Running Head: PROBLEM-BASED LEARNING IN THE ELEMENTARY CLASSROOM

Problem-Based Learning in the Elementary Classroom: Changing Role of Teacher in the 21st Century

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In partial fulfillment of the requirements for ED 565
Instructor: Dr. S. Winn Tutwiler
December 17, 2010

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INTRODUCTION

Teaching is a team effort (West, 2010). Blake West, president of the Kansas National Education Association, knows that students learn best when we focus on fewer outcomes, with deeper levels of understanding. This increases the rigor of student work and helps students learn not only the traditional outcomes, but also essential skills for preparing for the 21st century like, critical thinking, collaboration, communication, and creativity.

Although I strongly agree that students need to be engaged in real-world projects with relevance to them, I still spend a tremendous amount of my time in the classroom teaching in a way as to prepare students for high-stakes assessments and work-place readiness using traditional instruction models. At this moment, student scores on state standardized testing have become the motivation for instruction in the classroom. In part, I believe this is because the immediate incentive for successful test scores is greater than that of future student success outside of the school setting. I believe this is dreadfully wrong thinking, but how do I change what happens in my classroom and still have students perform well on state assessments? What will it take to make the change in role from teacher to coach in the classroom? For me….I want assurance that student motivation and achievement is increasing, not only on state assessments, but on 21st century skills that will prepare them for their ever-changing future. Problem-based learning changes the role of student/teacher and addresses the skills required in the 21st century, but does it in fact increase student achievement on standardized assessments, science process skills and analytical thinking, and motivation compared to traditional teaching methods?

REVIEW OF RELATED LITERATURE

It's not that I'm so smart, it's just that I stay with problems longer (Harris, 1995). The intellectual inspiration for Problem-Based Learning began with the type of learning methods used by Socrates. According to Brickhouse and Smith (2000), “the Socratic method is one in which a teacher, by asking leading questions, guides students to discovery.” It was a style of learning that entailed a question-and-answer dialectical approach. John Dewey, an educational reformer, also referred to this type of discovery-based learning and engagement in 1960’s. More recently, the term Problem-Based Learning began early in the 1970’s at a medical school at McMaster University in Canada. Most of its early history involves the education of medical students. In the past twenty years or so, PBL has extended into the elementary, secondary, and trade school classrooms.

Problem-Based Learning, as defined by Barrows (2002), has four components. It consists of an ill-structured problem that is unresolved. This allows students to generate causes and thoughts about solving the problem. Secondly, the approach is student-centered and students determine what they need to learn, what the key issues are, and pursue and gain useful and meaningful knowledge. Thirdly, in a PBL environment, teachers serve as facilitators and tutors, guiding students by asking provoking, thoughtful questions. And lastly, problems are always authentic and related to real-world practice. Maudlsey (1999) cautions that the term, Problem-Based Learning can refer to different concepts. Just because a problem is involved, it does not mean that the PBL instructional methodology is being used.

Multiple studies present the overwhelming benefits of Problem-Based Learning in light of 21st century educational outcomes. Rhem (1998) states that the information explosion brought about by technology have made “just covering the material” more and more difficult to manage in the classroom. We live in a technology-rich environment loaded with an abundance of information. As important as the information itself, is what we do with it. Students will need to take initiative and be self-directed. It is essential that they communicate and collaborate with others in an environment that encourages critical thinking and problem solving skills. Problem-Based Learning, by its very nature, not only encourages these skills, but requires them. They feel like they are acting like scientists, and they are (Sterling, 2007). Students work collaboratively to research problems, conduct hands-on activities, incorporate new information, and make informed recommendations based on their findings. Overwhelmingly, many studies show evidence of PBL as the favored, more effective approach to learning in the areas of performance/skill-based assessments, application of knowledge and principles, and long-term retention of knowledge (Stobel & van Barneveld, 2009; Ravitz, 2009).

Another benefit from the use of PBL in the classroom is its effectiveness beyond standardized testing. A Problem-Based Learning approach tended to produce similar outcomes as traditional methods on short-term standardized testing, but greatly exceeded the same methods on long-term retention of knowledge. The results clearly favor PBL when measuring application of knowledge and principles (Walker & Leary, 2009; Savery, 2006). With the paradigm shift in education away from rote-learning and memorization of information, application of knowledge and principles is increasingly essential to student success beyond the classroom.

Still another promotion of PBL in the classroom is the aspect of student motivation. There is no denying that student time-on-task is essential to their acquisition of knowledge. Partnership for 21st Century Skills (2010) challenges educators to imagine students that can hardly wait to arrive at school and classrooms with little or no discipline problems because students are so engaged in their studies that those problems disappear. One of the largest advantages is the enthusiasm and the sense of being an instructional designer that students take with them when they have finished their work (Wilson & Schweir, 2009). Uniformly, practitioners agree on several things: they've seldom felt as energized about their teaching and seldom seen their students so motivated and involved (Rhem, 1998).

Although Problem-Based Learning definitely has its advocates, there are also those (Kirschner, Clark, and Sweller, 2006) who argue that it fails to provide necessary guidance and lacks effectiveness in the area of short-term retention. Although several studies debated similar issues, the findings were inconsistent because of differences in defining effectiveness of learning, and how effectiveness was measured (Strobel and van Barneveld, 2009). Another shortcoming of PBL is the lack of research in the field of elementary education. Most research that has been done is in the field of medicine and do not easily extend to the public school classroom. More needs to be done in this area that includes specific techniques such as scaffolding, coaching, and modeling strategies for the successful facilitation of PBL (Strobel and van Barneveld, 2009). Finally, there needs to be a clear definition of what exactly PBL is and what its components are. Many studies shared similar aspects, but no two used exactly the same model or process. This makes it difficult to compare the effectiveness of PBL.

My own educational belief of allowing the child's natural curiosity to direct his/her learning meshes well with the PBL philosophy. I want to discover if in fact the use of Problem-Based Learning will not only sustain standardized test scores, science process skills and analytical thinking, and motivation in my students but increase compared to that of traditional instruction.

STATEMENT OF RESEARCH QUESTIONS

1. Is there a significant difference in student achievement scores based on teacher delivery method: project-based learning or traditional instruction?
2. Is there a significant difference in science process skills and analytical thinking scores based on teacher delivery method: project-based learning or traditional instruction?
3. Will the use of Problem-Based Learning instruction increase student motivation in comparison to Traditional instruction?

RESEARCH DESIGN

The participants in this study will be thirty-seven students in the third grade. Participants include twenty-six regular education students and eleven special education students. The specialties include behavior disorders, learning disabilities, and autism. All students speak English as their first language. Students are between the ages of 8 and 9 years of age. Twenty-four of the students are female, and thirteen of the students are male. The students attend science class for 45 minutes, four days a week. The third graders receiving PBL in science (experimental sample) will be compared with a corresponding group (control sample) receiving the same instruction in traditional, thematic format. This experimental research has an independent variable, the exposure to Problem-Based Learning methods and several dependent variables, test scores and level of student motivation. The goal of this research is to determine if PBL has a significantly positive effect on student achievement, science process skills/analytical thinking, and student motivation.

INSTRUMENTS/MATERIALS

- Two types of lesson plans: to include lessons plans of project-based instruction and of traditional, thematic instruction.
- Achievement test with thirty items of four choices
- Science Process Skills/Analytical Thinking Skills Assessment
- Science Motivation Questionnaire (Appendix A)

To validate the results of this study, I will use a t-test to assess whether the two groups, those exposed to PBL and those exposed to Traditional instruction are statistically different from each other in the areas of standardized testing, science process/analytical thinking skills, and student motivation.

PROCEDURE

All third grade students will be exposed to science instruction four days a week, over an eight-week period, for 45 minutes a day, from the same instructor. Both groups will cover the same science content and use similar print, video, and computer resources. The comparison group will be exposed to traditional instructional techniques such as vocabulary lessons, coverage of specific concrete knowledge through teacher-led discussions and print material, and experiments from text. The experimental group will be using elements of Problem-Based Learning as defined by Howard (2002) and Long, Drake, and Halychyn (2004) for elementary school students. This model will include four steps: 1) Engagement: a problem is presented to the student and any roles are explained for cooperative group. 2) Inquiry/Investigation: students determine what they already know, what information they need to know, and how they will acquire the new information. 3) Problem Resolution: students analyze their options and decide on an action or a decision. 4) Debriefing: students discuss the content they have learned and how it may be useful in new situations in addition to the processes involved in solving the problem. At the conclusion of the eight-week period, both groups will be given an achievement test with thirty items of four choices, a science process skills/analytical thinking assessment, and a science motivation questionnaire (Appendix A).

It is assumed that the instructor is well-trained and informed of both traditional and PBL instructional methods, has access to materials for all students, and has the ability to adjust to student needs as seen fit. Some limitations to this study may include daily attendance of teacher and students involved, pre-existing attitudes of students toward material, and prior knowledge of students regarding subject matter.

DATA ANALYSIS

T-tests will be conducted using the data collected from the student achievement test, science process/analytical thinking assessment, and the science motivation questionnaire. Comparing the means of the tests will determine if the use of PBL method is significant in any or all of the three categories. Significance in the use of Problem-Based Learning will determine if change in teacher instruction methods is warranted in the area of science instruction with elementary students. It could also support policy change in curriculum design and procedures at the district level.

TIME SCHEDULE

- January – Submit research proposal to school superintendent, board, and principal (see Appendix B)
- February – Submit letters to parents/guardians of third grade students and obtain permission for their child to participate in the research project
- March – Begin the eight-week research period
- May – Conclude the eight-week research period, analyze data, prepare a summary for presentation to the school board, superintendent, and principal.

BUDGET

Less than $100 – Lessons plans and materials will come directly from resources already purchased by the school district. Additional materials can be acquired at little to no cost from Internet resources. Any use of printed materials is already assumed in the classroom budget. I foresee no additional costs at this time.

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Appendix A

Science Motivation Questionnaire

1. I enjoy learning the science.
   - Never
   - Rarely
   - Sometimes
   - Usually
   - Always

2. I like science that challenges me.
   - Never
   - Rarely
   - Sometimes
   - Usually
   - Always

3. I am nervous about how I will do on the science tests.
   - Never
   - Rarely
   - Sometimes
   - Usually
   - Always

4. If I am having trouble learning the science, I try to figure out why.
   - Never
   - Rarely
   - Sometimes
   - Usually
   - Always

5. Earning a good science grade is important me.
   - Never
   - Rarely
   - Sometimes
   - Usually
   - Always

Appendix A

Science Motivation Questionnaire, cont.

6. I put enough effort into learning the science.
    - Never
    - Rarely
    - Sometimes
    - Usually
    - Always

7. I think about how the science I learn will be helpful to me.
    - Never
    - Rarely
    - Sometimes
    - Usually
    - Always

8. I worry about failing the science tests.
    - Never
    - Rarely
    - Sometimes
    - Usually
    - Always

9. I find learning the science interesting.
    - Never
    - Rarely
    - Sometimes
    - Usually
    - Always

10. I hate taking science tests.
    - Never
    - Rarely
    - Sometimes
    - Usually
    - Always

Appendix B

Letter to School District

January 1, 2011

Nancy D. Springer
5817 SW Davis Road
Topeka, Kansas 66610

Mission Valley Elementary
12913 Mission Valley Road
Eskridge, Kansas 66423

To whom it may concern:

The purpose of this letter is to inform you of my interest in carrying out a research project with the students in the third grade classrooms at Mission Valley Elementary.

My intention is to conduct this action research project in an effort to improve upon the teaching practices in my classroom. I will be conducting research that measures the value of project-based learning and traditional, thematic instruction in three areas; standardized testing, performance-based assessments, and student motivation. Please review my attached research proposal for approval. Prior to beginning the research project, parents of participating students will be notified and permission for participation will be obtained. Upon approval, I would like to begin the project by February 1, 2011.

Sincerely,

Nancy D. Springer

Appendix C

Parent Letter for Consent

Nancy D. Springer
Mission Valley Elementary
12913 Mission Valley Elementary
Eskridge, Kansas 66423
785. 449.2281

Dear Parent(s) or Guardian(s):

Beginning in January, I would like to begin a research project that includes some changes in teaching instruction and student learning. I will be comparing the value of traditional, thematic instruction compared with project-based learning methods. The goal of this research is to help identify the best delivery method that ensures student success on standardized testing as well as performance based in addition to being highly motivational.

I want to assure you that any changes made will not depart from the curricular requirements of our school district. These changes are in an effort to enhance and add to the current benefits that your child is already receiving.

As a result of this research project, your child will be exposed to Problem-Based Learning. Their roles as a student are very different from that of traditional learning methods. They will be required to work collaboratively to research problems, conduct hands-on activities, incorporate new information, and make informed recommendations based on their findings. Upon completion of the science unit, they will be required to take two different types of assessments; standardized and performance based, as well as a motivation questionnaire. All results of these assessments and questionnaires will remain anonymous and will not be part of your child's grade for science. They will simply be learning tools for the research project.

By signing and returning the permission form, you are allowing your child to participate in the above mentioned research.

Sincerely,

Nancy D. Springer
Mission Valley Elementary

I, ________________________________ give permission for my child, ____________________ to be a participant in the above research project, which includes testing and a questionnaire. I understand that my child will be asked questions regarding the research project and that their answers will remain anonymous.

Signature: ____________________________________ Date: __________________________