RUNNING HEAD: PBL and Special Needs

Perceptions of the Value of Problem-based Learning among Students with Special Needs

and their Teachers

Abstract

While Problem-based Learning (PBL) has been found to be effective with gifted and average students (Hmelo-Silver, 2004), little is known about its impact on students with special needs. This study examined the perceptions of middle school students with mild, moderate, and severe disabilities, and their teachers, regarding the value of participating in a PBL unit. The unit focused on the physical accessibility of a low-SES, rural community, where the students' school was located. We used the constant comparative method (Glaser & Strauss, 1967) to analyze interview data, and used observation data and artifacts to triangulate interview comments. Among the noteworthy findings were 1) students manifested strong engagement and 2) students with less severe disabilities developed compassion for students with more severe disabilities.

Introduction

Problem-based Learning (PBL) had been advocated by current educators (Gallagher, Sher, Stepien, & Workman, 1995; Gijbels, Dochy, Van den Bossche, & Siegers, 2005; Hmelo-Silver, 2004; Stepien & Gallagher, 1993) as one way to increase inquiry and problem-solving skills among gifted, average, and university students (Barrows & Tamblyn, 1980). PBL is an instructional framework in which students work in cooperative groups to solve real-world, authentic problems. In the course of solving the problems, students learn content and also expand their higher-order thinking skills (Hmelo-Silver, 2004).

Despite its use with gifted and average students, there is little literature that examines the effects of PBL on students with special needs. For the purposes of this paper, we define a "student with special needs" as a student who has specific learning disabilities or other cognitive and/or other physical disabilities, and "who, by reason thereof, needs special education and related services" (Individuals with Disabilities Education Act, 2004, p. 2652). In one study, Cerezo (2003) described a PBL unit that was used with at-risk middle school students. The sample included one student with Learning Disabilities and thirteen students who were at risk for failing science or mathematics. Participants perceived that the unit helped them to succeed in academics and social situations and thus to raise their confidence. Additional literature describes units that seem to employ several, but not all, of the principles of PBL (e. g., authentic context, investigation of a real-world problem). For example, Ervin (2002) described a unit designed for vocational students with special needs that examined the differences in how meatloaf is prepared in different regions of the country and the world. Bottge (2001) described a unit in which students with special needs attempted to determine where a model car needed to begin on a ramp

in order for it to reach a set speed and successfully navigate a course. Bottge noted that most students were engaged and able to effectively solve the given problem. This exploratory study was designed to examine the experiences and perceptions of students with special needs and their teachers at a middle school in order to understand the potential of PBL for use with students with special needs.

<div align="center">Literature Review</div>

The Goal of Special Education

A major goal of special education is to enable students with special needs to perform closer to the level of performance allowed by their intellectual abilities. The reason for this goal is twofold: 1) to ensure success in school and in life for these students, and 2) to enable schools to demonstrate adequate yearly progress as required by the No Child Left Behind Act (NCLB, 2001) and the Individuals with Disabilities Education Act (IDEA, 2004). That is, NCLB and IDEA both stipulate that all students with special needs must make continuous and substantial improvement in reading and mathematics achievement in order for a school to demonstrate adequate yearly progress towards the goal of 100% proficiency in reading and mathematics for all students.

A Call for New Methods

Though current instructional methods and strategies (e. g., inclusion, behavioral modification, social skills training) used in special education have shown a significant effect on the academic achievement of students with special needs (Hanushek, Kain, & Rivkin, 2002), many teachers and researchers within the special education community (Ibler, 1997; Pogrow, 1988; Rojewski & Schell, 1994) have called for new methods to help such students make even greater academic gains and to ensure transfer of their learning to new contexts. Ibler (1997),

Pogrow (1988), and Rojewski and Schell (1994) argued that the existence of special needs curricula that focus on students' ability to learn facts encourages students to memorize information rather than use the information in new contexts. Means and Knapp (as cited in Rojewski & Schell) wrote that, as a result, students with special needs are often caught in a "repetitious cycle of basic skills remediation" (p. 235). As such, these students are not able to perform at the higher levels allowed by their intellectual abilities, and thus fail to make the continuous and substantial improvement required by NCLB (Browder & Cooper-Duffy, 2003).

Could Problem-based Learning Help Students with Special Needs Make Greater Improvement?

By increasing their inquiry and problem-solving skills as well as helping them learn important content, PBL may have the potential to help prepare students with special needs for a world in which success is less dependent on simply knowing content than on knowing how to discover and manage information (Gallagher et al., 1995). There are several reasons why PBL might be an effective pedagogical approach for students with special needs. These reasons relate to three characteristics of PBL: it is experiential, involves cooperative learning, and occurs within a meaningful authentic context.

PBL is experiential. During a PBL unit, students must interact with their environments to carry out inquiry and discovery tasks (Stepien & Pike, 1997). Many authors have demonstrated that experiential methods are helpful to students with special needs (Scruggs, Mastropieri, Bakken, & Brigham, 1993; Scruggs, Mastropieri, & Boon, 1998; Udvari-Solner & Thousand, 1996). Frew and Klein (1982) specified a possible reason why:

> By engaging in a process of inquiry, students learn more effective ways of encountering their environment, processing information, and acting on it. If we are to fully prepare

handicapped students for an independent life in our complex society, we must provide

opportunities for them to expand their inquiry and discovery skills (p. 100).

Mastropieri and her colleagues (2001) noted, "many students with high-incidence disabilities

will perform similarly to normally achieving students on a constructivist science task, even

though they are far behind in reading and math achievement" (p. 135).

PBL involves cooperative learning. In a PBL environment, students must work

cooperatively (Hmelo-Silver, 2004; Savery & Duffy, 1995). Many authors have noted that

instructional approaches that involve cooperative learning have the potential to help students

with special needs increase their achievement levels (Barley et al., 2002; Gillies & Ashman,

2000; Jenkins et al., 2003; Malmgren, 1998; Slavin & Madden, 1989). Adams et al. (1996) also

found that cooperative learning can increase the engagement of students with special needs.

Upon reviewing research done on the effectiveness of educational programs for at-risk students

(including those with special needs), Slavin and Madden found that programs that involved

cooperative learning were among the two most effective categories of programs. As Johnson and

Johnson (1996) noted, students engaged in a carefully constructed cooperative learning

experience often exhibit greater effort to achieve.

PBL occurs within authentic contexts. PBL has the potential to appeal to students who

have trouble learning things that are taken out of context (Hmelo & Ferrari, 1997). Scruggs et al.

(1993) noted "…most students with LD have difficulty learning from reading and workbook

assignments and benefit from concrete examples" (p. 3). Lee and Songer (2003) found that

students at risk for failing due to cognitive disabilities, or other reasons, have a better opportunity

to apply their knowledge in the solving of problems when the problems are based on real world

"situations that closely match simple patterns in the knowledge students possess" (p. 944). Given

the similarities between the needs of at-risk students and students with special needs, it seems to follow that when PBL is used in the special education classroom, the ill-structured problem employed must not only be authentic, but also be similar to other problems with which the students are familiar.

Given the scarcity of literature that explores the use of PBL with students with special needs, we designed an exploratory study to examine how PBL works with these students. Although ultimately we hope to determine the impact of PBL on the academic achievement of students with special needs, this study was designed as a first step toward that goal. That is, we believed it was important to begin by determining the perceptions and experiences of the students and teachers involved in the PBL process since learning gains are unlikely to be realized without student engagement in or enjoyment of the process. Thus, the research questions guiding this study included:

- How do students with special needs and their teachers perceive the value of PBL?

- How do students with special needs feel about collaborating with other students in PBL?

- How do teachers perceive that their students collaborate with students with different special needs?

- How do teachers modify the PBL approach to make it work in a special needs classroom?

Methods

Role of Researchers

The researchers included one graduate student and two faculty members in educational technology, all with specific interests and expertise in PBL methods. The first author worked as a research assistant on a project to help middle school teachers implement problem-based learning, and the second and third authors were professors who led the same project. In addition, the

second author had previous classroom experience teaching students with learning disabilities. The first author participated in the unit as an instructional and technology assistant in the middle school classroom, enabling him to engage in participant observations. He also conducted all interviews using an interview protocol developed by the researchers. Human subjects approval was obtained from the university's IRB prior to the start of data collection.

Setting and Participants

This study took place in Wright Middle School (WMS), a middle school in Brownsville, a small, rural community in the Midwest. WMS had 36 teachers, and about 600 students, about half of whom received free or reduced lunches. Four years earlier, Wright Middle School has received a large, federal grant that enabled it to provide all of its students with laptop computers and to collaborate with professors and graduate students from a large, Midwestern university to help the teachers implement PBL.

The context for the study was a PBL unit on the physical accessibility (i.e., the accessibility of sidewalks, doors, and public places to people with physical disabilities) of Brownsville. Three classes, serving students with varied cognitive, emotional, and physical disabilities, worked together on the unit for one class period per week for 24 weeks, in order to answer the question: *Is Brownsville accessible to you?* A total of five students with learning disabilities (LD), two students with emotional disabilities (ED), six students with mild cognitive disabilities (MiCD; maximum IQ = 70), two students with moderate cognitive disabilities (MoCD; maximum IQ = 50), three students with multiple disabilities (MD), and one student with severe cognitive disabilities (SCD; maximum IQ = 35), participated in the unit. Two of the students with MD could not walk, and used wheelchairs. The participating teachers (*n=3*) had an average of 11 years teaching experience, and all held Bachelor's degrees, while one also held a

Master's degree. None of the teachers had conducted a PBL unit previously, although some of the students had participated in other PBL units in their inclusion classes.

We used maximum-variation sampling (Patton, 2002) to select our interview participants. According to Patton, the maximum variation sampling technique enables researchers to select participants who vary widely on a particular trait or characteristic in order to identify themes that cut across a diverse sample. We used this technique to select students from each of the three classes that worked together for the unit who appeared to 1) like the unit a lot or 2) were non-committal about their enjoyment of the unit, based on teachers' and researchers' observations. The sample included Bobby, a student with MD; Carrie and Jack, two students with MiCD; David and Andy, two students with LD; Sally, a student with ED; and the three teachers – Charlene, the LD/ED teacher; Sarah, the MiCD teacher; and Theresa, the MoCD/MD/SCD teacher. None of the students included in the interview sample suffered from physical disabilities.

Procedures

The PBL unit. The 2004-2005 school year was the first year that all teachers at WMS were required to implement at least one PBL unit. The three teachers who participated in this study developed the unit during a week-long summer PBL workshop offered by two professors and two graduate students from the university with which WMS partnered. During the workshop the teachers decided that the physical accessibility of Brownsville could provide a motivating topic for all of their students, and decided to work together to create the unit.

During the unit, students and teachers went into the surrounding neighborhood and to downtown Brownsville, took pictures and video, and recorded data about the physical accessibility of the sidewalks, crosswalks, and buildings of Brownsville. During the first part of

each PBL class session, one of the teachers led the students in a whole class discussion of what had been learned the previous week and what they were going to do that day. Then, later in the period, the students worked in small groups, led by one of the teachers, to either go out into the community as described above, or to complete research and writing activities using laptop computers. One or several members of each student group typed on his/her laptop(s) while the other members of the group (usually those with more severe disabilities) contributed content or search terms.

Data Collection Methods

Interviews. Individual interviews, lasting twenty to thirty minutes and based on a standardized open-ended interview protocol (one for students and one for teachers), constituted the first data source. The questions for the interviews were created based on a review of the literature on cooperative and constructivist learning and students with specials needs. The interviews were taped and transcribed, and member checks were used with the participating teachers. The interviews focused on participants' perceptions of the value and the impact of the unit.

Observations. Due to his presence in the classroom as an instructional and technical aid, the first author engaged in participant observations of the class. Immediately following each class session, he wrote field notes that described what he had observed, what the students had done, and any other notable information about the class session.

Presentation. The students created a Microsoft PowerPoint© presentation that incorporated text, pictures, and video about what they learned during the unit, including findings related to the physical accessibility of Brownsville. The presentation was displayed at WMS's

technology night, which was attended by WMS teachers, parents of WMS students, and other members of the Brownsville community.

Data Analysis Methods

In order to answer our research questions, we used a coding scheme to organize the data, and then to aid in counting frequencies of interview responses among teachers and students. We used the same coding scheme to analyze the transcripts of the teacher and the student interviews so that we could identify themes that ran through the transcripts of the student and teacher interviews. The scheme included 39 codes. The broadest codes represented major concepts such as teachers' perceptions of roles. More specific codes focused on more narrow concepts such as how teachers perceived that students' roles in PBL were different from their usual roles. Not all of the codes were valid for both the student and teacher interviews (e. g., codes that categorized teachers' perceptions of students' cooperation were not valid for student interviews). Once coding was completed, we used the constant comparative method (Glaser & Strauss, 1967) to determine themes that applied across cases.

Triangulation. The presentation and field notes from the observations were used to triangulate the interview data. The observations provided a check on what was reported in interviews (Patton, 2002). That is, the observation data were used to either provide an example to illustrate and support what was said in an interview, or to provide a counterpoint. The presentation was used to provide a check on interview comments in that it illustrated what the students produced and learned. For example, if a student with LD said that he tried to keep the behavior of a student with MiCD under control, the comment could often be confirmed by watching the video part of the presentation (which included examples of the students walking around Brownsville).

Results

How do students with special needs and their teachers perceive the value of PBL?

All participants perceived value in PBL for several reasons. First, all students and

teachers who were interviewed enjoyed participating in the unit. They also perceived value in

PBL in terms of specific affective outcomes. Teachers perceived that students concentrated

better and showed a sense of compassion. Students noted gaining patience and choosing to help

those of lower ability than themselves. These perceptions were confirmed by observations.

Charlene (the LD/ED teacher) perceived that her students gained the most from the unit

by acting as co-facilitators for students with more severe disabilities, a perception confirmed by

two of her students. David, a student with LD, stated that he liked participating with the students

with the most severe disabilities because they were "different" and "friendly." When asked what

he learned during the PBL unit, he stated that he learned that "You gotta have patience." He also

learned that it is valuable to help others who are less fortunate than yourself, noting, "It's good to

help others out…You have to think about more than just you. There's *(sic)* other people to think

about too." Observational data confirmed that on several occasions David actively sought to help

his lower ability classmates control their behavior, focus their attention on the task at hand, and

collaborate in class. Even more striking was the contrast between David's observed behavior

during the unit and his behaviors when he was in class with only his fellow students with ED and

LD, when he often displayed such inappropriate behavior as yelling.

Sally, a student with ED, also perceived that the unit caused her to want to help people

more: "I've learned a lot in the past, but I haven't learned a lot about our community, and it like

changed my personality on the community. Like I go around helping people and everything the

best I can." With these and other comments, Sally and David exhibited a sense of compassion that Charlene noted was not traditionally exhibited among students in a special needs class.

Sarah (the MiCD teacher) also perceived that the PBL unit helped her students improve their behavior and social skills, stating, "I saw some maturity from students that I was very impressed with, because I hadn't had an opportunity to see that in the regular classroom situations." Observations, which are detailed in the section on collaboration, confirmed the interview data, as students with mild and moderate disabilities often stayed on task and helped their classmates with severe disabilities stay engaged.

Sarah noted that her students' positive behavior was due, in part, to the fact that they enjoyed the unit more than traditional instruction:

> …since this was an activity where they did get to go out and move around outside of the classroom a lot, it was met with a lot of enthusiasm because they got to do something different….it was done on a Wednesday…they couldn't wait until Wednesday, when they could check on the board just what they were doing as far as PBL was concerned.

Sarah explained that students were engaged because the PBL unit concerned an interesting topic, different from what they usually did in class:

> They're [the PBL units] not the normal, what do you say, humdrum of education, of doing your math and doing the reading, you know the whole idea is it brings a different motivating idea that they're a part of, which stirs their interest just like it would a regular ed student, because they're [the PBL units] different.

Students also perceived that PBL helped them in areas other than motivation and social skills. Several students ($n=4$) noted that one of the things that they liked best about the PBL unit was working with, and learning more about, computers. Two students especially appreciated

being able to learn about the use of digital still pictures and digital video, and one valued learning more about Microsoft Word© and PowerPoint©.

Andy, a student with LD, perceived that PBL helped him to improve his grades. He explained that part of the reason was that he felt more motivated in school due to having participated in the PBL unit, and that the unit helped him to work better with other students. Observational data indicated that this student interacted more effectively with his classmates as the unit progressed, and appeared engaged in the project. Overall it appears that both teachers and students perceived positive value in PBL.

How do students feel about collaborating with other students in PBL?

The students who we interviewed believed that collaborating with other students, and especially with students from other classes, was useful in several regards. First, they enjoyed being able to interact with students who were from different classes because they did not normally get to do so. Four students stated that one of the things that they liked most about working with students from other classes on the PBL unit was that the other students were "nice." Carrie stated that one of the two things that she liked the most about PBL were the students from the other classes with whom she got to work. Theresa's (the MoCD/MD/SCD teacher) and Sarah's (the MiCD teacher) students also perceived that collaboration was helpful in that Charlene's (the LD/ED teacher) students were "good students" (Carrie's words), and that the latter really tried to help the former. Observational data indicated that the students with LD and those with ED often tried to help Theresa's students to behave appropriately, and also tried to work with them while performing Internet searches. The teachers also expressed this perception of the collaboration process.

How do teachers perceive that their students collaborate with students with different special

needs?

Sarah (the MiCD teacher) and Theresa (the MoCD/MD/SCD teacher) noted that their

students became friends with some of the students from the other classes because of the

interactions during the unit, and they did not think that this would have happened without

carrying out the activities of the accessibility unit. Though observational data cannot verify the

development of friendship, it did indicate that students from different classes were often excited

to see each other.

Theresa noted that one of the reasons that her students really enjoyed collaborating with

Charlene's (the LD/ED teacher) and Sarah's students was because they usually don't get to do

so:

> Well, usually they are just by themselves in my room in a self-contained classroom, and
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> during this [the PBL unit] they got to go out into another classroom and be with a lot of
>
> other students, and they enjoyed doing that. And, in years past, when they weren't doing
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> a PBL unit they didn't have another class to work with.

Charlene and Sarah noted that their students showed caring and compassion for the students from

the other classes. Sarah said:

> There were some students who maybe felt like they were a little higher level students
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> *(sic)*, but they had the maturity to not flaunt that at the younger kids or the less able kids,
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> and saw it as a chance to be helpful and to encourage students who were maybe at a
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> lower level than they were, or maybe were not as physically capable as they were. They
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> saw it as a chance to be helpful to them, and I saw some maturity that I was very

impressed with, because I hadn't had the opportunity to see that in the regular classroom situations.

Overall, both teachers and students felt that the cooperation between students of different ages and ability levels was very helpful. Teachers perceived that the cooperation was helpful in that it helped foster affective development in their students. This was because the students had to practice interacting with diverse students and teachers, and so had the opportunity to advance their social skills in that regard. Students enjoyed the collaboration because the other students were perceived to be nice to talk to and interact with, and also were seen as helpful (in the case of Theresa's and Sarah's students).

How do teachers modify the PBL approach to make it work in a special needs classroom?

Charlene (the LD/ED teacher) stated that one distinguishing factor in the PBL unit design was the amount of guidance students in all three classes needed. Noting that some students needed more guidance than most average students, she explained that the teachers structured PBL class sessions with direct instruction for the first part of the period, and small group work for the remainder:

> It was pretty much a traditional class setting for this part [the first part of the period] where I would be in front of the classroom…they definitely had to watch me for instructions and listen to me, just again because some of the kids needed a lot more guidance than others.

Observational data indicated that the direct instruction potion of the class lasted, on average, 15-20 minutes during the unit, however it was shorter on days when the small groups went into the community to collect data and take pictures and video. In general, the instruction focused on what the students were expected to do during their small group work. Each week, the

teacher leading the instruction first helped students recall what they had done the previous week (as the classes met for the unit once per week). Subsequently, she focused on procedures that the students would follow, and provided an overview of the conceptual information that they would be encountering (e. g., curb ramp slope or Americans with Disabilities Act).

Charlene described how breaking the class sessions into different segments helped her students engage because "they were listening, they were doing, they were hands on, and it also allowed them to not have to focus on, 'Man I've got to sit here, I know I can't get up.'" The other teachers noted that the variety that the class structure offered in terms of small-group work, field trips in the community, and lecture appealed to their students as well. This statement was corroborated by comments from the majority of the students interviewed (*n*=5), who appreciated being able to go outside and do different things during the class period. Half of the students (*n*=3) also noted that they liked being able to do hands-on activities.

While working in small groups in the second part of the period, Charlene and Sarah perceived that their students became co-facilitators, which was noted by several students. Observational data indicated that Charlene's students tried to keep the behavior of their classmates with lower ability under control and often took the lead during group work. Andy stated that the thing he liked most about PBL was "helping the kids that are in that class." When asked to specify to which kids he referred, he said that he meant the students from the other two classes that participated in the unit (e. g., those with MiCD, MoCD, MD, and SCD). Sally saw the unit as "a good opportunity to help the other kids learn." David stated that the students with MiCD sometimes got "out of hand a little bit." Though he did not state this in the interview, observational data indicated that David attempted to keep his group mates' behavior under control on several occasions.

Summary

Both students and teachers perceived that the PBL unit on the accessibility of Brownsville was valuable for several reasons. Teachers perceived that PBL was of value to students in that it helped them meet a number of affective objectives. Specifically, all three teachers perceived that PBL helped their students to develop social skills. Charlene (the LD/ED teacher) noted that her students developed greater patience and understanding for others. Sarah (the MiCD teacher) and Theresa (the MoCD/MD/SCD teacher) indicated that their students all made individual improvements on social skills objectives on their IEPs. Sarah and Charlene noted that their students made gains in demonstrating appropriate behavior. All teachers stated that their students were able to be more engaged and stay more on task during the unit. Sarah and Charlene noted that their students showed greater maturity during the unit than they usually do. The maturity included feeling compassion for those with more severe disabilities.

Students perceived that PBL was of value to them because it allowed them to stay more on task and be more engaged due to its interesting and fun nature. The students with MiCD and LD/ED perceived that the unit helped them to feel more patient with and more compassion for lower ability students. All students also appreciated being able to interact and make friends with students with whom they usually do not get to interact. The students with MiCD also liked PBL because they got to interact with "good students." Students also reported learning content such as definitions of physical accessibility and what properties doors, sidewalks, and other infrastructure needs to have to be physically accessible. They also reported learning technical skills including digital video editing, working with digital pictures, and working with Microsoft PowerPoint© and Word©.

Discussion

Results of our study suggest that PBL units involving students with varied disabilities

have the potential to help students with special needs gain social skills, feel compassion for less

able students, gain self-esteem, and stay engaged in their learning. Observational data indicated

that the students in the present study were engaged during the unit, and both teachers and

students perceived that students were more engaged during the unit than during traditional

instruction. Many students in this study perceived that they were more engaged due to the fact

that they were working cooperatively with other students, which confirms the findings of Adams

et al. (1996). Another aspect of the unit that students perceived to be engaging was the fact that

the topic of the unit was the community of Brownsville, and how it can be improved for the

benefit of everyone. Looking at the accessibility of Brownsville was a real-world problem to

which the students could relate, which in turn seemed to help make the PBL unit meaningful to

the students (Ellis, 1998; Lee & Songer, 2003).

These findings are interesting for several reasons. First, as we noted previously, there is

little literature that examines how students with special needs respond to PBL. Our findings

contribute to an understanding of how students with special needs value solving real problems in

their community. Second, students and teachers in this study valued PBL because of many of its

characteristics that have been shown to be helpful to students with special needs: namely, its

authentic context (Scruggs et al., 1993), its experiential nature (Scruggs et al., 1993; Scruggs et

al., 1998; Udvari-Solner & Thousand, 1996), and its use of cooperative learning (Barley et al.,

2002; Gillies and Ashman, 2000; Jenkins et al., 2003; Malmgren, 1998). Third, and perhaps most

importantly, our findings indicate that PBL has the potential to work with students with special

needs. Students in this unit were engaged due to the characteristics of PBL listed above, which

suggests that students with special needs may be motivated by, and thus engage in a PBL unit. If this is true, then PBL may have the potential to raise the achievement motivation, and subsequently, the achievement, of students with special needs (Stipek, 2002). If this happens, then such students could potentially make the continuous and substantial improvement required by IDEA (2004) and NCLB (2001).

Additionally, many of the benefits that the students and teachers in this study perceived (e. g., improvement in patience, greater compassion for people who are less fortunate) were benefits that students attributed to working with students at a lower level than themselves. This finding is interesting because little literature explores what it means to student with special needs to work cooperatively with students with lower abilities. Osguthorpe and Scruggs (1986) reviewed the results of 26 empirical studies of students with special needs who served as tutors for students with more severe disabilities and/or younger students with special needs. The results of these studies generally indicated that the tutors gained academically and/or socially from serving as tutors.

Perhaps the benefits observed in this study, such as improvement in patience and greater compassion for people who are less fortunate, could be attributed to the dynamics of the interactions between students with mild disabilities and those with more severe disabilities. It was clear during the course of the study that the students with more severe disabilities tended to see the students with mild disabilities as tutors: the latter were perceived to be helpful to the former, and observation data confirmed that the interactions between students with mild and those with severe disabilities often took the form of the interactions between a tutor and a tutee. While these benefits may not be directly related to participating in a PBL unit, the fact that the unit involved students with various disabilities appeared critical. Still, this occurred within the

context of solving a meaningful problem, specifically a problem with which these students could identify. It is possible that the content as well as the context for the PBL unit helped the students develop compassion for others with more critical needs than their own. This suggests that more research is needed that examines the effects of allowing students with mild and moderate disabilities to work on academic units with students with severe disabilities. It also would be important to determine if the use of different PBL units had the same result.

Finally, our findings on how PBL was modified to make it work in a special needs classroom are important in that even in the little literature that examines the use of PBL with students with special needs there is little indication of the strategies that teachers used to make PBL work with their students. Before beginning the study we did not expect that the teachers in the class we studied would break class periods into direct instruction and small group work segments. The PBL literature base does not advocate the use of direct instruction. However, its use in a class with special needs makes sense, and students with special needs do need additional kinds of support that average, gifted, and university students – the students who served as participants for the majority of studies on PBL – do not.

Limitations and Suggestions for Future Research

The interviews for this study were conducted one and a half months after the end of the unit. This delay between the activities of the unit and the interviews may have caused many of the participants, especially the students with MiCD and MD, to be unable to recall specific examples when asked to describe their interactions with other students and their activities during the unit. However, the fact that students with MD and MiCD remembered anything specific from a class that met one period per week ending one and a half months prior to being interviewed is noteworthy. Their teachers stated that normally they do not remember many details from week to

week. However, the use of observations helped to triangulate our sources by allowing us to substantiate interview comments.

Future research should focus on the impact of PBL on the academic achievement of students with special needs. It is important that PBL be investigated as to whether it has a demonstrable impact on academic achievement of students with special needs. Frew and Klein (1982) suggested that in order for teachers to prepare students with special needs "for an independent life in our complex society, we must provide opportunities for them to expand their inquiry and discovery skills" (p. 100). In regular and gifted K-12 classrooms, and in medical school contexts, PBL has been shown to help students not only learn content, but also to expand their inquiry and problem-solving skills (Stepien & Gallagher, 1993; Stepien & Pike, 1997). Thus PBL might be an instructional framework that can help prepare students with special needs for life in today's complex society. Additional research with special education populations is needed to determine if this is so.

Overall Importance of Study

This study was exploratory in nature, and was not designed to determine definitively if PBL is an effective method of instruction for students with special needs. However, it provided some evidence that PBL can be beneficial to such students in the areas of motivation and social skills. Bryan (2005) and Cartledge (2005) wrote that affective outcomes for students with learning disabilities still receive little emphasis from teachers and schools. It is often assumed that inclusion will address the affective needs of students with mild disabilities; however little empirical research exists to support that claim (Dyson, 2001; Gresham & MacMillan, 1997). Our finding of positive affective outcomes of a PBL unit involving students with varying disabilities suggests that PBL may offer one means for increasing affective outcomes among this population

and warrants additional study (Cartledge, 2005; Gresham & MacMillan, 1997). Berninger (1997)

wrote, "A final myth that needs to be destroyed is that interventions directed to the

behavior/mental health and academic domains are mutually exclusive" (p. 332). If PBL can be

found to have a demonstrable effect on the academic performance of students with special needs,

then perhaps ultimately Berninger's myth can be destroyed.

References

Adams, N., Cooper, G., Johnson, L., & Wojtysiak, K. (1996). *Improving student engagement in learning activities*. Unpublished thesis. Chicago: Saint Xavier's University. [Eric Document Reproduction Service No. ED400076].

Barley, Z., Lauer, P. A., Arens, S. A., Apthorp, H. A., Englert, K. S., Snow, D., & Akiba, M. (2002). *Helping at-risk students meet standards: A synthesis of evidence-based classroom practices*. Aurora, CO: Mid-Continent Research for Education and Leaning. [Eric Document Reproduction Service No. ED475904].

Barrows, H. S., & Tamblyn, R. M. (1980). *Problem-based learning: An approach to medical education*. New York: Springer.

Berninger, V. W. (1997). Introduction to interventions for students with learning and behavior problems: Myths and realities. *School Psychology Review, 26,* 326-332.

Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar, A. (1991). Motivating project-based learning: Sustaining the doing, supporting the learning. *Educational Psychologist, 26,* 369-398.

Bottge, B. A. (2001). Building ramps and hovercrafts – and improving math skills. *Teaching Exceptional Children, 34(1),* 16-23.

Browder, D. M., & Cooper-Duffy, K. (2003). Evidence-based practices for students with severe disabilities and the requirement for accountability in "No Child Left Behind." *Journal of Special Education*, *37,* 157-163.

Bryan, T. (2005). Science-based advances in the social domain of learning disabilities. *Learning Disability Quarterly, 28,* 119-121.

Cartledge, G. (2005). Learning disabilities and social skills: Reflections. *Learning Disability Quarterly, 28,* 179-181.

Cerezo, N. (2004). Problem-based learning in the middle school [Electronic version]. *Research in Middle Level Education*, *27(1),* 20-42.

Dyson, A. (2001). Special needs in the twenty-first century: Where we've been and where we're going. *British Journal of Special Education, 28,* 24-29.

Ellis, E. S. (1998). Watering up the curriculum for adolescents with learning disabilities-part 2. *Remedial and Special Education, 19,* 91-105.

Ervin, A. (2002). Meat loaf around the world. *Learning and Leading with Technology, 29(5),* 18-21.

Frew, T. W., & Klein, N. K. (1982). Instructional models for children with special needs. *Theory into Practice*, *21,* 97-105.

Gallagher, S. A., Sher, B. T., Stepien, W. J., & Workman, D. (1995). Implementing problem-based learning in science classrooms. *School Science and Mathematics, 95,* 136-146.

Gallagher, S. A., Rosenthal, H., & Stepien, W. J. (1992). The effects of problem-based learning on problem solving. *Gifted Child Quarterly, 36,* 195-200.

Gijbels, D., Dochy, F., Van den Bossche, P., & Siegers, M. (2005). Effects of problem-based learning: A meta-analysis from the angle of assessment. *Review of Educational Research, 75,* 27-61.

Gillies, R., & Ashman, A. (2000). The effects of cooperative learning on students with learning difficulties in the lower elementary school. *The Journal of Special Education*, *34*, 19-27.

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research.* Chicago: Aldine.

Gresham, F. M., & MacMillan, D. L. (1997). Social competence and affective characteristics of students with mild disabilities. *Review of Educational Research, 67,* 377-415.

Hanushek, E. A., Kain, J. F., & Rivkin, S. G. (2002). Inferring program effects for special populations: Does special education raise achievement for students with disabilities? *Review of Economics and Statistics, 84,* 584-599.

Hmelo, C. E., & Ferrari, M. (1997). The problem-based learning tutorial: Cultivating higher-order thinking skills. *Journal for the Education of the Gifted, 20,* 401-422.

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational Psychology Review*, *16,* 235-266.

Ibler, L. S. (1997). *Improving higher order thinking skills in special education students through cooperative learning and social skills development*. Unpublished masters thesis. Chicago: Saint Xavier University. [Eric Document Reproduction Service No. ED410732].

Individuals with Disabilities Education Act. (2004). P.L. 108-446.

Jenkins, J. R., Antil, L. R., Wayne, S. K., & Vadasy, P. F. (2003). How cooperative learning works for special education and remedial students. *Exceptional Children*, *69*, 279-292.

Johnson, D., & Johnson, R. (1996). Cooperation and the use of technology. In D. Jonassen (Ed.), *Handbook of Research for Educational Communications and Technology* (pp. 1017-1044). New York: MacMillan Library Reference.

Lee, H., & Songer, N. B. (2003). Making authentic science accessible to students [Electronic version]. *International Journal of Science Education*, *25*, 923-948.

Malmgren, K. W. (1998). Cooperative learning as an academic intervention for students with mild disabilities. *Focus on Exceptional Children*, *31(4),* 1-6.

Mastropieri, M. A., Scruggs, T. E., Boon, R., & Carter, K. B. (2001). Correlates of inquiry

    learning in science. *Remedial and Special Education, 22,* 130-137.

No Child Left Behind Act. (2001). P.L. 107-110.

Osguthorpe, R. T., & Scruggs, T. E. (1986). Special education students as tutors: A review and

    analysis. *Remedial and Special Education, 7(4),* 15-25.

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd Ed.). Thousand Oaks,

    CA: Sage.

Pogrow, S. (1988). HOTS: A thinking skills program for at-risk students. *Principal*, *67(4),* 19-

    24.

Rojewski, J. W., & Schell, J. W. (1994). Cognitive apprenticeship for learners with special

    needs. *Remedial and Special Education, 15*, 234-243.

Savery, J. R., & Duffy, T. M. (1995). Problem-based learning: An instructional model and its

    constructivist framework. *Educational Technology, 35(5),* 31-38.

Scruggs, T. E., Mastropieri, M. A., Bakken, J. P., & Brigham, F. J. (1993). Reading versus

    doing: The relative effects of textbook-based and inquiry-oriented approaches to science

    learning in special education classrooms. *The Journal of Special Education*, *27,* 1-15.

Scruggs, T. E., Mastropieri, M. A., & Boon, R. (1998). Science education for students with

    disabilities: A review of recent research. *Studies in Science Education*, *32*, 21-44.

Slavin, R. E., & Madden, N. A. (1989). Effective classroom programs for students at risk. In

    Slavin, R. E., Karweit, N. L., & Madden, N. A. (Eds.), *Effective programs for students at risk*

    (pp. 23-51)*.* Boston: Allyn and Bacon.

Stepien, W., & Gallagher, S. (1993). Problem-based learning: As authentic as it gets.

    Educational Leadership, 50(7), 25-28.

Stepien, W. J., & Pike, S. L. (1997). Designing problem-based learning units. *Journal for the Education of the Gifted, 20,* 380-400.

Stipek, D.J. (2002). *Motivation to learn: Integrating theory and practice*. Boston: Allyn and Bacon.

Udvari-Solner, A., & Thousand, J. S. (1996). Creating a responsive curriculum for inclusive schools. *Remedial and Special Education*, *17*, 182-192.