get the technology would be irrelevant, and Michelle likely would not have identified the topic as a learning issue. Jill's dismissal of Michelle's proposed learning issue and failure to propose an alternative may indicate that she had difficulties grasping the macro-strategy.

Sometimes Jill did not seem to understand the macro-strategy, but nonetheless argued over fine points of the strategy with Michelle, as in this example:

Michelle: Okay, are we wanting to go for drawbacks or benefits?

Jill: You have to do both.

Michelle: Yeah, but which one do we want to focus on?

Jill: Like during the uh, which one, the brochure? You have to do both in the brochure.

Michelle: I know, but you have to do both in the debate too. But which one do you want to like focus on?

Jill: Well, what drawbacks is there that we *(inaudible)*?

Michelle: I couldn't think of any, except that it just, it would cost money, maybe. So I'm guessing benefits.

Jill: Well, like I was thinking that we could, like, why we need the money is because, like–

Michelle: Is this for benefits?

Jill: What are you talking about?

Michelle: Well first we need–

Jill: I'm talking about for the, I'm talking about for the trial.

Michelle: Well, the–

Jill: Never mind.

Michelle: Okay, for the brochure, what we're gonna use the brochure for is to prepare for the debate, to plan out our debate. So, for the brochure, do you want to focus on benefits?

Jill: We're focusing on both *(puts hand down on table in assertive manner).*

Michelle: No, we gotta focus on one, but *(puts hand down on table in assertive manner).*

Jill: There's one for each of them.

Michelle: I know, but we got to do both, but focus on one.

Jill: *(Smiling)* Who cares, why don't we just do both?

Jill noted during the interview that she was confused during the preceding passage, but she argued with

Michelle as if she were certain that she was right. Michelle did not try to say that they had to cover benefits or drawbacks, but Jill acted as if that was Michelle's intent. Finally, she tried to win the argument with the last comment, which did not logically flow from the previous comment, in which Michelle said that they have to cover benefits and drawbacks. When prompted with this exchange in the interview, Jill noted being confused about what they were supposed to do, but then later she understood that Michelle was right:

Jill: She said we were either for or against it, and suddenly I said we were going to do both, and she said we had to pick one, and I don't know, I didn't get it, but then I got it.

Interviewer: Okay, what did you end up realizing later?

Jill: Um, well, for the trial we did it, we said both benefits and drawbacks, but we were for it, so we wanted to put more benefits. And then in the brochure, we did the benefits and drawbacks too.

Michelle

Michelle's difficulties. When shown clips from the initial days of the unit, Michelle also indicated that she was confused about many things, including the overall task, and sub-tasks: "We didn't know what to do, we just knew the basics about … the human genome project, but we didn't know … where we stood." When prompted with episodes from later days of the unit, Michelle noted being confused about micro-strategies: "We were just confused about what all we had to do. I think we knew what we had to do; we just didn't know who was going to do it."

In this interview clip Michelle seemed to portray that the whole group was confused about how to get specified tasks done. However, in the video clip that was shown, Jill had explained to Sean how to describe benefits and drawbacks for the brochure, so it appears that at least Jill was not confused about who was going to do what and how it was going to be done. Thus, the "we" in the interview comment may have been more appropriately stated as "I."

Michelle's level of thinking about the problem. Michelle spent most of her time focusing on the macro-strategy, but had trouble translating the strategy into specific steps. She seemed to concentrate primarily on the global strategy of how to make the brochure and prepare for the debate, and not on conceptual understanding or the fine details of the strategy. She noted in the post-survey that the unit could be improved by giving "some more information on the [Human Genome Project] as a whole before researching."

Michelle did not appear to spend time looking for detailed information. Mrs. Smith encouraged all students to write in their notebooks what information they were having trouble finding. Each day after school, Mrs. Smith read the notebooks and wrote down additional resources. In response to one question, Mrs. Smith provided the group four links, but Michelle did not want to look through all of the links:

Michelle: Mrs. Smith?

Mrs. Smith: Yes?

Michelle: Out of all these … I just don't feel like going to all of 'em.

Mrs. Smith: *(Laughs)* That's why I narrowed it down to four.

Michelle: Well, I know but still that's a lot.

Mrs. Smith: Which one's the best one?

Michelle: Yeah, for like the benefits?

Mrs. Smith: For the benefits of?

Michelle: Yeah.

Mrs. Smith: That one right here. This one is, and unfortunately it's also the …

Michelle: The longest.

Mrs. Smith: Longest. I knew you were going to say that. Unfortunately yes, but once you get there … all you have to do is click back and forth.

When considering this passage, it is important to remember that Mrs. Smith provided Michelle with four links; as such, all Michelle had to do was type in the URLs and read the material. However, Michelle raised her hand, waited two minutes for Mrs. Smith to come, and then asked what web page she should read. Mrs. Smith anticipated that Michelle would ask if it were the longest and so started to state that it was, but then tried to reassure Michelle that it would not be that hard or time-consuming to go through it.

On another occasion Michelle seemed to feel overwhelmed by the attention to detail that she had to pay to the brochure as they were putting it together. On Day 4, she had assembled several drawbacks and benefits of the HGP, and then talked about them with Jill. After finishing describing the benefits and drawbacks she and Sean found, Michelle asked:

Michelle: Do you think that's enough?

Jill: Well we have to be able to … fit it all in here.

Michelle: Well that could fit in that.

Sean: What's the etc. thingy for? Hey what's the last square for?

Michelle: Gosh, Jill, do we have to figure it out?

Sean: *(to Michelle)* Hey, hey, there's drawbacks, benefits, and what's this last one for?

Jill: I don't know exactly what you guys already have.

Michelle: That's why I'm asking you if that's enough.

Jill: Well I don't know because I don't know what all you have.

Michelle: I just told you.

It is important to note that Michelle had only told Jill orally what she had for benefits and drawbacks but then she expected Jill to be able to tell her if she had enough for the benefits and drawbacks section of the brochure. When Jill said that she was not sure, Michelle appeared confused because she had already given Jill the information orally. However, Michelle relayed them in narrative form and not in bulleted form, as they would appear in the brochure.

Sean attempted to join the conversation by asking what should be put in the space left in the pamphlet template. Nevertheless, his attempt to join the conversation was not successful. This may have been because (a) Michelle appeared to be waiting for a clear, unambiguous answer to her original question ("Do you think that's enough?"); and (b) Jill was straining to respond to Michelle's question. Sean's interjection may have appeared to be irrelevant to their conversation, and for that reason, they did not respond to his question.

When they finished a draft of their brochure, they showed it to Mr. Thomas to see what they needed to add. The group previously divided the task of creating the brochure, and Michelle was responsible for the outside of the brochure (general overview, basic information about the HGP, and miscellaneous information) and the benefits, while Jill and Sean were responsible for the inside (which contained the drawbacks, benefits, and websites and phone numbers for more information). Mr. Thomas indicated that they needed to add more details to the entire brochure, and then Michelle said:

Michelle: We have to add a lot more like information, details, and then we're done. (Pause) Yes Jill we've got a (inaudible) and a good job. Now you have to add the details and then.

Mr. Thomas: You need more details, the more details you get the better.

Jill: I'm working on it.

More details were needed on all brochure parts: general overview, benefits, drawbacks, basic information about the HGP, and miscellaneous information. However, Michelle delegated the gathering of all additional details to Jill. When Jill replied, she noted that she, not she and Sean, was working on it. However, she subsequently worked with Sean to add details to the brochure, providing evidence that she was not considering completing the task alone.

Sean

Sean's difficulties. Sean mentioned on several occasions in both interviews that he was confused because he "didn't know a whole lot." When asked what he did not know, he was often not able to provide specific examples. In the interview, Sean had just finished stating that he understood the problem on the first day of the unit, and then said he was still "a little confused."

Interviewer: Do you know what you were still confused about? Do you remember?

Sean: Not really.

Interviewer: Not really? Okay…

Sean: All I know was I was a little confused.

On other occasions in the interviews, Sean indicated that he had trouble understanding what was going on during the unit, as indicated in the following passage:

Interviewer: Do you know what [you were confused] about?

Sean: Basically … what everything was going on, you know? Like, um…

Interviewer: Okay, go ahead. Did it have to do with the project?

Sean: I think it was the uh, trying to write everything down, and listen to it at the same time, listen to them talk, and write it down and stuff. But I don't [think] I got it all written down.

Sean's level of thinking about the problem. For most of the unit, Sean appeared to have trouble grasping either macro- or micro-strategies. Part of his difficulty performing tasks assigned to him by his teammates seemed to result from not understanding the problem or steps to solve the problem. For example, it took Sean a long time to understand the definition of drawbacks as they pertained to the HGP. He seemed to see them as something he should be able to simply look up in a book based on how Michelle initially explained drawbacks: "why we wouldn't want the three million dollars." After Michelle's explanation,

Sean began looking in a book for drawbacks, but he quickly became discouraged and said to her, "There's nothing in here. Hey, Michelle, there's nothing in here like saying about why we wouldn't want … the three million dollars."

Sean never seemed to understand fully the strategy behind his group's solution to the problem. For example, when Mr. Thomas asked what strategy his group was going to use in the debate, Sean replied, "Oh, we're gonna get really, real big missiles and stuff." When Mrs. Smith asked what needed to go on the group's debate poster, Sean replied, "Um, important stuff," and when asked to be more specific he could not.

When asked at various points during the unit why he let Michelle and/or Jill take the lead, Sean replied it was because he "didn't know a whole lot," and was "just waiting to know a little bit more so [he] could understand it more." But he mentioned that another factor was that he felt nervous talking in his group: "You see I get nervous around a whole bunch of people, so the worst thing was … when I had to talk, I kept mispronouncing stuff, I was nervous." He noted, however, that he would like to participate in another PBL unit: "I would like to do another one now that I could probably get myself up there in front of people." This may imply that working in a group allowed Sean to increase his confidence speaking in front of others.

Though he did not appear to understand the macro-strategies or micro-strategies, Sean was able to focus on and complete specific tasks, such as searching for stories about mothers who did not know the identity of their children's fathers, for which clear guidance was provided.

Assertion 2: Each Group Member Filled Specific Roles During the Unit

Jill

Jill appeared to fill two roles during the unit: task guidance provider and Sean's tutor. Jill tried to ensure that tasks assigned to Sean were explained clearly. For example, on Day 3 of the unit, the group started planning their brochure. Mrs. Smith explained that brochures needed to include benefits and drawbacks of the HGP from groups' assigned stakeholder perspectives (e.g., doctors, lawyers). Michelle had assigned Sean the task of finding drawbacks by stating that he should find "why we wouldn't want the three million dollars." On Day 4, Sean was still confused about what to find, but Jill explained drawbacks to Sean in a more concrete way:

Sean: I can finally think of, oh, a couple of drawbacks. I don't know. *(To Michelle)* Could one be, a drawback, don't want children growing up without a dad?

Jill: Well, we're talking about drawbacks if we do get—

Michelle: The drawbacks *(inaudible).*

Jill: Well, no, I'm trying to think. A drawback would be … like what, if you do get the DNA test, and you find out who the dad is, it's like the drawback was finding out the wrong … dad. But, and another drawback would be, if you think the dad is one person, but it's really somebody else you don't want it to be. Or like when you're taking the DNA sample, something could go wrong. Something like that.

Sean: Uh *(starts to write in his notebook).*

It is important to note that Jill offered an explanation of drawbacks that was much more concrete than Michelle's explanation–that drawbacks were "why we wouldn't want the three million dollars." Jill provided Sean with examples of drawbacks, which helped him to understand the nature of drawbacks. He still had a few questions about drawbacks, which he asked later during the period. By late on the Day 5, Sean contributed his two drawbacks: "want a machine to work perfect so it's never wrong. And when taking DNA samples they could go wrong and the dad would have to pay child support."

In addition, Jill may have felt a responsibility to intervene when Michelle was not providing Sean clear task guidance. For example, later during Day 4, Michelle asked Sean to help write up benefits for the brochure, but had trouble explaining exactly what she wanted him to do. Jill initially questioned why they still needed to work on the benefits, but then left the two to work. However, when she heard Michelle providing Sean unclear task guidance, she intervened:

Michelle: *(to Sean)* Do you wanna help me with the benefits?

Jill: You said you already have 'em. Okay, you guys can do whatever you want to.

Michelle: *(to Sean)* Okay, you have to make sentences, make it like a paragraph about, well not really a paragraph, about some *(inaudible).*

Jill: Just put it in bullets! You say benefits: blah blah blah blah blah.

Michelle: *(to Sean)* I know, well, you need to number your drawbacks, even though you only have two, you need to put like drawbacks, do do do do do. Like make a square. Like, okay, you know on the brochure. You know?

In this passage, Michelle explained what she wanted Sean to do in an ineffective manner, and it appeared that Sean was very confused. Michelle seemed to want Sean to put the benefits in a format that was not a standard paragraph (e.g., a bulleted list, or separate sentences); however, Michelle did not make this clear. Jill intervened and explained what Sean needed to do in a more straightforward manner, thus helping him understand better what he was supposed to do, as evidenced by his subsequent completion of the task with Michelle's help.

Michelle

Though the students indicated in the group interview that no one member was the leader, Michelle often appeared to function as group manager, though not always effectively. Michelle seemed to focus largely on the macro-strategy, as opposed to the practical steps needed to complete tasks; furthermore, she did not readily accept group input on the macro-strategy. On Day 3, the group drew up their plan of action. Michelle took the lead drawing up the plan, but as soon as a detail came up on which she and Jill could not agree, she simply said to move on:

Michelle: Uh, yeah, *(talking aloud as she writes in her notebook)* wait three million dollars, is going to be used *(pause)* to improve … what do we have to improve? What is it called?

Jill: Help find like …

Michelle: Yeah, I know, but what is it called? DNA machines?

Jill: Don't put it like a scientist.

Sean: Improve what?

Jill: Improve *(pause)*.

Michelle: No, she said *(pause)*, we aren't finding moms.

Jill: Moms and dads.

Michelle: No moms are already, moms are the ones having the babies.

Jill: *(raising hand)* Well, I'm *(inaudible)* the mom.

Sean: So it's not to improve?

Jill: What, like this is what *(shows notebook)*.

Michelle: We use the money to get better technology, but that's not what we're gonna put. The main action is to find out.

Jill: I know.

Michelle: Anyways let's move on. Okay, what do we need to know?

Michelle and Jill were discussing what they should use the grant money for to further their stakeholder position regarding the HGP. Before telling her "we're not finding moms," Michelle saw Jill write down that they needed to use the money to get better technology to help find moms and dads. Michelle disagreed with Jill, but before she said to move on, Michelle wrote down in her journal next to the heading "POA" (Plan of action): "Focus on benefits. 3 million is going to be use (sic) to find dads, that don't know who's the father of the kid" on the first line and "what do we need to know" on the next line. Michelle did not follow up to resolve the disagreement before deciding that the group was going to use the money to help find dads. This is important because even though Michelle was acting as the manager, she did not take into consideration what Jill or Sean contributed to the discussion. Jill appeared to attempt to involve Sean in the discussion by beginning to respond to his question ("Improve what?") before being interrupted by Michelle. When Jill and Michelle did not agree on whether to focus on finding moms and/or dads, Michelle decided that the group would focus on finding technology to find dads, and did not even inform Jill or Sean of her decision.

Although she appeared to serve as manager, Michelle had difficulty translating necessary tasks into practical steps. As illustrated in a previous passage, when Sean finished with the drawbacks, Michelle asked him if he could help her with the benefits, but could not clearly state what she wanted Sean to do: "Okay, you have to make sentences, make it like a paragraph about, well not really a paragraph, about some (inaudible)."

Sean

Sean's role appeared to be that of task performer, though at times he had difficulty performing tasks due to inadequate task specification and guidance. During the unit, Sean never asked or talked about his group's strategy and the overall task that they faced. When asked to discuss the problem during the interview, it became clear that he harbored some misconceptions about the unit goals. His group needed to come up with a project that could help their stakeholders—lawyers for mothers who do not know the fathers of their babies—with which they could spend $3 million. The closest Sean came to saying anything about the problem or his group's task was, "Well, I thought maybe if the, uh, mother wanted, well, if the mother wanted to know who the father was she shoulda got married to him." Due to his poor

understanding of the problem, he was not able to aid in the macro-strategy of how to solve the problem.

Sean never autonomously volunteered to perform a task. He also appeared to experience considerable difficulty completing tasks assigned to him by Michelle or Jill when not given clear task guidance. Sometimes Sean seemed to understand a task, but was not able to (or did not want to) perform the task independently. For example, Jill asked Sean to find construction paper to put behind stories and charts for a poster for the debate. Though Jill said to pick "as many colors as (he) could find," Sean insisted she specify what colors she wanted: "Just name up some colors you would like to have." It appeared that Sean did not understand that the exact colors were not important, and thus delayed starting the task he was assigned. Then, when he was to cut the stories and data into smaller pieces so they could be arranged on the poster, Sean asked Jill several times what he was supposed to cut and how he was supposed to cut it. When prompted with the episode in the interview, he noted, "But we didn't get the things on the uh poster. So I guess Jill did it."

However, when Sean clearly understood what a task entailed, he performed it. For example, he searched for stories about single mothers who did not know the identity of the fathers of their children, and found several. While none of these stories ended up on the poster used in the final debate, they did provide some major themes for the story that Michelle invented of a single mother who did not know the identity of the father of her child. He also critiqued the layout of the brochure and provided suggestions for improvement.

Assertion 3: Each Group Member Served to Counterbalance Each Other's Shortcomings to Solve the Problem

Each group member had specific shortcomings. Jill was confused about the overall strategy of how to solve the problem but was able to determine how to accomplish and provide guidance for accomplishing certain tasks. Michelle understood the overall strategy but was confused about how to accomplish individual tasks. Sean was confused about the overall strategy and how to accomplish tasks, but could carry out tasks when given guidance. However, they each appeared to counterbalance each other's shortcomings in order to derive a viable solution: to use the grant to find "better technology so we are positive who the father is." This is because each group member's role formed part of the process of solving the problem. Mrs. Smith noted that Jill, Michelle, and Sean performed well in the debate, though they did not "win" the grant. They presented a coherent position in which they aimed to use the grant money to (a) improve DNA testing technology to make sure that correct fathers were identified consistently, (b) advertise their services to help clients find the fathers of their babies, and (c) help pay for DNA tests and legal representation for low-income single mothers. Sean participated in the debate by describing the benefits and drawbacks of the HGP as they pertained to their stakeholder group (total speaking time: one minute, approximately one-third of the presentation). Their performance in the debate was considerably stronger than that of other, mostly average, groups in their class as well as in different class sections that completed the unit at the same time. Video of the debate in all classes completing the unit showed that three of the six groups containing only average students did not present their proposed use of the money until specifically requested to do so by the judge. For example, many groups talked for their entire allotted time without ever mentioning their plans for using the grant money. Even when groups did present their proposed use of the grant, it was often not coherent. For instance, a lawyer group in another class said "we could possibly help people who are missing chromosomes, and stuff like that." A teacher group said they would use the money to find answers to questions such as "if we evolved from monkeys, um, why don't we look like them … [and] how come they're still here?"

Jill, Michelle, and Sean's viable solution of the problem may be due to the methods they used to interact with each other. During the interviews, the participants indicated that, when confused, they had three resources—the teacher, their group mates, or research. Though Michelle and Jill valued asking the teacher when confused, all participants indicated that they also valued highly discussing among themselves sources of confusion. As Sean noted, "Um, we got more, uh better, we got better ideas [from] what everybody had, from what they … what they had found out and stuff." In fact, Sean asked Mrs. Smith or Mr. Thomas for help only once during the seven-day unit, but asked his group mates for help 26 times. When asked what helped him do well in the unit, Sean replied "The group." When asked for another thing that helped, he replied "Encouragement … from the group." Michelle and Jill asked the teacher for support a combined total of 22 times, while they asked each other for help 14 times.

Though the students did appear to support each other as they worked through the problem, it does not appear that the support was omni-directional: that is, Jill appeared to be the only group member who consistently supported her two group mates. She seemed to act as an intermediary between Sean and Michelle. Michelle and Jill seemed to support mutually each other, and Jill seemed to support Sean.

Michelle appeared to support Jill by suggesting certain general tasks that the group members should perform during the unit. Though Michelle was not able to provide detailed task guidance, once Jill knew what needed to be done, she could translate the task into concrete steps, which she could then relay to Michelle and Sean.

Jill appeared to support Michelle and Sean by providing explicit task guidance and managing details that the latter either did not feel capable of handling or did not want to handle. Jill took what needed to be done according to the problem resolution strategy, and helped to make the tasks doable by laying out a road map for their completion.

Sean served to support Michelle and Jill by completing tasks and serving as the tiebreaker between Jill and Michelle. For example, when planning the brochure, Michelle asked Jill and Sean whether they wanted to focus on benefits or drawbacks. Not able to come to consensus with Jill, Michelle then asked Sean, who had been silent throughout the discussion. Upon Sean's answer, Michelle and Jill considered the case closed and moved on.

Michelle: Well, we do have to do both. Sean, which one do you want to do?

Sean: Uh, me? Uh, for the focus on mainly? Benefits, I guess.

Summary

Each participant focused on a certain level of thinking about solving the problem, filled a unique role, and supported each other as they worked toward a solution. Michelle seemed to focus almost exclusively on the macro-strategy (overall strategy of how to solve the problem), pay little attention to the micro-strategies (concrete steps that the group needed to take to carry out the macro-strategy), and carry out tasks without fully understanding the content she was researching. Jill appeared to focus largely on breaking tasks into concrete steps, and also on conceptual understanding, but seemed to have trouble understanding the macro-strategy and what specific new micro-strategies should be performed at any given time. Sean performed tasks, but had trouble understanding the macro-strategy, content, and micro-strategies. However, the students were able to support each other to come up with a viable solution, and Sean appeared to have gained public speaking confidence. Given that they served to counter each other's shortcomings during the unit, it appears all were instrumental to the group's inquiry process.

Discussion

Results of this study suggest that members of mainstreamed groups may be able to support each other to solve an open-ended PBL problem successfully. Though the participants' experiences may not seem entirely positive, the group arrived at a viable solution, which was not the case for all groups. Sean also perceived benefits from the unit, such as helping him feel more comfortable talking in front of others. Michelle and Jill noted being more engaged during the unit than during teacher-led instructional units, in which they usually felt bored.

The findings (a) confirm the potential of PBL in mainstreamed classrooms, (b) provide an example of effective interaction among members of mainstreamed PBL groups, (c) suggest types of support needed to support members of mainstreamed groups, and (d) indicate potential benefits of PBL to mainstreamed students.

Confirmation of PBL's potential. As noted previously, little research examines whether PBL has the potential to work in mainstreamed classrooms. Sean's group, one of two mainstreamed groups in his class, was able to come up with and present a viable solution to the presented problem. In doing so, its members performed substantially better than most other groups completing the unit, most of which were composed of average students. We asserted in the results that each group member filled a specific role during the unit. In doing so, group members offered support and clarification throughout the process. This suggests that mainstreamed groups may have the potential to be successful in PBL. This is important because (a) mainstreaming is widely used in middle schools and (b) PBL fits the three characteristics of effective middle school curricula—challenging, exploratory, and integrative (NMSA, 1995). In addition, it incorporates cooperative learning that has been shown to be responsive to the needs of middle school students (Wood, 1992). As Vars (1998) noted, it is important yet difficult to use curricula meeting NMSA's standards. Further research with groups

including students of varying abilities completing PBL units of different content and scope is needed to confirm the potential of PBL in mainstreamed middle school classrooms.

Example of effective interaction. Central to the successful implementation of PBL is group work, and our findings contribute to an understanding of how members of mainstreamed groups engage in PBL group work. The group work in this case appeared to be effective, and its description may help researchers understand how group work could look in a mainstreamed classroom. All participants in this study perceived that they would not have been able to complete the unit by themselves, not simply due to the unit scope. As we observed in the results, each group member served a specific role that counterbalanced the shortcomings of their group members' approaches. Sean, Jill, and Michelle all appreciated being able to ask other people, group mates included, "what was going on" when they were confused. They also appeared to support each other as they worked through their individual difficulties related to micro-strategies and/or macro-strategy.

Our finding of effective interaction in a mainstreamed group engaged in PBL parallels what researchers found when investigating the use of cooperative learning in mainstreamed classrooms: when cooperative groups included students with learning or physical disabilities, all group members interacted and participated in a similar manner and contributed to the completion of their task (Beaumont, 1999; Gillies, 2003; Okolo & Ferett, 1996; Pomplun, 1997). Sean was less proactive in determining tasks to complete than Jill and Michelle, but perhaps this is similar to Okolo and Ferett's findings that mainstreamed students sometimes are less active in group work than their average group mates. Members valued support from their group mates, and this is encouraging for the use of PBL in inclusion classrooms (Hmelo-Silver, 2004).

Suggest types of support to be developed. The effective division of tasks among group members is important in PBL (Duek, 2000; Hmelo & Ferrari, 1997; Lindblom-Ylänne et al., 2003), but it may be even more important in mainstreamed groups. We asserted in the results that each group member demonstrated one level of thinking regarding the problem. A student with similar or more severe difficulties than Sean's would not likely be able to manage the macro-strategy of how to solve the problem or the micro-strategies of how to conceive of and complete many subtasks during a PBL unit. For PBL to be successful in mainstreamed classrooms, it appears that teachers and researchers need to consider how to best support an effective division of roles among members of mainstreamed groups in PBL.

In this study, a teaching assistant helped Mrs. Smith facilitate the unit. The teaching assistant was paid through a grant that supported the implementation of PBL at TMS. However, most public schools cannot afford to have more than one teacher in each room. When facilitating PBL, teachers must support their students on a variety of levels, including promoting effective group interaction, challenging students' thinking, guiding students' thoughts, and guiding students away from misconceived approaches (Rangachari & Crankshaw, 1996; Silén, 2006; Wood, 1994). Promoting effective group interaction, thus, can be challenging, and may be even more challenging in a mainstreamed class. There are several things that teachers can do before and during the unit to support effective group interaction in mainstreamed groups. Before the unit, teachers should consult with the special education teacher assigned to the student with special needs to determine the specific support needed and possible tasks the student with special needs could perform during the unit (such information may be present in the student's Individualized Education Plan). They then can direct students to choose roles at the beginning of the unit such that the student with special needs is assigned an appropriate role, and that one average student is assigned to provide needed support (e.g., task guidance) to the student with special needs. Sean's group managed well determining roles and providing support that Sean needed. However, it is unlikely that all mainstreamed groups would do this on their own.

Second, group members should be asked to reflect not only on that day's work at the end of each period, but also specifically on their roles in the group process. Reflection helps PBL students reinforce their learning (Dunlap, 2005; Hmelo-Silver, 2004; Peterson, Hakendorf, & Guscott, 1999). Guided reflection on how they are fulfilling their roles may help members of mainstreamed groups recognize where they may make modifications in their group work to promote better group functioning. An example of a prompt could be "Your role is [insert role]. Write about how you fulfilled your role today and about how you (a) contributed to your group's progress today and (b) helped your group mates."

Other supports for members of mainstreamed groups may include computer or paper-based scaffolds that remind students of their individual roles, as well as things to consider during the overall process of problem definition and solution (Hannafin, Land, & Oliver, 1999; Saye & Brush, 2002). Every day at the beginning and the end of the period, Mrs. Smith reminded students what they were supposed to do. When students asked for help finding web sites on particular topics, Mrs. Smith helped. Additionally, Mrs. Smith and the teaching assistant always walked around the room to provide just-in-time support (Lepper et al., 1997). Nevertheless, this support did not sufficiently help the students, perhaps because, as Sean noted, it is hard to pay attention to many different things that are going on, write them down, and remember them. With computer-based scaffolds that help students manage the overall process, students would not have to worry about having to write down the process hints and strategies as they are being said, which Sean mentioned as a difficulty that he had, and with which Michelle and Jill also seemed to struggle.

Suggest potential benefits of PBL to mainstreamed students. PBL is advocated largely because it is said to lead to deep content learning and greater self-directed and problem-solving skills (Hmelo-Silver, 2004). We did not collect the type of data that could speak to any changes in Sean's self-directed or problem-solving skills. Rather, we were interested primarily in assessing the potential of PBL in mainstreamed classrooms and, more specifically, in providing thick description of Sean's and his group's interactions. However, cooperative learning is largely advocated for mainstreamed classrooms because it is said to increase the motivation, peer acceptance, academic achievement, and social skills of students with special needs (Johnson & Johnson, 2002; King-Sears, 1997; Putnam, 1998a; Slavin, 1983; Waldron & Van Zandt Allen, 1999). Sean perceived that participating in the unit allowed him to gain confidence to speak in front of others, and noted that he would like to participate in another PBL unit. For many students with special needs, speaking in front of others and in small-group situations can be challenging (Bokhorst, Goossens, & de Ruyter, 1995). More research is needed that examines the use of PBL with mainstreamed students with similar and different needs to determine whether this perceived effect is likely to occur with students with diverse special needs. An intervention that can help students feel more comfortable speaking in front of others is important in that it can affect the future success of students (Bijstra & Jackson, 1998). In addition, student motivation is a prerequisite to learning (Stipek, 2002), and it appears that PBL may have the potential to be motivating to students with special needs.

Limitations and Suggestions for Future Research

This case study was designed to describe in depth how the members of one mainstreamed small group managed the processes involved in PBL and supported each other as they worked toward a solution to the presented problem. We purposely chose a small sample size because, given the lack of literature about the use of PBL in mainstreamed classrooms, we perceived that there was a need for deep description. However, this approach limits generalizability. It is likely that the way in which one mainstreamed group engages in PBL will not reflect the way in which other mainstreamed groups engage in PBL. Members of mainstreamed groups that include students with different special needs will likely interact differently than the group studied in this research. Also, the specific PBL problem could have influenced the roles of Jill, Sean, and Michelle. However, as Stake (1978) suggested, authors of case studies should not strive for generalization, but rather for "particularization" of the case. If the authors do a sufficient job describing the case, then the reader can generalize to similar cases that are of interest to him/her.

Future research should investigate if members of other groups that include diverse mainstreamed students assume similar roles while solving similar and different PBL problems. Such research should focus both on individual small groups and on multiple mainstreamed groups in a class. Such further research is necessary before researchers can develop a strong understanding of how mainstreamed students respond to PBL. Future research should also focus on the impact of PBL on mainstreamed students and their group mates. Though we found evidence of a perceived impact of PBL on Sean's willingness to talk in front of a large group, and in front of his group mates, one cannot assume that other mainstreamed students who participate in PBL would enjoy the same effect. In addition, it would be important to learn how PBL benefits the average members of a mainstreamed small group.

Implications

Implementing PBL in the middle school may help ensure that middle school curricula are challenging, exploratory, and integrative (NMSA, 1995). Using it

in the middle school science classroom may also help to promote NSTA's vision of inquiry-based science instruction in the middle school classroom that allows students to make decisions (NSTA, 2003). Middle school students with special needs are increasingly mainstreamed in general classrooms. Knowing how one mainstreamed group engaged in a PBL unit, and the difficulties that its members faced, represents an important first step toward determining the potential of PBL for use in mainstreamed classrooms. When the difficulties faced by members of this and other small groups that include students with similar and different special needs are known, support can be developed to help students with special needs and their group mates overcome those difficulties.

Cooperative learning has been promoted for mainstreamed classrooms in large part because it is said to raise the motivation, peer acceptance, academic achievement, and social skills of students with special needs (Johnson & Johnson, 2002; King-Sears, 1997; Putnam, 1998a; Slavin, 1983; Waldron & Van Zandt Allen, 1999). It may also respond to middle school students' needs (Wood, 1992). The results of this study indicate that PBL may have the potential to increase the motivation and social confidence of students with special needs, and also help all group members—average and special education—overcome their challenges. Additional research can help confirm the potential of PBL to support the learning and social needs of average students and students with special needs in the middle school context.

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