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Andrews University

School of Education

PERCEPTIONS OF PROBLEM-BASED LEARNING AND  
ATTITUDES TOWARDS ITS ADOPTION AMONG  
K-12 TEACHERS IN SEVENTH-DAY  
ADVENTIST SCHOOLS IN FLORIDA

A Dissertation

Presented in Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

by

Eileen A. Pilliner

March 2003

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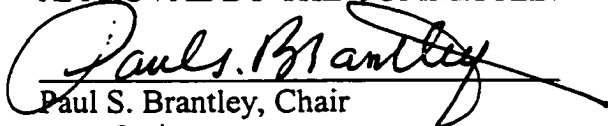
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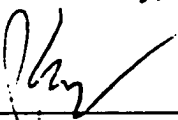
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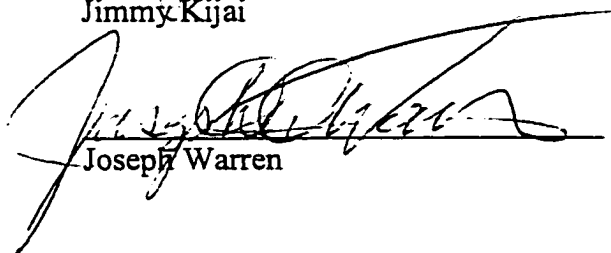
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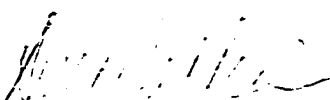
  
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ABSTRACT

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K-12 TEACHERS IN SEVENTH-DAY  
ADVENTIST SCHOOLS IN FLORIDA

by

Eileen A. Pilliner

Chair: Paul S. Brantley

## ABSTRACT OF GRADUATE STUDENT RESEARCH

Dissertation

Andrews University

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Title: PERCEPTIONS OF PROBLEM-BASED LEARNING AND ATTITUDES  
TOWARDS ITS ADOPTION AMONG K-12 TEACHERS IN SEVENTH-  
DAY ADVENTIST SCHOOLS IN FLORIDA

Name of researcher: Eileen A. Pilliner

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Date completed: March 2003

### Problem

One of the founders of Seventh-day Adventist education, Ellen G. White, advocated learning through practical experiences and critical thinking. In 1997, the Seventh-day Adventist Church recommended problem-based learning (PBL) as a preferred teaching practice for its North American K-12 schools. However, Brantley and Ruiz observed that many Seventh-day Adventist educators feel inadequate to use this method of instruction. Little information exists anywhere concerning teachers' awareness and perceptions of problem-based learning (PBL) or factors related to its use.

This study examined the relationship between PBL, philosophy of teaching, preferences for PBL teaching components, and perceived barriers to PBL adoption and use.

### Method

An ex post facto survey was conducted among a convenience sample of 315 K-12 teachers in 50 schools in Florida. Four instruments were used to gather data to answer four research questions. The same instruments were administered to a group of experienced PBL teachers and results were compared to the Adventist group.

### Results

The majority of Seventh-day Adventist K-12 teachers in Florida are unaware of problem-based learning (PBL). Teachers who embrace a student-centered teaching preference are more likely to be aware of PBL.

Little more than half the teachers have a student-centered teaching philosophy, and less than half appreciate the student-centered teaching components of PBL. Teaching philosophy is related to the teachers' age and preference for PBL teaching components. More female than male teachers embrace the student-centered components of PBL.

The greatest perceived barriers to teacher implementation of PBL included (1) assessing and reporting student learning, (2) allowing students' needs and interests to determine pace and content of curriculum coverage, (3) a loosely structured, sometimes noisy learning environment, and (4) system unwillingness to provide PBL support sources. The majority of the teachers did not identify factors that would deter them from implementing problem-based learning.

## Conclusions

Although most Seventh-day Adventist teachers are unaware of PBL and seem to embrace a teacher-centered teaching philosophy, they appear willing to learn about the method and to implement it in their classrooms. However, they do not expect support from their school systems, parents, and colleagues, as preconditions to successful adoption.

It should be noted that the major barriers to PBL adoption appear to be reflective of the teaching philosophy of the school systems, parents, and teachers. Addressing these barriers is likely to increase the possibility that successful adoption will take place.

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## CHAPTER 1

### INTRODUCTION

Critics of traditional education comment upon how artificial and unlike the real world schooling is today. The curriculum is fragmented into subject areas, and a bell ringing at some prearranged time often interrupts students' study. In the real world, life's activities are integrated, and individuals stay with a task until it is completed, or a natural break in time occurs (Knight, 1998).

Too many students in traditional classrooms today complain that school lacks relevance; that they are bored. They see little connection between what they study and what they do repeatedly every day (Nagel, 1996). Students seem to have short attention spans and little time to sit and listen to teachers disseminate knowledge. Sousa (1998) explained that the restlessness and lack of interest in learning is a result of changes in the learners' environments. He described the changes as fast-paced living and an ever-changing multimedia-based culture that cause stress and affect the way the brain learns.

Consequently, educators such as Brooks and Brooks (1993), Caine and Caine (1997), Eastin (1999), Toffler (1970), Tucker and Coddling (1999), and Wiggins and McTighe (1998) posit that the education offered in most schools is obsolete and inadequate to prepare citizens for a decent life in the 21st century or for economically productive roles. Eastin stated, for example, that our current educational system is not preparing enough of its young people with skills that the job market will require in the

21st century, and that we cannot continue to borrow overseas talents, but that we need to grow our own (p. 18). Jackson (1993) and Levy (1996) admonished teachers to implement practices that will encourage student-to-student interaction, foster cooperative learning, expose students to interdisciplinary curriculum, and impress students that they are responsible for their own learning. Glasgow (1997) and Marsh (1999) posited that schools' functions should include teaching of problem-solving skills and learning strategies, teaching students to use their minds, to acquire and evaluate the usefulness of knowledge, to reason, to serve the workforce, to be knowledgeable, functional members of a society; and to prepare students "to manifest the fullness of their humanity in their thoughts, their feelings, and their deeds" (Levy, 1996, p. 3). Gallagher (1998) posited that efforts at educational reform advocate that all students be given educational opportunities for acquiring critical thinking and problem-solving skills.

Society is dissatisfied with students' learning. Students appear to have little depth of knowledge. Although they may be able to state their opinions clearly, they cannot provide sufficient details in support of their opinions. While they may seem to understand simple passages, more complex ones baffle them. For example, Shanahan, Robinson, and Schneider (1995) state that although some students may possess reasonable amounts of awareness of content in knowledge of social studies and science, they do not understand the meanings and how ideas relate to each other.

Teachers, students, and parents often have adversarial relationships because teachers tend to blame the home when students do poor work, and parents blame it on the teachers and the schools. Some parents express concern that they have "bright" students who repeatedly make poor grades in school, and these parents blame their children's

poor performance on the absence of challenges caused by the way schools traditionally deliver instruction. They feel that the students are too often only required to read books, or listen to lectures and then complete workbook pages. Such activities demand little more than regurgitation of information, and do not prepare students to think critically, or to solve authentic problems.

Additionally, students who are usually esteemed to be among the brightest are those who score high on standardized tests. However, even these students cannot often transfer learning to real-life situations. Without a depth of understanding, they seem to forget the information they appeared to have mastered earlier. Caine and Caine (1997), Jensen (1998), Languis (1998), and Sousa (1998) compare such surface knowledge with the knowledge that results when educators use the results of brain research. It is the latter kind of knowledge that results in deeper understanding and retention, and that can be called upon for real-world application. It is this kind of knowledge that can be transferred from one situation to another in solving real-world problems. It is this kind of knowledge that students need to acquire if they must understand and retain information.

The evaluations that schools receive currently indicate that they are not accomplishing their goals satisfactorily (Brooks & Brooks, 1996; Caine & Caine, 1993; Dewey, 1916/1944; Gallagher et al., 1995; Glasgow, 1997; Levy, 1996). Postman, Silberman, and Weingartner (cited in Knight, 1998) suggested that the failing educational system may be due to educational leaders always creating new techniques without a purpose or goal in mind. They claimed that the absence of purpose causes educational decisions that are made daily concerning classroom and children's learning to be inconsistent in the use of methods and materials. Levy (1996) wrote:

Perhaps that is why our pedagogy sways with the current of the latest educational fads and innovations. If we try to serve the fruit without any knowledge of the root we can deliver a tasty meal or two, but we will not be able to sustain growth. When the fruit is gone, we will look for a new tree. (p. 2)

Additionally, society's needs are changing and students' needs are changing, so that more dynamic teaching and learning styles that match a fast-changing society should be employed. Today, knowledge is quite short-lived making it necessary for people to have the ability to acquire new information throughout their lifetime. Therefore, schools must teach individuals to be lifelong learners. Educators are asked to teach students to think, solve problems, work together in teams, and be creative. Glasgow (1997) suggested that educators look to the real world for an educational model that will make education more relevant. The real world is integrated, multi-disciplinary, and interdisciplinary, and requires continued learning and problem solving. Besides, the most innovative and successful education occurs in corporate America where assessment is accomplished by the performance of the worker. If teachers want to be successful at what they do, they should observe the skills and practices that make people successful in the real world and create curricula that would provide those skills for students. According to Caine and Caine (1997) and Glasgow (1997), schools are still operating on a paradigm that does not meet the needs of today's society. Therefore, there are calls for reform and restructuring so that schools may prepare individuals for life in the 21st century.

Seventh-day Adventist (SDA) church schools have been designed to prepare workers to carry out the work of the Seventh-day Adventist Church. Ellen White, a prominent 19<sup>th</sup>-century leader in the SDA church and principal contributor to the principles of Adventist education, wrote that education should develop students in a balanced way, giving them practical experiences and enabling them to become good

thinkers who can complete assignments, make good judgments, and appreciate the interdependencies of different areas of life. She condemned our current practice for taking too narrow and too low a range, and recommended a higher aim, one that should develop students mentally, physically, and socially by giving them practical applications (White, 1923, 1903/1952).

Some educators (Brantley & Hwangbo, 2000) feel that Seventh-day Adventist schools fail to implement the kinds of instructional methodologies that reflect their high principles of education, as enunciated by White, one of the founders of Seventh-day Adventist education. White (1923) wrote that

children go through the routine of study mechanically, but do not retain that which they learn. Many . . . seem almost destitute of intellectual life. . . . They have not an inward love of thought, and an ambition to acquire knowledge. They do not encourage in themselves habits of reflection and investigation. (pp. 26-27)

The most useful education she said is both practical and literary, so that both should be combined (White, 1954).

Recognizing the deficits in traditional Adventist education, church leaders have recommended the use of problem-based learning as an instructional method that should prove useful to many Seventh-day Adventist schools (Curriculum Futures Commission, North American Division, 1997). This method embraces one tenet of the philosophy of Seventh-day Adventist education that students should be given opportunity to discover for themselves and not merely accept what others tell them (White, 1903/1952).

### **Problem-Based Learning**

Problem-based learning (PBL) is an instructional approach that initiates learning by presenting students with an ill-structured, real-life problematic scenario from which

they have to identify the real problem. The scenario is usually centered around the curriculum, and so, as the students hypothesize and seek for solutions to the problem, they actually acquire knowledge based upon the curriculum they have to learn. The students are allowed to work in their learning styles, individually, and/or in groups, and can choose many ways of presenting the solution, usually to a real audience. The teacher acts as a facilitator of learning and uses probing questions to guide students to arrive at the best or most defensible solution to the problem.

In problem-based learning, the students first encounter a problematic situation, which becomes the stimulus for hypotheses. The students next conduct inquiries to test the hypotheses. As discussions ensue, hypotheses may change; students gather information from many sources, traditional and non-traditional, and try to arrive at a solution to the problem. They will then select the most defensible solution and present this to their audience. They are able to present in whatever style or method they choose.

During the process, students work individually, or in groups, and use the learning style with which they are most comfortable. Because the problem is a real-life one, the students have the pleasure of acting as stakeholders. The problem is theirs and they decide how to resolve it. Of course, in the first place, the ingenious teacher creates the scenario around curricular material so the students' work enables them to acquire and learn curriculum information. After creating and presenting the scenario, the teacher is then a facilitator, coach, and a resource person giving information only as it is asked for and using appropriate questions to move students along.

Throughout the students' engagement with problem-based learning, assessment occurs. Through discussion they are discovering what they know, what they need to

know, or are learning, and the coach is observing those who are doing well and making progress, or those who need extra assistance. The final evaluation is the product of their findings and not a test.

Problem-based learning presents teachers with a way to make instruction meaningful while managing time effectively. It is also a way to motivate students to dig deeper into what they are studying, find meaning in it, see and understand relationships, study subjects as part of a more complete picture, enjoy learning, and retain the learning. In so doing, students work with and inquire more deeply into bigger ideas than they would in a traditional separate-subject curriculum.

Problem-based learning allows students and teachers to interact to create a curriculum that moves them toward identified goals as together they determine procedures for solving problems. It meaningfully integrates the curriculum around themes or topics rather than around subject areas such as reading, science, or mathematics. When integrated, such subjects are brought together as part of a meaningful whole, and will interest the students and motivate them to accept more responsibility for their work.

The method, by being inherently interdisciplinary or adaptable to integration, helps students to see the real-world connection and to make learning more meaningful. Students are able to have some control as to how they get involved in the learning, are able to exercise choice, and their own style of learning can be practiced. The teacher will then become a guide, a coach, a facilitator, and a resource, and can better prepare an environment that is stimulating to, and supportive of, the student. The method can be used to meet curriculum requirements while at the same time allowing students to go



beyond required learning. Students have been observed to remember the learning long after they have experienced the projects (Delisle, 1997; Sage, 1996; Stepien & Gallagher, 1993; Torp & Sage, 1998).

Problem-based learning has been used extensively in medical schools in the United States and Canada and in other non-medical higher institutions of learning, with very successful results. The students have become self-directed, life-long learners with the ability to transfer and recall learning, and to solve problems. It is an enjoyable way of teaching curriculum meaningfully, with relevance and at very little additional cost, with no large budgetary increase for its implementation and requiring no mandate from state legislature (Alper & Fendel, 1996; Aspy, Aspy, & Quinby, 1993; Barrows & Tamblyn, 1980; Stepien & Gallagher, 1993).

Through problem-based learning methods, students can acquire information in their learning styles. Thus faculty members can show sensitivity to the differences children bring to the classroom. Lessons may be matched to students' learning styles to help poorly prepared students and new college students, who are the ones most likely to drop out of school (Claxton & Murrell, 1987). Research has shown and continues to show that when a brain-compatible approach is exercised in a classroom, "students of all backgrounds and ages, with every imaginable history of failure, and with lifelong discouraged attitudes can, and have succeeded with this approach" (Jensen, 1998a, p. viii). Problem-based learning is a brain-compatible approach to learning, supported by the literature review in the next chapter.

Used with its multi-disciplinary, interdisciplinary, and integrated components, problem-based learning will meet curricular goals. Its curricular style offers teachers a flexible, yet cohesive model in which to address the limits of the more traditional (secondary) school methodologies. (Glasgow, 1997, p. 9)

Glasgow said that most of the support for the use of problem-based learning has been anecdotal and intuitive but positive, and although much of the research centers around its use in medical schools, problem-based learning can be used successfully in secondary school settings. The method is attractive both to more motivated and academic students, to students with a wide range of abilities, and to other students whom the program allows to work in the style that meet their needs, and maximize their potential for success.

Problem-based learning can be used in most teaching modalities but seems to be most suited for multidisciplinary and interdisciplinary learning and teaching styles. It can also be employed with single subjects without being integrated with others so that "it can exist independently within the confines and be successfully employed as an instructional device within many curricular modalities" (Glasgow, 1997, p. 39). Where the method has been used, teachers and students report gains in academic achievement, children enjoy learning, retain longer, have better depth of understanding, can solve problems, exercise higher-order thinking skills, work together cooperatively, and practice creativity and independence (Alper & Fendel, 1996; Aspy et al., 1993; Delisle, 1997; Sage, 1996; Stepien & Gallagher, 1993; Torp & Sage, 1998).

Stepien and Gallagher (1993), in describing PBL, asserted that this type of learning motivates students because they know why they are learning the information--to solve a problem. They retain information better because they are grappling with a problem to solve, and they recall the information more easily because they learn in a way that stores knowledge in memory patterns that make for easier recall of information.

Medical school educator Howard Barrows developed problem-based learning in the mid-1960s to allow students, while they studied medicine, to act as physicians so they

would integrate, use, and reflect on information and apply it appropriately. Prior to the use of problem-based learning, student physicians were forgetting medical information soon after tests and failing to apply the information to real-life situations (Barrows & Tamblyn, 1980). Based upon its successful use in medical schools, a growing number of K-12 schools have used problem-based learning to improve student achievement, teach children to think, solve problems, and work together cooperatively (Bleich, p. vii, cited in Delisle, 1997).

### **Differences Between Problem-Based and Project-Based Learning**

Problem-based learning differs from the more traditional project-based learning in the following three ways as recorded by Levin, Dean, and Pierce (2001, p. 124):

1. PBL focuses on the problem and its solutions; products are a part of the solution. Project-based learning focuses on projects or products.
2. PBL requires that learners research and study information to generate several possible solutions to a problem. Project-based learning concentrates on creating a product or project.
3. PBL usually involves cooperative group work. In project-based learning, learners are more likely to work autonomously on their projects (p. 124).

Woods (1991) added a fourth difference:

4. In PBL environment, the problem drives the learning. It is posed *before* knowledge is provided through instruction. In project-based learning, problems are posed after knowledge is provided through instruction.

Stepien and Gallagher (1993) provided a fifth difference. They declared that

5. In PBL the problem does not test skills; it helps in development of skills. In project-based learning, the problem tests skills.

In 1997, the North American Division (NAD) K-12 Board of Education that oversees the SDA educational system published its *FACT 21* report. This was the result of the work engaged in by the North American Division Curriculum Futures Commission, a 16-member sub-committee commissioned by the Division's Office of Education "to develop suggested changes for curriculum reaching into the 21st century in Seventh-day Adventist secondary schools" (p. 2). They later wrote that the Commission's recommendations also applied to all K-12 schools.

According to the authors:

The Seventh-day Adventist K-12 educational system stands on the edge of one of the most exciting periods in the church's history. As we enter the 21st century, Adventist education will build on the strengths of the past to create a new future. (Curriculum Futures Commission, North American Division, 1997, p. 2)

In this report, problem-based learning was recommended as an educational strategy that has the potential to improve the educational programs of K-12 schools.

Levin (2001) related that some universities have recently begun including problem-based learning as part of their teacher education programs, not only as a means of delivering instruction to student teachers, but also as a strategy that teachers are required to learn as part of their teaching repertoire. This teaching method is acclaimed as one necessary for preparing citizens for the 21<sup>st</sup> century.

Joyce and Showers (1995) wrote that there are many curricular and teaching alternatives that can be beneficial to learners. These have come about as a result of research on teaching and learning. Many of these strategies can help the average and

below-average achievers make substantial gains in learning. However, for teachers to learn and implement these strategies, there must be strong pre-service and in-service programs. They cited Lortie (1975) who emphasized the need for more collaboration between administrators and teachers for the improvement of schools.

Joyce and Showers (1995) indicated that if our schools are to employ problem-based learning to benefit learners, there will be a need for in-service and pre-service training for staff development. The authors suggested that the workplace does not provide the time and structure for faculty and staff to work together collectively, but that individuals and faculties do need support and training in order to “become knowledgeable about alternative solutions to problems, and learn new curricular and teaching strategies” (p. 6).

They suggested that administration and all policymakers must be involved in any attempts to renew schools. All stakeholders involved must be ready to undertake what is necessary to effect the improvements.

### **Statement of the Problem**

Seventh-day Adventist education embraces some very high principles related to a practical curriculum and student-initiated thinking. At a time when lecturing was a common practice among educators and in the schools of her day, Ellen G. White (1903/1952), one of the founders of the Seventh-day Adventist system of education, wrote that the work of true education is to "train the youth to be thinkers" and not to merely reflect what others have said or done. She advocated letting "students be directed to the source of truth to the vast fields open for research in nature and revelation . . . and the mind will expand and strengthen" (p. 17).

In spite of these clearly enunciated principles, preliminary indications are that Seventh-day Adventist educators feel inadequate to teach their students to be thinkers. The North American Division Curriculum Futures Commission has recommended the use of problem-based learning as a strategy to improve Seventh-day Adventist education. However, little information exists as to (a) how teachers perceive such an innovative approach as PBL, and (b) the nature of barriers to PBL's potential installation and use. Additionally, in one survey conducted to determine the status of curriculum and instruction in Seventh-day Adventist schools, only 19% of Adventist educators felt proficient in using problem-based learning as a teaching methodology (Brantley & Ruiz, 2001-2002).

### **Purpose of the Study**

Schools today should educate students for the 21st century, that is, to think, to work cooperatively in groups to solve problems, and to become self-directed learners (Caine & Caine, 1997; Eastin, 1999; Kagan, 1994; Marsh, 1999; White, 1952). Some of these authors described the workplace of the 21st century as one where workers will need to work together cooperatively to solve problems and be self-directed. They claimed that the type of education that was practiced over the past 100 years is unfit for these times (Caine & Caine, 1997). White (1903/1952) emphasized the need for students to be educated in a way that develops their abilities to exercise high-order thinking, and where the curriculum is of such a practical nature that the students can appreciate the practical application of what they learn in class.

Seventh-day Adventist educational leaders have identified problem-based learning as a promising methodology that would improve SDA education for the 21st century. The purpose of this study is to identify Adventist teachers' perception of PBL,

their attitudes towards its implementation in their classrooms, and factors that teachers may identify as hindrances to a successful adoption.

### **Research Questions**

To determine how Adventist teachers feel about problem-based learning, and what preconditions will be necessary so that this promising innovation can be successfully implemented in SDA classrooms to reflect the high ideals of SDA education, this study sought to answer the following questions:

1. To what extent are SDA K-12 teachers aware of problem-based learning as a teaching methodology?
2. To what extent do SDA K-12 teachers support the underlying philosophy of problem-based learning?
3. To what extent do SDA K-12 teachers embrace the teaching components of problem-based learning?
4. What factors are perceived as impediments to the adoption and implementation of problem-based learning?

### **Rationale**

Problem-based learning involves children actively engaged in learning. Although there may be times when they work individually, they usually work in teams providing support for each other, with the teacher as a facilitator of learning; a guide and resource manager. The students are involved in investigation and discovery, examining problems, researching, and making decisions on possible solutions, and in preparing a defensible product as a solution to the problem. Once the teacher presents the scenario, the students

choose the procedure they will follow. The teacher is then there to question, prompt, and provide guidance, but not to direct.

This instructional method is founded on the work of Piaget and Dewey, who posited that learners should be actively involved in learning so that they may construct their own learning; on the work of Vygotsky, who emphasized that learning takes place in an environment that provides social interaction between the learner and his or her peers or an adult; and on the work of Glasser who stated that students are more motivated to learn when they are given choice.

This study proposes to identify teachers' perceptions of PBL and their attitude towards its implementation in their schools and classrooms. Borg and Gall (1996) wrote:

If doctors were to lose their base of medical research knowledge, most of them would have to stop working. They would have no idea how to treat anything except common ailments. . . . In contrast, if educators suddenly were to lose the body of knowledge that has been gained thus far from educational research, their work would be virtually unaffected. Schools would continue to operate pretty much as they do now. It is difficult to imagine teachers who would refuse to teach students because they did not possess sufficient research-based knowledge about the learning process or the effectiveness of different instructional methods. (p. 4)

The authors asserted that the findings of educational research should be used to improve and amplify educational practice in the same way that medical practice is improved and amplified by medical research, but that that is not the case usually.

Since problem-based learning is a method of instruction that is supported by research, and since preliminary studies in the Profile Series (Brantley & Ruiz, 2001-2002) indicate that only 19% of teachers felt proficient in the use of PBL, and since problem-based learning appears to have the potential to help SDA schools practice the principles of true education as put forth by White (1903/1952), and since the North American Division of Seventh-day Adventists has recommended the adoption of problem-based learning as a



preferred teaching practice to improve Adventist education for the 21<sup>st</sup> century, I hope that the research results will prove extremely useful and beneficial to the church school system as it seeks to improve education for the 21st century.

### **Assumptions**

In doing the study, some assumptions must be made:

First, that teachers, by their responses, will give an honest opinion that would guide their actions regarding PBL if it were introduced by the church school system.

Second, that this discussion, framed from a Christian perspective, will be useful to Christian schools, although it is also hoped that other schools will find the research applicable to their operations.

Third, that because the Seventh-day Adventist philosophy of education is based on E. G. White's instruction that education should be of a practical nature, and should develop students into thinkers rather than reflectors of other men's thoughts, and because the Futures Commission has recommended PBL as a preferred practice to improve SDA education, I am conducting this research with the hope that leaders in the SDA school system will use the results of this study to effectively prepare teachers to adopt and implement this promising innovation.

### **Theoretical Framework**

Problem-based learning finds support in the following three supporting theories:

1. *Active Learning Theory*: When students are actively involved in their own learning, both high and low achievers tend to learn more effectively.

Dewey (1910) wrote that children learn by doing, by manipulating, and by experimenting. Later (1916/1944), he said that children must be given learning opportunities that provide them with experiences with what is to be learned, so that they may develop thought. The experiences or problems should engage the students in experimentation and observation outside of school. The problem should become that of the student, and not the teacher's or the textbook's problem to accomplish instruction. The classroom arrangement should be conducive to the students' getting experience; therefore, it should not be rigidly structured. Others, such as Froebel and Pestalozzi (cited by Edson, 1975) and White (1903/1952) had advocated a learning environment where students would learn by doing.

Piaget (cited in Woolfolk, 1998) pictured the human mind to be composed of cognitive structures that grow intellectually as the individuals mature, interact with their world, and gain experience. He said that the cognitive structures that are required to comprehend bits of information depend on the maturity level of the child and the simplicity or complexity of the information. Young children first form schema about their initial experience with aspects of their world, and when they acquire more information about an object, for example, they adjust their schema by the process of accommodation. The new cognitive structure allows assimilation of the new experience to occur in the child's mind.

Piaget's stages of cognitive development are the sensorimotor, the preoperational, the concrete operational, and the formal operational stages. They follow that sequence of development and cannot be forced. Bruner (cited in Woolfolk, 1998)

discovered three stages of cognitive development similar to Piaget's, and established the discovery learning method based on this principle.

Problem-based learning allows students to manipulate materials, form images as they observe specific features, and from those experiences and observations, abstract general ideas and principles.

2. *Social Learning Theory*: When students work in teams, both high and low achievers tend to learn more effectively.

In group learning, students work together on complex, real-life problems and learn by doing, teaching, and helping each other. They have to take positions and defend these positions, while respecting the ideas of others. Through research, students find and integrate information from different sources.

Vygotsky (cited in Woolfolk, 1998) reported that higher mental processes develop through social interactions. Critical thinking skills begin with social interactions and are then internalized by the individual. He said that children need to develop mental tasks in groups before they can do them alone. Woolfolk said that an important implication of Vygotsky's theory is that learning and understanding require interaction and conversation. When students grapple with problems in their zone of proximal development, scaffolding is provided by their teachers or peers, and real learning is possible.

In problem-based learning, although the student may work individually at times, it is in groups that discussions take place. It is also in groups that the students work together on solving and presenting the solutions to their problems. The teacher functions as a facilitator, coach, or guide using probing questions to move the students along.

3. *Choice Theory*: When students are given choice about what they learn, they learn more effectively.

Glasser (1998) stated that schools would produce more successful students, who would get along with their teachers and each other and do their best, if schools would give students the choice to learn useful and relevant information by pursuing their interests. His emphasis is on choice rather than coercion, and usefulness rather than uselessness.

According to Glasser, all of our behavior is always our best attempt to satisfy at least one of five powerful forces, which, because they are built into our genetic structures, are best called basic needs. These are (a) physiological need to stay alive and reproduce, (b) love and belonging need, (c) need for power, (d) need for freedom, and (e) need for fun.

Choice theory works because it exercises an "internal control psychology" based on one's own motivation since one is not being controlled externally by someone else. The student chooses to learn because of the benefit to him or her and because of the relevance of the material to be learned.

Motivation, according to Woolfolk (1998), is "an internal state that arouses, directs, and maintains behavior" (p. 372), and one of the factors in motivation is the choices people make about their behavior. Some explanations of motivation are internal factors such as needs and interests (intrinsic motivation), and others are external such as rewards and punishments (extrinsic motivation). Intrinsic motivation has an internal locus of causality, because the person makes the choice freely, based on personal

interests. The activities themselves are rewarding so there is no need for external rewards, punishment, or any form of coercion.

Deci, Vallerand, Pelletier, and Ryan (1991) and Deci and Ryan (1985, cited in Woolfolk, 1998) reported on the individual's need to experience choice in what he or she does and how it is done. One desires to be in charge of one's behaviors and resists outside pressures or coercion. Citing deCharms (1976, 1983), Woolfolk differentiated between students as "origins" and students as "pawns." As origins, students perceive themselves as being in control. They are active and responsible for their learning. Other studies cited reveal that when students feel like origins, they have higher self-esteem, they feel more competent, and they feel that they are in charge of their learning. They also perform better on standardized tests, and are absent less.

When students feel like pawns, they are powerless, and are controlled externally. They become passive and take little responsibility for schoolwork. Lepper and Greene (1978, cited in Woolfolk, 1998) say students then regard play as work, leisure as obligation, and intrinsic motivation becomes extrinsic motivation.

Problem-based learning appears to be effective because students work on authentic problems that are presented to them in such a way that they become the students' problems. Students engage in discussion, hypothesize solutions to the problems, and choose how they will test their hypotheses as they seek information. They also choose the sources they will use for their research and how they present the outcome of their research. Teachers do not coerce, nor use rewards or punishments to get students to perform, but act as coaches and guides to facilitate learning. The social context in which they work provides the environment that is necessary, according to Glasser (1998),

to satisfy some of their basic needs. These theories provide the underpinnings for the efficacy of problem-based learning as a method that enables all children to learn (Delisle, 1997). See Fig. 1.

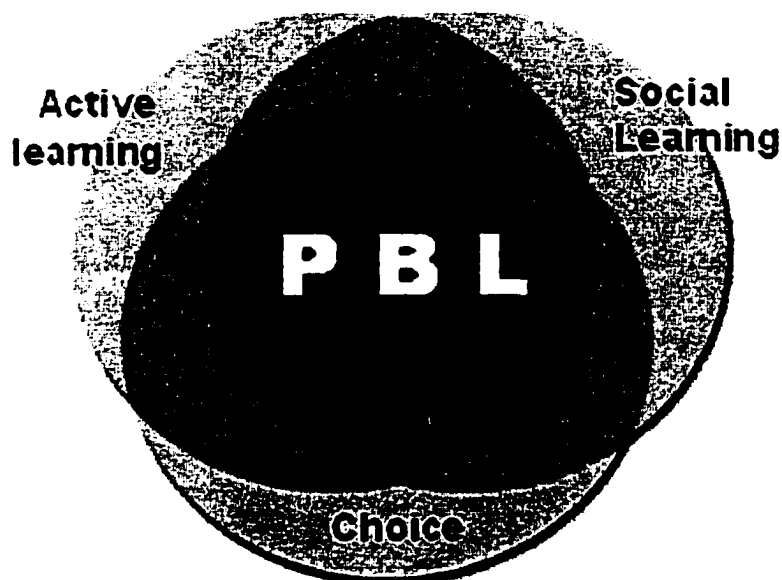


Fig. 1. Theoretical components of problem-based learning

### **Significance of the Study**

Caine and Caine (1997) wrote that some teachers may have habits so ingrained that it is difficult to break them. This means that some teachers will have to be coaxed into a change mode. Besides, policymakers need to know what they are asking others to do, or what they are embracing, and the associated needs. Therefore, the results of this study should provide invaluable information to teachers who will need to take an

introspective look, to principals, and to conference directors of education as they make policies and plan expenditures to enhance Christian education.

Joyce and Showers (1995) wrote that no matter how excellent a teaching method is, if it is not used, it will not change student learning. Caine and Caine (1997) felt that because mental models of teaching and learning are not changing that education goes through cycles where "strategies that work" usually revert to business as usual. It is necessary to "educate" teachers and other education practitioners about a new way, in order for them to change their mental models. The authors noted that to effect change requires modifying powerful assumptions about teaching and learning. In their own study they found that "real change is extremely difficult because it challenges traditional and personal beliefs and asks us to revisit and reinterpret our own experiences and our own sense of self" (pp. 23, 24).

That is why it was necessary to first determine if Seventh-day Adventist K-12 educators know enough about problem-based learning and are ready to adopt and implement it as a teaching strategy. Information on the preparatory state of teachers should be useful to Seventh-day Adventist educational leaders and policymakers.

### **Definition of Key Terms**

*Association for Supervision and Curriculum Development (ASCD):* A non-profit group that facilitates communication among educators, sponsors curriculum development, and disseminates research internationally (Caine & Caine, 1997).

*Curriculum:* Written and unwritten skills, knowledge, and behaviors; a set of norms that define what is to be learned (P.S. Brantley, personal communication, March 23, 2003).

*FACT 21*: The NAD Curriculum Futures Commission (1997) study and report on ways to improve Seventh-day Adventist secondary education for the 21st century. It was titled *Focus on Adventist Curriculum and Trends for the 21<sup>st</sup> Century* (Curriculum Futures Commission, North American Division Office of Education, 1997).

*Illinois Mathematics and Science Academy (IMSA)*: A boarding academy in Aurora, Illinois, where problem-based learning is practiced in the classroom. Through a government grant, teachers in the state of Illinois receive intense training in problem-based learning at this academy for use in their classrooms. Students at the academy do very well in science and math performance (D. Workman, personal communication, July 16, 1999).

*Innovation Configuration (of problem-based learning)*: A checklist that lists the components of any educational innovation in a way that shows how the innovation may be used purely as the developer meant or as variations. It shows progressions of the innovation from its pure form to acceptable variations of it (Hall & Hord, 1987).

*Locus of Causality*: The source of the motivation for a behavior. It may be internal or external (Woolfolk, 1998).

*Multi-Grade*: The combination of two or more grade levels in a self-contained classroom with a single teacher (R. Williams, Superintendent of Education, Southeastern Conference of Education, personal communication, April 7, 2003).

*North American Division (NAD)*: A level of the organization in the Seventh-day Adventist Church structure that has jurisdiction over the territory of “Bermuda, Canada the French possession of Saint Pierre et Miquelon, the United States of America, Johnston Islands, and all the other islands of the Pacific not attached to other divisions and bounded by the dateline on the west, by the equator on the south, and by longitude



120 on the east; comprising the Atlantic Seventh-day Adventist Church in Canada, Columbia, Lake, Mid-America, North Pacific, Pacific, Southern, and Southwestern Union Conference” (*Seventh-day Adventist Yearbook*, 2002, p. 179).

*Post-Holes*: The act of inserting short problems into the curriculum occasionally rather than designing the entire curriculum around problems (Stepien, Gallagher, & Workman, 1993).

*Preferred Practices*: Nine areas of curriculum that the North American Division Curriculum Futures Commission has identified as “central to the success of the ideal Adventist secondary school” (p. 10). Problem-based learning is a teaching approach that is included among four recommended methods of classroom instruction (Curriculum Futures Commission, North American Division Office of Education, 1997).

*Problem-Based Learning*: An instructional method that uses a real-world problem that is ill-structured as the context for an in-depth investigation of core context. (Checkley, 1997).

*Profile Series*: A biennial survey of NAD Adventist educators to assess the status of curriculum and instruction in SDA schools and classrooms (Brantley & Ruiz, 2001-2002).

*Scaffolding*: Any kind of support for learning and problem solving provided in a social context (Woolfolk, 1998).

*Seventh-day Adventist (SDA)*: A Christian denomination that operates a global system of education with more than a million students from kindergarten through the university level. The system, founded upon the writings of E. G. White, advocates a curriculum that espouses thinking skills and whole-person education (P.S. Brantley, personal communication, December 7, 2002).

*Student-Centered:* Teaching/learning approaches planned around a child's needs and interests, allowing the student to take full responsibility for his/her learning. There is an emphasis on the student actively acquiring information and skills. Teacher becomes a guide (Barrows & Tamblyn, 1980).

*Traditional (Teacher-Centered) Method of Instruction:* An instructional strategy where the teacher decides the information and skills children should learn, and the sequence, manner, and pace at which learning should occur. The student is not responsible for his or her education (Barrows & Tamblyn, 1980).

*Zone of Proximal Development:* Stage when a child can master a task with appropriate assistance from a peer or adult (Woolfolk, 1998).

### **Limitations of the Study**

A convenience sample is chosen because of the constraints of time and finances. I am also limited by the distance by which many schools in the SDA educational system are separated, so that the sample chosen is the most feasible. Therefore, statistical generalization is limited. However, the Seventh-day Adventist school system in North America should benefit from the study if it is to implement PBL as recommended by the church leaders. Other schools whose populations might be similar to the one used in this study may also find the results of this study to be useful since there is little information on how teachers feel about an innovation such as PBL, and what barriers they may foresee.

Some teachers might have been reluctant to express their true feelings concerning problem-based learning. They might have thought that to express ignorance of the method or a reluctance to learn it might put them in an unfavorable light, especially with

their administrators, so they might have provided untrue responses. Others have indicated unwillingness to learn about PBL because they might have regarded it as something else they would be required to do with already limited time. Some teachers might have expressed reluctance to learn about PBL because of their past experience with in-service training or methods that have been used to teach new techniques. Very often they were given only awareness, with no opportunity to practice and acquire proficiency, but were expected to transfer learning to their classrooms. Also, depending on the way some respondents might have been feeling when they received the questionnaires or inventory, there could be variations in the responses and these are beyond my control.

The responses to the questionnaires were subject to the respondents' interpretations, and if some items were unclear to the respondents, they could not be modified or explained once they had been distributed. Getting responses via the telephone and conducting interviews could have helped with this shortcoming. However, anonymity was promised to the participants and I had no way of identifying responses.

### **Summary**

Although problem-based learning was developed for medical schools, Bleich (cited in Delisle, 1997) wrote that it has been adopted by a growing number of K-12 schools as a method to raise student achievement. Delisle (1997) also stated that in the same way that medical students need to develop their ability to discover and use information, K-12 students need to acquire problem-solving skills, to develop their abilities to think, and to learn content.

Problem-based learning seems to be able to help most students achieve, and should be of great benefit to many schools, and to SDA schools especially where there

are heterogeneous and multi-grade classrooms. Problem-based learning's component of real-life problems actively engages students in activities that integrate many disciplines and allows students choices about how and what they learn. In a collaborative setting, students with a range of academic abilities and diverse backgrounds can help each other learn and acquire skills and knowledge.

Administrators and teachers working in such situations should find that the resources of time and money invested in preparing to adopt and implement PBL should be well worth the effort. According to Glasser (1998), students will like school, enjoy learning, and experience success. There will be better student-teacher and student-student relationships, and teachers will be happy.

Leaders of the educational system of the Seventh-day Adventist Church have suggested that problem-based learning become one of a number of preferred teaching practices in its schools. Since there is little information on teachers' perception of this strategy or impediments to its adoption, I undertook this study to identify how much information SDA K-12 teachers had about PBL, their teaching philosophy and attitudes towards PBL, and perceived barriers towards its adoption and implementation.

## CHAPTER 2

### REVIEW OF THE LITERATURE

Almost a decade ago, Brooks and Brooks (1993) wrote on a matter of growing concern in America: the state of its schools. They wrote that politicians and educators are troubled that American students are unable to perform on context area tests as well as students from other nations do. Other concerns related to students' inability to understand and find meaning in what they read.

Ten years prior to the writing of these comments by Brooks and Brooks, in 1983, the United States Department of Education's National Commission on Excellence in Education published its report, *A Nation at Risk*, the gist of which could be summed up in this quotation:

If an unfriendly power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war. As it stands, we have allowed this to happen to ourselves. We have even squandered the gains in achievement made in the wake of the Sputnik challenge. Moreover, we have dismantled essential support systems which helped make those gains possible. We have, in effect, been committing an act of unthinking, unilateral educational disarmament. (p. 5)

There was an immediate call for educational reform and many promising proposals were put forth. In the *Nation at Risk* report, for example, recommendations were made that would improve students' test scores. Among the numerous subsequent publications that proposed solutions to the educational dilemma was the *American 2000 Sourcebook* (1991) published by the United States Department of Education and released

by President George Bush, Sr., on April 18, 1991. In this book, six education goals were outlined with four strategies to accomplish them.

Caine and Caine (1997), also engaged in discovering ways to improve American education, wrote that all sectors of society, “newspapers, documentaries, teachers and administrators, businesspeople, and parents--all voice their opinions and concerns” about education, and that despite multiple reform efforts and many changes and much research on good teaching and on learning, “*much stays the same*” (p. 3). They asserted that traditional education has worked well for the industrial age, but is inappropriate for this fast-changing information age (p. 10).

An explanation for the continued lack of improvement in education may be due to what Brooks and Brooks (1993) have noted. They said that the proposals did not go deep enough, because they did not address the “education system’s underlying suppositions about what it means to learn . . . the processes of teaching and learning. . . . Educational reform must start with *how* students learn and *how* teachers teach, not with legislated outcomes” (pp. 3, 4). Sternberg (1998) said that there are several reasons why educators are usually slow to put proven strategies into practice. One is because of vested interest and inertia. Another is because, in the case of the research he described in the article, for example, data were too new, recently published, or up to that time unpublished, so unavailable for use. Other reasons for the slowness of change in education are that people are leery of reform proposals that may have good intentions but no research data for support of their effectiveness, people’s fear that achievement scores may decrease rather than increase, and fear that implementation may be too difficult. Or, the explanation may be, in the claim of Caine and Caine (1997), that despite available research results, schools are not making use of what they know.

According to Caine and Caine (1997), Brooks and Brooks (1993), and Toffler (1970), that with advances in technology, information is increasing so rapidly that facts and skills can be obtained from very many sources and not from the teacher only, and the teacher is only one source of information. A teacher will never be able to teach individuals fast enough before knowledge becomes obsolete.

Therefore, to keep pace with the fast growth of information in the 21st century, Benjamin (cited in Nagel, 1996) stated that there must be a shift from passive acquisition to one of active seeking of knowledge by the student. Schools should teach children how to learn and how to access information from the many sources which now exist. Schools must teach skills, knowledge, and attitudes needed for survival, success, and lifelong learning (Caine & Caine, 1997).

Today's workplace requires workers who are able to work cooperatively with others, who are self-directed, and who can solve problems (Caine & Caine, 1997; Kagan, 1994). Checkley (1997) and Delisle (1997) posited that education should shift to requiring that students solve ill-structured problems centered around curriculum. Rather than teachers providing all the answers, students should hypothesize possible solutions to problems, research for answers themselves, and decide on the best solution to problems. Moreover, Kagan (1992/1994) recommended that "it is incumbent on schools to provide cooperative, interdependent experiences in order to provide students with the interpersonal skills they will need for positive participation in economic life" (p. 1:1).

Levy (1996) wrote, that students entering today's classrooms have such varied learning needs that a teacher is not able to meet them all. Gardner (1985) argued, too, that because society emphasizes only some of the intelligences that some students may possess, that not all of our students are allowed to experience success by our current

educational system, because their intelligences are overlooked. Schools must give every child an opportunity to learn using his or her natural intelligences.

Sternberg (1998) expressed that if teachers do not change their current traditional methods of instruction and assessment of learning, we will not be able to identify much-needed talents in some students. He stated that if teachers were to teach differently, that students traditionally regarded as average or low achievers might join the group traditionally regarded as bright, because of the emphasis on analytical skills. He said

we are wasting human talent in much the way we would be wasting money if we threw it, bill by bill, into a trash can. We are taking in students with unidentified talents; teaching them in a way that leaves these unidentified; and assessing their achievement in a way that leaves the talents still unidentified. We have thus created a vicious circle in which our current ability tests predict academic success fairly well, but only because we teach and assess achievement in ways that recognize the talents of just a handful of our students. (p. 5)

According to Sternberg (1998), analytical skills can be easily identified using any test of intelligence or scholastic aptitude. Creative and practical skills are more difficult to identify, and teachers need to exercise differentiated instruction and assessment that match students' abilities in order to identify them. In his experiment, Sternberg found that when students were instructed in ways that allowed them to exercise their abilities and strengths, they achieved at higher levels. When creative, practical, and even analytical strengths were identified and emphasized in students, there was an increase in number of bright students, and that group became more diverse ethnically, socioeconomically, and educationally than when they were traditionally identified using only analytical skills. Sternberg also noted that there is no need to differentiate curriculum to accomplish these results, but by teaching all students in ways that give them opportunities so they may learn. The opportunities must enable them to utilize their strengths, "compensate for and correct their weaknesses" (p. 8).



Sternberg said that with the rapid rate of change, creative and practical skills are needed to make the creative ideas work. Some of the talents educators are now failing to identify are the ones we will need later in the job market, and we can harness them only by changing our teaching and assessment methods so that we may find these talents.

According to Brooks and Brooks (1993), Caine and Caine (1997), and Checkley (1997) the traditional way of providing students with information, which they memorize and then regurgitate on tests, is not the way to teach them to understand and retain information, to solve problems, or to think. Bruner (1966) stated that if teachers are to teach for understanding, students must be able to apply knowledge successfully in new situations, and Delisle (1997) declared that we often remember best what we experience and that “our greatest challenges become our greatest learning experiences” (p. v). He further stated that students would be best prepared to be productive if they were taught how to learn and get and use information for themselves rather than “cram them with today’s facts and theories--which soon may be outdated” (p. 7).

Eastin (1999) declared that “education is the United States first line of defense in the 21st century. . . . We must all be in the business of preparing our students for the 21st century. We must all make sure the right stuff gets mastered” (p. 24). She also posited that, by the year 2008, changes in the workforce will require “well-educated people who are self-directed problem solvers and team players” (p. 18). Therefore, schools should consider the recommendation by Perkins (cited in Nagel, 1996) that education should produce knowledge that functions in people’s lives to “help them understand and deal with the world” by actively engaging them in research and inquiry.

The prevailing instructional practice in today’s school views students as passive recipients of knowledge, which a teacher, who is regarded as the repository of

information, dispenses. This method of instruction does not give students experience in solving problems, making decisions, researching, or finding information for themselves (Checkley, 1997). Delisle (1997) posited that in order for students to learn, understand and retain information, they must grapple with situations that give them problems to solve, that is, they must be actively engaged.

When students are required to learn information that teachers teach them, then reproduce this information on tests, the students may perform well by recalling information, but they soon forget the information and quite often cannot apply what they learned (Barrows & Tamblyn, 1980). On the other hand, when students' education allows them opportunity to apply information as they acquire it, through active involvement, they will retain the information and understand it.

White (1903/1952) over 100 years ago directed educators to teach students in a practical way so that they would learn to think. She declared that every individual was made with the power to think and that that power should be developed through true education. She defined true education as the "harmonious development of the physical, the mental, and the spiritual powers" (p. 13). She said that it trains youth to be

thinkers, and not mere reflectors of other men's thought. Instead of confining their study to that which men have said or written, let students be directed to the sources of truth, to the vast fields opened for research in nature and revelation. (p. 17)

White (1903/1952) posited that for too long education has been mostly memory work that crowds the mind with knowledge that is never usually used. The student does not practice independent thought, and sacrifices reasoning and judgment. She recommended the employment of practical education that engages the student.

Montessori (1966) also wrote that students have a natural predisposition to develop and learn, but that adults interfere with and repress this tendency by imposing on children

what adults think that students should learn. She stated that children's potential to learn is released when adults detach themselves from being all-knowing, put on "the vesture of humility" (p. xx), and allow students to follow their own interests.

### **Problem-Based Learning**

In this chapter, I present a review of the literature that supports problem-based learning as a strategy that engages students in active learning through problem solving so that students acquire and retain information, and are able to make informed decisions. Checkley (1997) posited that students of problem-based learning become better problem solvers because they "hone skills such as reasoning, collaboration, and persistence in their self-directed search for solution" (p. 3).

Problem-based learning is a method of instruction that engages the learner in the pursuit and acquisition of knowledge with an initial problematic scenario. As opposed to the traditional methods where the teacher provides all the information, which the student absorbs and regurgitates as needed, this method regards the learner as a stakeholder in the learning and actively engages him/her in the process. The teacher then shifts roles to becoming a helper and adviser and not the controller of learning.

Problem-based learning enables children to obtain information from many sources, traditional and non-traditional. It is also a method of instruction that allows children to work together as they solve their problem. This methodology provides students the opportunity to work in their preferred style and multiple intelligences, thus making it possible for all or most students to excel with time. The method is also claimed to be successful with all sorts of learners resulting in increased achievement, fewer discipline problems, and better school attendance. Problem-based learning is efficacious

in preparing successful students because it engages the students in active learning in an environment where they work together collaboratively, and can choose the content and pace of their learning and the manner in which to present evidence of their learning (Checkley, 1997; Delisle, 1997; Torp & Sage, 1998).

### **Components of Problem-Based Learning**

Problem-based learning is a powerful instructional strategy because of its three major components. These are active learning, social learning, and student choice. Two of the major proponents of active learning were John Dewey and Jean Piaget. Constructivist ideas also support active learning. Major proponents of social learning were Lev Semenovitch Vygotsky and Spencer Kagan; William Glasser proposed the importance of students having choice. Problem-based learning seems to be also supported by brain research on how people learn.

### **Active Learning**

Marlowe and Page (1998) wrote that there is much literature that indicates that students acquire knowledge through active involvement and not through passively listening to lectures. They posited that although information can be received from many sources, learning has to be constructed through the process of questioning, interpreting, and analyzing. The receiver builds and alters meaning and understanding based on past experiences with the information or subject. Each person makes his own meaning and understanding of issues, concepts, and problems. Content is acquired when the learner uses processes such as inquiring, investigation, or research, as in solving a problem, or critical questioning, rather than listening to someone disseminate information through

lecture. The learner has to discriminate between what is relevant or irrelevant from all the data received, and look at issues from different perspectives.

One early proponent of active learning was John Dewey. Dewey (1916/1944) asserted that children should be educated to function in a democracy. They should be able to make informed decisions based on logical thinking. Consequently, he stated that schools should teach children to think. He declared that children acquired the ability to think when they are involved in activities that give them something to think about, not only when they are in school, but also when they are outside of school. He posited that children should be engaged in problem solving through inquiry and investigation and that because children are active organic beings who grow and change, their study should reflect their stage of development and their needs and interests.

To function effectively in a democracy, children should also be allowed to take responsibility for their learning, so Dewey said that they should be involved in planning the curriculum, which should change as society changes, or with the needs and interests of the child. The teacher should not be an authority figure in the classroom, or the reservoir from which knowledge flows, but should be a facilitator of learning, encouraging the students, using questioning to help them think or offering suggestions to move them along, and be the person who writes the curriculum. This was also the belief of Montessori (1966).

Dewey (1933) believed that students should interact with the environment in order to think, so that they should be involved with educative learning projects that met the students' interests, and involved them in inquiry and problem solving for a considerable length of time. He practiced these ideas at his Laboratory School, which he started in 1896 at the University of Chicago.

He posited that when the child is actively engaged, learning takes place as information gained is used, organized, digested, and assimilated in the process of integration. What is learned in one situation helps understanding in a future situation through the continued reconstructing of impulses and thoughts. Dewey is named as a major philosophical influence underlying the progressive education movement that began to impact American education from the 1920s and continues to do so in some form even today (Knight, 1998).

Knight (1998) wrote that John Dewey was one of the intellectual influences that contributed to the progressive education movement in America during the late 19th and early 20<sup>th</sup> centuries. The movement was a reaction against traditional education and was influenced by the pragmatist worldview. William H. Kilpatrick and Dewey were among some educators who applied the progressive educational theory to school practice. From the 1920s to the 1950s progressive education became the dominant theory in American education. During the last decades of the 20<sup>th</sup> century, emphasis was again placed on some progressive principles:

1. *The process of education finds its genesis and purpose in the child.* This is saying that the curriculum should reflect the student's interests, needs, and initiatives. Children have a natural desire to discover and they have needs that must be fulfilled (Knight, 1998; Montessori, 1966).
2. *Pupils are active rather than passive.* They naturally want to, and will learn. This will only be hindered by the adults who "seek to impose their wills and goals upon them" (Knight, 1998, p. 101; Montessori, 1966).
3. *The teacher's role is that of advisor, guide, and fellow traveler, rather than that of authoritarian and classroom director.* The world is changing rapidly and so the

teacher does not have all the information that will be needed in the future. The teacher cannot teach children all they will need to know. Yet the children must be equipped to adapt to the changes (Caine & Caine, 1997; Levy, 1996). Knight (1998) says, in addition, that because of their greater knowledge and abundance of past experiences, adults are able to guide students concerning the past, advise them when they reach an impasse; and as fellow travelers, learn with the students as they face new situations. In effect, they will teach students to learn how to learn.

4. *The school is a microcosm of the larger society.* Learning takes place outside of school and inside of school, and school should make learning as natural inside as it happens outside of school. In the everyday world, learning and educative experiences are not artificially divided into cubicles of time, space, and content (p. 102); so in school, learning should not be divided into separate subjects or disturbed

by calling an unnatural halt to an educative experience by ringing the bell at a pre-arranged time. In the larger world, the subject matter . . . is integrated in its usage, and individuals stay at a task until they complete it or come to a natural break. (Knight, 1998, p. 102)

5. *Classroom activity should focus on problem solving rather than on artificial methods of teaching subject matter.* This is based upon the premise that knowledge is not the reception of information. It is not what someone can give or do to someone else (Levy, 1996). "Knowledge is an instrument for managing experience" (Knight, 1998, p. 102).

6. *The social atmosphere of the school should be cooperative and democratic.* According to Knight, the progressives claim that schools are unnaturally competitive. In the real world of work it is expected that individuals will seek for, or help each other to solve problems, while in school students are prohibited to walk around, talk with, or help each other. The school should teach children how to work together.

Another proponent of active learning was Jean Piaget. Piaget (cited in Ginsburg & Opper, 1979); Montangero and Maurice-Naville (1997); Singer and Revenson (1978); Small (1990); and Vidal (1994) posited that the learner takes an active role in the growth of his/her intelligence. Piaget claimed that the world cannot be learned merely by observation and imitation but by interpretation; that the child perceives the world as he or she experiences it for himself or herself. Understanding occurs as he or she perceives the world and interprets it, based on his or her past experiences. The level of understanding depends on the child's stage of cognitive development, or mental maturity. Piaget declares that the mental structures are genetically determined, mature with age, and limit intellectual functioning at specific stages.

Piaget theorized that our thinking or cognitive development occurs slowly and radically from birth to maturity as we constantly try to make sense of our world, by direct experience with objects, people, and ideas, thereby actively creating knowledge. Our thinking processes and knowledge develop as we adjust to the environment through the process of adaptation, and organize behaviors and thoughts into coherent systems. He posited that children are born with innate materials that interact with the environment to influence the development of cognitive structures. These cognitive structures are composed of a set of schemes that enables the learner to generalize a pattern of behavior to other situations. As the child gains experience, schemes change to become rules about the kinds of operations that hold true for certain situations or events.

Piaget stated that development of cognitive structures passes through four qualitative stages that occur in an invariant order. At each stage children have a set of schemes about the world and use these schemes to direct their actions as they have new experiences through acting on their environment and observing changes that occur. The



development of these structures is determined by two processes – adaptation and organization, which are common to all biological systems.

He said that there are two components of adaptation: assimilation and accommodation. Assimilation describes the child's effort to incorporate new behaviors into existing schemes, for thought and actions. Accommodation occurs when assimilation does not work and disequilibrium results. The learner through trial and error adjusts the existing structures to accommodate the new behaviors and re-establish equilibrium. As the child's experiences broaden, assimilation and accommodation constantly interact to promote the development of cognitive structures.

Schemes once formed are coordinated into higher-order relationships through organization. For example, three schemes, one initially for grasping, one for looking, one for sucking, can become organized, with experience, into a "look-grasp-suck" scheme. According to Piaget, these processes of adaptation and organization enable children to actively construct cognitive structures that help them understand the world.

Piaget's (1954) four stages of development are the sensory-motor stage, the preoperational stage, the concrete-operational stage, and the formal-operational stage. In the sensory-motor stage infants learn about the world through their senses and motor activities. In the preoperational stage about ages 2-7 years, the child starts developing use of language and the ability for symbolic thinking and logical operations. Between ages 7-11, the child is at the concrete operational stage and can solve concrete (hands-on) problems logically.

The child is able to solve abstract problems in logical fashion when he/she enters the formal operation stage between ages 11 and adult. That is also the time when he or

she becomes more scientific in thinking. At the level of formal operations children can imagine situations, form hypotheses, set up mental experiments, and test hypotheses.

Although the ages may vary when children experience these growths, the stages occur in a constant order. Piaget said that the mental structures that produce intellectual development are genetically determined and limit intellectual functioning at specific ages. As children mature the structures become more developed and, thus, children are enabled to interact with the environment more effectively.

Piaget (1941/1995) declared that when learners interact with their environment they assimilate stimuli from the environment into their existing cognitive structures. If the new experiences do not fit the existing knowledge structures or schemes, the student experiences disequilibrium and will change or alter these structures to accommodate the new reformation. The processes of assimilation and accommodation produce equilibrium. The thought process the learner goes through to reestablish equilibrium when an external stimulus causes disequilibrium is what causes cognitive growth (Piaget, 1967/1971).

Neimark (1975, cited in Woolfolk, 1998) posited that physical realities force the first three stages of Piaget's theory on us; we soon learn that objects do not disappear because they are removed from view, nor does the amount of water change when it is poured from one container to the next. A person, however, approaches formal-operational stages only through experience and practice in solving hypothetical problems and using formal scientific reasoning. These abilities may be valued and taught in cultures that are literate such as colleges and universities; however, because many students never make it to college or are not from cultures where literacy is highly valued, such students may never learn the skills necessary to function as responsible adults. In school, therefore, they must be taught to develop this kind of reasoning ability.

Otherwise, such adults will scarcely make it through the stage of concrete operations. If students have not learned to think beyond the literal, they are not going to be able to think hypothetically about problems; they may memorize formulas and steps for solving problems and these may help them to pass tests, but there is no real understanding unless students learn to use formal-operational thinking.

Gardner (1985) and Montessori (1966) also agreed that children's cognitive development goes through stages, and while other psychologists agree that there are changes, they question the existence of four separate stages of thinking according to Piaget. Other support for stage theory is provided by Epstein (1978, cited in Woolfolk, 1998) who reported changes in growth rate, brain weight, and skull size and the electrical activity of the brain between infancy and adolescence occurring "at about the same time as transitions between the stages described by Piaget" (Woolfolk, 1998, p. 41). Berk (1997, cited in Woolfolk, 1998) provided similar evidence from studies of infant rhesus monkeys that "show dramatic increases in synaptic (nerve) connections throughout the brain cortex at the same time that they master the kinds of sensory-motor problems described by Piaget" (Woolfolk, 1998, p. 41). Woolfolk suggested that this observation may also be true for humans.

Glasser (1998) explained that the reason individuals perceive realities so differently is that each of us has a personal "quality" world that we start constructing from our personal experiences from birth. We do so by forming pictures (Piaget's schemes) in our minds of "the best ways to satisfy one or more of our basic needs," (p. 45). The pictures may be of people we want to be with, things we want to own or experience, or ideas or systems of belief that govern our behaviors. These are based on our experiences, and are different for different people.

### Active Learning Research

In terms of academic achievement, affective learning, and skill learning, active learning has been shown to be superior to traditional learning where the teacher transmits information that students passively absorb. Marlowe and Page (1998) cited research that supports this condition.

For the first half of the 20<sup>th</sup> century, they described the research of Washburne and Raths (1927) at the Winnetka School in Illinois. Students at this school worked on projects for the first half of the day, and for the second half, on individual subjects. When these students and others from three other towns of similar composition were tested, the students from the Winnetka School scored higher than the others on major subject tests.

In 1933, the Progressive Education Association began an 8-year study tracking a total of 2,000 students from 30 high schools where progressive innovations had been implemented. These students were admitted into 300 colleges not based on college entrance requirements, but on the assessment of their respective high schools regarding their ability to succeed, as well as on their own interest.

The first follow-up of 1,475 of the original 2,000 students who were matched with graduates of conventional high schools in terms of scholastic aptitudes, interests, and socioeconomic status was conducted in 1936 when the first graduates entered college. Every year until 1939, a new graduating class was added.

The assessments indicated that graduates of the progressive schools were more successful than their counterparts from conventional schools, and that the more different

from traditional schooling the progressive school was, the more the graduates were superior to their counterparts from traditional high schools.

Some of the other studies cited include those of Gray and Chanoff (1986); Worthen (1968); Phillips and Faris (1977); MacKenzie and White (1982); Sharan and Sharan (1989/1990); Booth (1980); Secules, Cottom, Bray, and Miller (1997); and Puckett (1986). These were conducted among elementary and high-school students.

### Constructivism

Constructivist views are based on the philosophy of Dewey and the research of Piaget, Vygotsky, and Bruner, to name a few of the contributors (Woolfolk, 1998). Although there is no single constructivist theory, studies (Driscoll, 1994; and Marshall, 1992, cited in Woolfolk, 1998) indicated that many approaches have the following recommendations in common: “complex, challenging learning environments and authentic tasks; social negotiation and shared responsibility as a part of learning; multiple representations of content; understanding that knowledge is constructed; student-centered instruction” (p. 346).

Montangero and Maurice-Naville (1997) recorded that in 1970 Piaget used the term *constructivism* to explain the development of a child’s reasoning ability as an activity between the innate, inherent properties of the mind and the child’s experiences.

Constructivism asserts that knowledge is not transmitted from the teacher to a student, but that it is actively constructed by the mind of the student. The theory claims that children are more likely to make or construct knowledge when they create something that they can reflect upon and share with others. It is through their encounters with objects and activities that children construct and reconstruct knowledge. Kafai and

Resnick (1996) stated that in a constructivist environment, children can use multiple learning styles, and knowledge can be represented in many ways. The inquiry or discovery method is a constructivist method of learning in which many educators became interested during the 1960s and 1970s (Nagel, 1996).

Brooks and Brooks (1993) asserted that we learn through our experiences by constructing meaning based on those experiences. Experiences are interpreted from what we already understand. If that interpretation does not make sense, we either force the experiences to conform to our existing set of rules or we generate a new set of rules for their explanation. Brooks and Brooks (1993) and Levy (1996) said that in school many students never get true understanding. Instead teachers are preoccupied with covering curriculum. In school, students are afforded little opportunity to ask questions or to interact with each other, because schools operate on the notion that there is a world of knowledge that the learner must be taught (Brooks & Brooks, 1993). However, they recommended that teachers study the principles of cognitive development and make every effort to help children construct individual understandings. They believe this is when students will be willing to take risks, and perform their assignments with a willingness to accept challenges to their current understandings.

### Social Learning

Problem-based learning is not only characterized by active involvement that allows students to construct their own learning and understanding based on their stage of cognitive development, but it involves learning in an environment where students work together in groups with the teacher as a guide who facilitates learning. Children have an innate need to belong. This need, as other deficiency needs, must be satisfied

before children are motivated to learn (Maslow, as cited in Woolfolk, 1998).

Woolfolk stated that the need to belong and maintain self-esteem is important to children and that children would choose to defy teachers' rules simply to satisfy the need. In a social environment, students may work together cooperatively, may work as teams, or simply as part of a group.

Raffini (1996) wrote that all students have a need to belong and to relate to others, and this need impacts motivation in the classroom. He further stated that achievement is enhanced when students are willing to help and support one another. A research-based view of student-relatedness (Connell & Ryan, 1984; Deci & Ryan, 1985, cited in Raffini, 1996) proposed that the desire for relatedness is a basic psychological need of students. The authors declared that students will feel better about themselves, and will be more intrinsically motivated and involved in their learning when they feel connected to, rather than isolated from, those who are significant in their lives, such as their schoolmates, teachers, and parents.

Piaget's (1954) theory of cognitive development recorded the importance of the child's involvement with physical objects in the environment on his or her cognitive development, emphasizing the child acting alone. He also asserted that the child had to be developmentally ready for instruction. Vygotsky (1987), however, suggested that cognitive development depends on the child's interaction with other people. He said that the child's intelligence is socially constructed through interaction with adults and peers, and that it is through the use of language to communicate with others that thoughts are clarified and learning is enhanced.

Vygotsky (1987) also stated that when children receive guidance in the form of prompts or leading questions from a peer, a parent, or a teacher, they are able to solve

problems that may be considered to be beyond their actual level of cognitive development. He supports the importance of language by making reference to little children using self-directed talk or “egocentric” speech to guide their behavior as they work or play. He speaks of the zone of proximal development as a point in the child’s learning that marks the difference between what the child cannot do without assistance, but can do with assistance.

Therefore, learning groups provide the environment in which students can get and provide guidance for each other through explanations, demonstrations, and working together. In such situations, they may use language to organize their thinking and talk about what they are trying to accomplish. Important to the learning process are dialogue and discussions (Karpov & Bransford, 1995; Kozulin & Presseisen, 1995, cited in Woolfolk, 1998, p. 50).

### Learning Teams

Glasser's (1986) control theory describes "learning teams" as the method that provides the environment in which students achieve, enjoy learning and have fun, and where teachers are happy. The learning team model employs cooperative learning structures as the media in which students work together to complete assignments, have fun learning curricular materials, assess their work and that of their classmates, and have the teachers work as facilitators and encouragers. Glasser said, "Used properly . . . this model is the most powerful classroom tool there is" (p. 95) and that it "has been proved effective by over ten years of extensive research" (p. 96).

In the schools where Glasser employed and studied the effects of cooperative learning teams, the students worked hard, and figured out how to work together and to complete complex assignments in a timely manner. Glasser said that when he reviewed



the examples, he was "struck with how well these lessons carried out those basic requirements for good education—involvement, relevance and thinking. . . . In all cases, students were deeply involved with each other, they were thinking throughout and what they did they believed had relevance to their lives" (pp. 116, 117). The teachers structured the assignments for the student so that the students saw the need to work hard, and learn the material. They also acted as coaches and facilitators answering questions and providing materials as needed.

Glasser (1969) recommended that teachers should conduct class meetings that would give participating students the opportunity "to think, listen to others solve problems, and ponder intellectual questions" (p. 120). Students and teachers attempt to solve individual and group educational problems starting as early as kindergarten. By being part of such a discussion group throughout their elementary lives, children learn that they can have some control over what happens to them. Glasser said that not only will children learn to solve problems, but they will also make gains in scholastic achievements. Quoting from the "Coleman Report," Glasser wrote:

The extent to which a pupil feels he has control over his own destiny is strongly related to achievement. This feeling of potency is less prevalent among Negro students but where it is present their achievement is higher than that of white pupils who lack that conviction. (p. 123)

The meetings help children learn that they are a vital part of the world they live in and that they can control their own destinies.

Although Glasser recommended the use of cooperative learning groups, which can be very successful when used properly (Caine & Caine, 1998; Kagan, 1994), Woolfolk (1998) stated that group learning and cooperative learning are not the same

thing and that group learning can also be used successfully She included Pitt's (1992) model for using group work.

### Cooperative Learning

Kagan (1994), another proponent of social learning, wrote that in today's world students need to develop interpersonal skills through cooperative, interdependent activities, and that schools must provide these experiences in order to help students to participate positively in economic life. Schools, however, are not simulating the workplace because their social structure is not cooperative. Our economy is moving towards information-related and high technology jobs, which will require cooperative interpersonal skills. While that method should not be used exclusively, children do need to learn to work together and solve problems cooperatively.

According to Kagan (1994), some benefits of cooperative learning are that the group assumes more responsibility for their learning so that there is less need for direct instruction and the teacher becomes a guide or resource. Use of cooperative structures in different ways "offers methods to reach the whole range of educational objectives more efficiently than traditional methods" (p. 1:4). Cooperative learning will help students develop skills to structure and restructure their own social environment and learning experiences, and set the pace for lifelong learning.

### Brain Research and Cooperative Learning

Caine and Caine (1993) and Montessori (1966) reported that the human brain is designed to do a job of learning and that educators need merely to understand its operations and create an optimal learning environment. Citing work done by O'Keefe

and Nadel (1978) concerning memory systems, Caine and Caine related the memory functions of the brain to cooperative learning as outlined below.

The authors declared that we have two memory systems with different but connected functions. They are the locale and taxon memory systems. The taxon system records facts or routines that never change and are needed for the development of repetitive complex skills. It is the system that stores repeated information such as multiplication tables. The locale system helps us find our location in space so we can recall locations. It also organizes and records everyday activities for our ability to recall.

The two systems interact in real life to make sense of our repetitive habits, facts, and daily experiences as everything falls into place. In education, repeated information acquired through our taxon memory needs to be indexed into daily activities by the locale system, so it will all make sense. Conditions need to be set up for this interaction to take place. According to the authors, when educators encourage students to prepare for tests, and use rewards and punishments, they set up conditions for memorization of what is meaningless rather than create conditions for the learner to understand and perceive what is meaningful.

Cooperative learning can be a vehicle for connecting the two memory systems because it creates “a life context within which the content of the curriculum takes on meaning” (Caine & Caine, 1991, p. 25). Cooperative learning procedures allow students to move about, hear different points of view, and allow for interpersonal relationships and increased communication. Students do not just sit and listen and look at the teacher; instead, they can move about, communicate, and hear other points of view, besides the teacher’s. As groups solve problems, explore subjects, and work on projects, they use language meaningfully. All these simulate and provide more real-life experiences.

Cooperative learning structures engage the locale memory system and make more sense of the curriculum.

Anderson, Manoogian, and Reznick (1976, cited in Vallerand, Pelletier, & Ryan, 1991) wrote about the importance of social learning and indicated that although there are only a few studies done, there is still sufficient evidence that when children are denied the interpersonal involvement they desire to have with adults, they can lose their intrinsic motivation. They also stated that other studies (e.g., Grolnick & Ryan, 1989; Grolnick et al., in press) indicated that parents and teachers who are more involved with their children have children who are more motivated and self-determined, especially if the involvement supports the learner's need for choice and autonomy. Problem-based learning seems to empower all students to do well (Delisle, 1997; Jensen, 1997).

#### Student Choice

As Glasser (1998) noted, children are empowered when their innate need for choice is satisfied. In PBL, once the teacher assigns a problem, students engage in discussions, hypothesize, and make choices concerning how learning continues. Problem-based learning classrooms are autonomy-supportive classrooms that foster intrinsic motivation.

#### Choice and Intrinsic Motivation

Deci and Ryan (1987, as cited in Reeve, 1996) described two teaching styles, which are controlling and autonomy-supportive. Glasser (1998) described the controlling method as one conducted by "people who have discovered not only what is right for them – but also, unfortunately, what is right for us. . . . People feel obligated to try to force us to do what *they know* is right. Choice theory challenges this ancient I-know-what's-right-

for-you tradition” (p. 4). Autonomy-supportive classrooms are those in which teachers give students choice, and recognize that “all living creatures are internally motivated” (Glasser, 1998, p. 17; Montessori, 1966). Other authors (Bogianno, Flink, Shields, Seelbach, & Barrett, 1993; Deci, Schwartz, Scheinman, & Ryan, 1981; and Flink, Boggiano, & Barrett, 1990, cited in Deci, Vallerand, Pelletier, & Ryan, 1991) found that students of autonomy-supportive teachers perceive themselves to be more competent; they perform better on achievement tests, and show greater motivation to learn.

Glasser (1998) explained that our motivation is built into our genes. He stated that 100,000 genes are contributed by an egg and a sperm to the first cell of the human body, and these genes make us anatomically and physiologically who we are. He declares further that geneticists agree that each human being needs thousands less than the 100,000 genes in order to be a normal individual, and so he believes that some of these genes whose functions are not yet known are responsible for our psychology--how we behave and what we choose to do with our lives. Some of those genes make us genetically programmed to try to satisfy the four psychological needs of love and belonging, power, freedom, and fun (p. 28).

He purported that choice theory is based on an internal control psychology, and is in contrast to an external control psychology that tries to force people to do or behave in a certain way, and that uses a system of rewards and punishment. Choice theory is what makes people get along together, because they make the choices that control their lives.

The author noted that in schools, children who are allowed choices are happier and have fun learning. Their teachers are also happy. In coercive schools poor students and many good students usually do badly, but when students are given choices concerning their education, even those from poverty areas will do better. Glasser (1998)

asserted that although more students in poverty areas refuse to make the effort to learn in coercive schools than do students from more prosperous areas, the failure is not related so much to the poverty as it is to the poor relationships that exist between students and teacher, because the teacher and the system are coercive. Raffini (1996) said that students are driven by

their psycho-academic needs to control their own decisions (autonomy); to do things that help them feel successful (competence); to feel part of something larger than themselves (belonging and relatedness); to feel good about who they are (self-esteem); and to find pleasure in what they do (involvement and stimulation). (p. 3)

Deci, Vallerand, Pelletier, and Ryan (1991) referred to the basic psychological needs for competence, relatedness, and autonomy (or self-determination). This drive provides a compelling force or motivation to choose to do activities simply for the satisfaction of doing them, and is called intrinsic motivation. Deci et al. (1991) said that these needs explain the “energization of behavior” (p. 327).

Human beings want their choice to initiate and regulate their behavior, and the choice they make should depend on their inner needs and desires (Deci & Ryan, 1985). When students perceive that their own needs and interests motivate their behavior, Heider (1958, cited in deCharms, 1976) said that the *perceived locus of causality* is internal and is synonymous with self-determination (autonomy). The *perceived locus of causality* is external when the student perceives that his or her behavior is influenced by external causes such as a parent, a teacher, a threat, or a pressure of some kind.

deCharms (1976, 1984) and Ryan and Grolnick (1986) elaborated on the more vivid synonyms of “Origins” and “Pawns” to differentiate between students whose behaviors are self-determined (autonomous) and arise from an internal perceived locus of causality, and students whose behaviors are other-determined (controlled) and arise from

an external perceived locus of causality. In the classroom, origins are responsible for their actions and set goals for themselves. The person who originates his own behavior and is not pushed around by others is an origin.

On the other hand, the pawn is pushed around like a puppet and is a passive student who does not assume responsibilities for school activities. A pawn is externally motivated, while an origin is internally motivated. deCharms (1976) asserts that people differ on a continuum from origin to pawn depending on the cause of their motivation. The origin person feels that he or she can make choices concerning what happens to him or her, or about what he or she does; a pawn feels that he is under the control of someone, who pulls his puppet string and pushes him around. The locus of causality for his behavior is outside of himself. He states that the child in the traditional classroom is most often a pawn to the dictates of the teacher. "If the child could be encouraged to originate his own learning behavior, then, it would seem, he could be more of an origin in school" (deCharms, 1976, p. 3).

But deCharms (1976) stated that

man at his best is *active*, not *reactive*; he must strive rather than submit as a puppet. Man must author his own behavior, rather than have it dictated by authority. Man is not a pawn to the dictates of others; at his best man is the origin of his actions. (p. 4)

The motivation the origin experiences is different from that of the pawn; the former is positive, while the latter is negative. Consequently, the origin feels empowered and confident, while the pawn feels powerless and defensive. In his 1976 studies of this concept, deCharms found that teachers' behavior in the classroom can influence whether a student feels like a pawn or an origin and that when teachers became aware of the difference their attitudes make and were more supportive of student's autonomy, their

students' attitudes and behaviors changed from being relatively pawn-like to relatively origin-like. The students displayed greater commitment to their school work, assumed more responsibilities for their learning, had more confidence, and reported internal perceived locus of causality (Deci et al., 1981). Ryan and Grolnick (1986) and Deci et al. (1981) found also that students' personality characteristics also influence whether a student feels like an origin or a pawn because their characteristics determine how they interpret a teacher's support and control.

Studies (Atwel, 1987; Calkins, 1986, 1991; Fox, 1988; and Graves, 1983, cited in Dudley-Marling & Searle, 1995) found that students benefit when they have some control over the topics on which they write or the audience for which they write, and better writing results, but when they do not have control they are less likely to edit and revise their work. The same results are obtained when students have control over what they read and write and the purposes for which they read and write in whole-language classes/programs (Goodman, 1986, cited in Dudley-Marling & Searle, 1995).

Dudley-Marling and Searle (1995) said the extent to which teachers are willing to grant students some control over their learning may relate to their perceptions of student ability, and also to the extent to which teachers feel that they as teachers have control. Those who have little control may find it difficult to share control with students. Constructionists claim that meaningful learning will always depend on how much learners feel that the learning is under their control, that learning is their own (Searle, 1995).

Raffini (1996) claimed that the desire for autonomy and independence from adult control begins in toddlerhood, about 18 months of age to 3 years. If adults are firm but reasonable then, they help children to feel confident and to exercise self-control over their



behavior. The onset of adolescence is another stage at which children again try to assert their need for self-determination as they try to define their own sense of identity. At this stage it is difficult for them to accept adult direction, and the more teachers or other adults insist on imposing their will and desires on these adolescence, the more they will meet with resistance. White (1903/1952) advised against trying to break a child's will.

### **Problem-Based Learning: Research and Practice**

Results of research on how the brain learns seems to support the use of problem-based learning as a teaching/learning strategy. Jensen (1998a) declared that

If you wanted to get your car fixed, you'd likely go to a mechanic. For legal help, you'd find an attorney. To understand the brain and how we learn, would you go to a teacher? Probably not. Yet every year, millions of parents trust that the professionals who teach their children know something about the brain. (p. 7)

If learning occurs in the brain, then those who are engaged in teaching and learning should know and understand the brain's part in learning. It may be that knowledge of the brain's function in learning may help educational practitioners to teach so that students may learn. Piaget (1971) wanted to establish a connection between biology and how individuals come to know, epistemology, a link which became more possible with the advent of brain-imaging devices as described by Jensen (1998a). There are Magnetic Resonance Imaging (MRI) machines to study cross sections of soft tissue like the brain without X-rays or radiation. Positron Emission Tomography (PET) is an imaging device that reads the amount of radioactive substances that are released when certain areas of the brain consume glucose in a subject who has imbibed radioactive glucose.

The electroencephalogram (EEG) is a device that produces readings about the electrical output of the brain. Along with magneto encephalography that is used to

locate faint magnetic fields generated by the brain's neural networks, these tools can help trace the amount of brain activity that occurs during problem solving.

Spectrometers can also be used to measure the specifics of neurotransmitters during the occurrence of neural activities.

The use of these devices, along with clinical studies of human volunteers, laboratory experiments with animals, and autopsies, provides much biological evidence that may support some claims of cognitive development. Jensen (1998) says that models of the brain's operation prior to the 90s are outdated and that

The 90's may be remembered as the emergence of the 'chemical learner'. Those with just the right 'brain chemical' (more or less serotonin, dopamine, or other related compounds) will succeed while those whose chemistry is not quite right will be inattentive, unmotivated or violent. Brain-altering medications, mind food, and smart drugs already contribute to a billion-dollar, worldwide industry, and they may soon become the rule of the day. (pp. 4, 5)

### **Brain Research**

Wolfe and Brandt (1998) wrote that physiologically the brain changes as a result of the experiences it undergoes, and the environment in which it operates determines its functioning ability. They said that research shows that dendrites in humans and animals can grow at any age. The brain is always searching for meaning and grows new synaptic connections as it acquires new meanings. If information is within the student's context and related to his or her prior learning, meaning is enhanced (Kruse, 1998). Languis (1998) wrote of brain-imaging studies and clinical evidence for individual differences in brain-processing patterns, related to learning styles and the kinds of thinking skills the learner practices. Diamond (cited in D'Arcangelo, 1998) asserted that education changes the structure and chemistry of neurons in the cerebral cortex. When nerve cells are stimulated by new experiences and information from an enriched environment, they grow

new dendritic branches. If the environment is impoverished, the neurons lose branches (Diamond & Hopson, 1998, cited in D'Arcangelo, 1998). It is the connections among nerve cells that measure intelligence, and while we cannot grow new neurons (with few exceptions) we have a limitless capacity to grow new branches and connections (Wolfe & Brandt, 1998). Jensen (1998b) claimed that a mind is customized by life's experiences, and each individual's experience is determined by his or her genes and environment. Thus each person has a neural history that influences his or her learning.

According to Jensen (1998a) a stimulus to the brain is sorted and processed at several levels; then a memory potential is formed. The experience is viewed as either something new or something the learner already knows how to do. If we are doing something we already know how to do, the neural pathways become increasingly efficient by myelination of the axons, causing their thickening; this is exercise. Stimulation is when the brain does something new and this causes the involvement of more parts of the brain and greater beneficial electrical energy than does exercise. Repeated electrical stimulation and nutrients produce more dendritic branching and more synaptic connections to help learners understand better. Intelligence is determined by growing more synaptic connections between brain cells and not losing existing connection.

Jensen (1998a) stated that up to age 25 myelination and maturation of the brain with formation of new connections continue. From birth the brain customizes to the learner's lifestyle. Soon after birth, the brain gets rid of unwanted cells and unused connections. By age 4, the brain's infrastructure has been custom designed (Kotulak, 1996, p. 7, cited in Jensen, 1998a). Sousa (1998) added that research shows that the amount of engagement the learner experiences and the thinking involved will determine

the permanence and stability of the connections between neurons. The brain is modified by the type of use and how often it is used (Healy, 1990; Green, Greenough, & Schlumpf, 1983, as cited in Jensen, 1998a). Black et al. (1990, cited in Jensen, 1998a) provide a formula for learning as increased neural stimulation causing dendritic branching, leading to increased neural connections resulting in increased learning. They also found that variations in experiences cause variations in the way the brain develops.

Jacobs (cited in Jensen, 1998a) reported that autopsy studies of graduate students revealed up to 40% more connections than the brains of high-school dropouts, and that the group of graduate students who were involved in challenging activities showed 25% more "brain growth" than the control group. Besides, brains of graduate students who were just making it through school had fewer connections than those of students who challenged themselves every day (Jacobs, Schall, & Scheibel, 1993, cited in Jensen, 1998a).

Studies (Case, 1991; and Fischer, 1980, cited in Fischer & Rose, 1998) reported the results of research that show that brain development occurs in recurring growth cycles several times between birth and age 30. At those times there may be an expanded reorganized neural network, and with each subsequent cycle, learners have the opportunity to relearn skills missed in previous cycles.

Research also shows that emotions play a very important role in learning. If emotions are not expressed, they can inhibit learning. LeDoux and his colleagues (1996, cited in Jensen, 1998a) described the effect of fear on brain functioning in learning. When the child perceives conditions for fear, the brain bypasses the more sophisticated learning connections that have been organized, reverts to exercise, and thus reduces new learning to memorization and repetition. Caine and Caine (1998) defined this type of fear as a sense of

helplessness and borrowed the synonym “downshifting” to describe it more completely. “Downshifting” is defined as “the psycho-physiological response to fear associated with helplessness or fatigue” (p. 5); and may be caused by the following conditions:

1. Pre-specified “correct” outcomes have been established by an external agent.
2. Personal meaning is limited.
3. Rewards and/or punishment are externally controlled and relatively immediate.
4. Restrictive timelines are given.
5. Work to be done is relatively unfamiliar with little support available.

These conditions are typical of traditional classrooms where the teacher is in control and the students are helpless listeners. The traditional classroom model is based on the school as a factory, creates conditions that lead to downshifting, and reduces the student’s capacity to function at optimal levels.

Hooper and Teresi (1986, cited in Jensen, 1998) reported on the work of McGaugh, a neurobiologist at the University of California at Irvine. They said that McGaugh stated that the chemicals adrenaline, norepinephrine, and vasopressin, for example, are released when the body experiences intense emotions and they communicate to the brain what is and what is not important. Slywester (1995, cited in Kovalik & Olsen, 1998) said that learning and memory are influenced by attention, which is influenced by emotion. These authors remarked that the chemicals or neurotransmitters perform the synaptic leap on receptor cells throughout the body and on the brain. These substances provide the brain with information that alters the messages back to the body.

## **Problem-Based Learning: Practice**

### **In Teacher Education Programs**

Dean (1999) wrote that many educators, businesses, and government leaders have concerns about the goals and direction of education for the 21<sup>st</sup> century, and there is consensus that American education must prepare students to acquire higher-order thinking skills, decision-making, and problem-solving skills. Kagan (1994) also posited that today's employer needs workers who can work cooperatively with others. Instead of merely disseminating information, schools should help students access the many sources of information and select what is useful and relevant.

Restructuring of schools' curriculum to include problem-based learning has been done in some schools since PBL has the potential to help students acquire the skills mentioned (Delisle, 1997). However, unless special efforts are made to ensure that teachers implement the strategy, most teachers will continue to teach the way they have been taught, and many have not experienced PBL so they must be trained in its use in order to implement it. Education reform in the 1950s and 1960s failed, said Dean (1999), because "teachers entering the classroom were not prepared to implement an innovative curriculum" (p. 8).

It is, therefore, the responsibility of teacher education programs to equip teachers with strategies such as PBL. Such a move is "critical for the ultimate task of preparing students at all levels for the next 21st century" (Dean, 1999, p. 8).

In the book *Energizing Teacher Education and Professional Development with Problem-Based Learning* (ASCD, 2001), several authors, including Carol Dean, described the use of PBL in teacher education programs at several universities, in an effort "to foster the kinds of active learning experience that prospective teachers should

be engaged in during their initial teacher preparation and that veteran teachers should experience throughout their professional lives” (p. 1).

Dean (2001) stated that at Stamford University, where she implemented PBL in undergraduate teacher-training courses, the teachers benefited in many ways:

1. They took ownership of issues and recognized the effect on their professional lives.
2. They connected the issues and understood the relationship of the course to their lives.
3. They learned the value of working as a team and of using perseverance to solve a problem.
4. They began to appreciate the historical and philosophical contexts of current educational problems practices (before PBL method was used to teach about this, the students showed lack of interest).

These conclusions were supported by the journal comments of the students.

Although Dean (2001) and other authors described difficulties new users of PBL may encounter, they did suggest and have tried ways to overcome the difficulties with subsequent implementation of PBL, and they agreed that “PBL is an excellent way to engage students in material that might otherwise seem irrelevant . . . they begin to explore and take ownership of their future profession” (p. 13).

Another author, Lee Shumow (2001), wrote of using PBL in an undergraduate educational psychology course to help students:

Apply educational psychology research to teaching, early in their professional preparation sequence . . . gain content knowledge, strengthen problem-solving skills, engage in learning, and develop a professional identity. . . . Make classroom practices for teaching prospective teachers consonant with research knowledge about best practices that promote student learning and engagement – such as PBL. (pp. 24, 25)

The participants' responses to an "open-ended probe" support Shumow's (2001) conclusion that overall the students appeared to have learned more with PBL techniques than from traditional methods and took more responsibility for their learning. The students themselves reported that they liked attending classes more when they used PBL; they thought about the problem more, and felt more involved.

Jean Pierce and Herbert Lange (2001), giving their reasons for employing PBL in the educational psychology course at Northern Illinois University, stated that:

1. PBL methods are congruent with the learner-centered psychological principles identified by a taskforce of the American Psychological Association (1997). These principles are firmly rooted in a wide body of research conducted over a number of years (Alexander & Murphy, 1998).
2. The course is also congruent with program standards of the association for Childhood Education International (2000, pp. 39, 40).

Other authors used PBL in their teacher-training programs at the University of North Carolina at Greensboro to prepare pre-service teachers, to include students with disabilities in a general education classroom, and also to understand the elementary school curriculum as it impacts students. The outcomes were positive based upon anecdotal feedback from the mock school board audience and the students' course evaluations. The PBL unit provided an excellent learning experience for the student teachers; they were able to apply various models of curriculum theory and integration. The student teachers also "began to develop the knowledge, skills, and attitudes they will need to successfully teach students with disabilities in general education classrooms" (Hibbard, Levin, & Rock, 2001, p. 70).



In a graduate elective course at Indiana University, South Bend, Sara Sage (2001) used PBL as a delivery method that would help teachers “create their own unique understanding of the teaching and learning process, using the interaction of what they already know and believe, and the ideas and experience with which they come into contact as the basis” (p. 88). The course also taught teachers how to use PBL in their own teaching situations.

Among the benefits, the student teachers reported that they developed increased enthusiasm for their teaching, and a change in their teaching practices. Sage (2001) declared that using PBL was an effective strategy because it taught teachers to become involved with their students in an “authentic and complex problem” so that they may become “a collaborative community of learners” (p. 106). Such a cooperative effort, she said, would “help us meet the challenges of moving forward in education in the new millennium” (p. 106).

#### In Staff Development Efforts

Mettetal (2001) reported the use of PBL and CAR (Classroom Action Research) in staff development efforts in two school districts in Northern Indiana “to counter the charge of irrelevance” (p. 108). Their goals were to determine what works in the classroom for the purpose of improving student learning, and to help teachers learn the inquiry method.

Mettetal described this staff development initiative as extremely successful; the two goals were met and teachers reported that they felt more professional having been empowered to respond to parents’ questions concerning instructional strategies because they can respond that they were participants in the investigations and they are able to

explain the findings. The teachers also experienced an increase in collegiality because they worked as a team with other teachers at their site. One teacher is quoted to have said, “The professional growth comes from within—constructing our own learning instead of someone teaching us” (p. 117).

#### In K-12 Education

Savoie and Hughes (1994) and Gallagher et al. (1995) described problem-based learning as a method that helped students to understand and learn social studies and science. The strategy turned on the students and teachers and proved to be a definite advantage. Savoie and Hughes also showed that problem-based learning does not have to cover the whole curriculum but can be used as inserts in the course; a practice referred to as post-holing, with some desirable results on student learning. In both articles, the changed roles of teachers and students are described and explained. The teacher and students become colleagues, and the teacher is no longer the disseminator of information but a facilitator of learning.

Sage (1996) listed advantages in the use of this method in a K-8 setting. She admitted that there was not much documentation comparing content acquisition by students trained by problem-based learning with that of students trained traditionally on a K-12 level, although there was documentation to this effect with students in medical schools.

Stepien and Gallagher (1993) described PBL practice at the Center for Problem-Based Learning at the Illinois Mathematics and Science Academy (IMSA) and declared that the method provides many benefits to the students, including increased understanding, the ability to recall the information when needed, and the ability to be self-directed learners

and problem-solvers. The article described how the method allows the collaboration of students, teachers, and community and how all those involved become colleagues in the teaching/learning process. The article included a description of the training program for teachers to make them meta-cognitive coaches. It also provides information on how those wanting to do so may design problem-based learning units and on the availability of elementary and middle school units that they have prepared at the center.

Hartman et al. (1994) worked in an area that had a high rate of poverty, and chronic underachievers, and where teachers and children “loathed coming to school.” However, recently the teachers have been able to see increased achievement scores and a reduction in discipline referrals. For example, in 1993 only 1% of fourth-graders and 3% of fifth-graders scored at or above the national norm in the writing scores on the Metropolitan Achievement Test. By 1994, 30% of fourth-graders and 50% of fifth-graders scored at or above the national norm. Discipline referral dropped 71% and students have become more engaged and cooperative. The authors attributed this success to the fact that students, through guided inquiry, do research on a topic of their choice, which has been created around curriculum. They apply what they learn to projects that they present to peers, their parents, or community, as a culminating activity. They may work alone or with others.

Slavin et al. (1994) described their results with the use of simulations. They said that they were able to guarantee successful elementary education for every child regardless of family background or disability. Their purpose for using simulations was to allow every elementary student to achieve the highest standards in basic skills (p. 10. Simulations come close to real-life situations and “engage students in activities that enable them to apply everything they learn so they can see the usefulness and inter-

connectedness of knowledge” (p. 10) and are a comprehensive alternative to traditional elementary school curriculum. While the students learned to creatively solve problems, to understand their own learning process, to connect knowledge from different disciplines, and to work cooperatively with their peers, they also learn the curriculum. The authors said that this learning-by-doing approach was showing great results. There is substantial improvement in the overall reading of participating students and the need for special education for students with learning disabilities has been “significantly reduced” (p. 13). They posited that their program ‘Roots and Wings’ “provides one practical vision of what elementary schools can be like if we decide to give every child the academic grounding and the thinking skills, creativity, and broad world view we now expect only of our most gifted children” (p. 13).

Problem-based learning appears to have the potential to accomplish these results because the activities students are engaged in are simulations of authentic situations.

Herdman (1994) wrote of using students’ experience to create curriculum so that students’ academic class work was brought to life and helped them to better understand their own lives. The learning-by-doing projects turned his school around so that whereas at one time his school had one of the highest dropout rates in New York City, over 90% of the students in the first project group graduated from high school. He credited the programs’ success to the students’ personal involvement, their improved self-esteem, and development of problem-solving skills, cooperative working support for academic and emotional risk-taking and an opportunity for reflection. He wrote:

Education should not be merely informing; it should be transforming. We need to encourage students by using their own lives and realities as a point of departure. We can create an environment that encourages positive risks, challenges students with relevant raw material, and empowers them to use this new information as a tool to forge their own futures. (p. 19)

Baum et al. (1994) also described the success their students experienced by employing components of problem-based learning. The students were allowed to pursue areas of study that appealed to their interest and learning styles.

#### In Higher Education Programs

Boud et al. (1987) described the great impact that problem-based learning has had on the higher education programs at various institutions in Sydney, Australia. Practitioners were questioning the efficacy of basic science courses to adequately prepare students in the health professions, as they compared the differences in outcomes of academic and vocational programs that prepared students for various professions. The academic orientation alone did not seem to accomplish the job sufficiently. Boud (1987) writing about the use of problem-based learning in higher education in Australia stated that of all the educational innovations that were developed to address the inadequacy of their undergraduate programs, problem-based learning was the one with the greatest impact. Graduates needed to be better prepared to adapt to challenges they face in their professional lives, and to communicate effectively.

Stretton (1985), Woods (1985), and Barrows and Tamblyn (1980) posited that their institutions' move towards problem-based learning was driven by the mismatch between the competencies of the learner with the needs of the industries and professions they were entering. Barrows found that at MacMaster University, medical students were required to memorize many facts and usually were able to reproduce these on exams. However, when they had to apply their knowledge to patient cases, they lacked the information.

Stretton (1985) wrote that graduates from his program used to experience a shock when they tried to come to grips with the realities of complex, real-world situations. The graduates found a mismatch between the expectations they developed because of their education, and the realities of the world of work. His move to problem-based learning at his institution was to bring education and practice closer together to eliminate the dissatisfaction in both camps. Synonyms he quotes for problem-based learning are “education for capability” and “education for achievement.” Boud (1987) argued that most teachers have been educated to emphasize academic subject disciplines, but in professional practice, problems are not organized in this manner and that explains why graduates experience such a contrast between their subject-centered education in school and their problem-oriented real-world experience.

### Summary

Traditionally the learner was regarded as an absorber of information (Caine & Caine, 1997, p. 17). Now the results of brain-based learning research present the learner as one who interacts dynamically with information. While brain-based learning indicates that the traditional use of memorization is still useful in learning, memorization and integration into a whole picture facilitate learning best “when information is embedded in rich, meaningful experiences” (p. 18). However, if the learner has to memorize facts when they are dictated by someone else, then downshifting (a psycho-physiological response to threat associated with fatigue or perceived helplessness or both; p. 18) occurs. When learners downshift, they “bypass much of their capacity for higher order functioning and creative thought” (p. 18). Caine and Caine (1997) said that the brain is meant to learn from “naturally complex and ‘messy’ experiences” (p. 11).

Twenty-first-century education needs to employ the results of research on how the brain learns, and other related research to provide a supportive learning environment. Rapid rate of change and the fact that a teacher will not be able to teach a student everything the student will be required to know, as needs and information change, dictate that schools must teach students how to be lifelong learners in order to survive in a turbulent society. As Levy (1996) says, teachers cannot provide for the learning needs of all students, so they should create an environment that will enable every student to develop to his/her potential.

According to Jensen (1998a) using brain-compatible methodology “students’ grades and school participation went up, and the students reported greater self-confidence. . . . Students of all backgrounds ages, with every imaginable history of failure, and with lifelong discouraged attitudes can and have succeeded with this approach” (p. viii).

Problem-based learning is a brain-compatible method of teaching and learning because it gives children problems to solve through hypothesizing, discovery, and inquiry (Jensen, 1998a). It is based on this principle, that “our greatest challenges become our greatest learning experiences” and is a method that “educates by presenting students with a situation that leads to a problem for them to solve” (Delisle, 1997, p. v). Because the problem is centered around the curriculum, students acquire the curricular information as they work to solve the problem.

Problem-based-learning teachers seek for the best way to allow students to encounter the problem so that the students would take ownership of the problem and the inquiry and make personal investment in the solution (Jones et al., 1997). This kind of instruction leads to deeper understanding.

Barrows and Tamblyn (1980) said that when the teaching/learning situation is student-centered, the student is motivated by the internal rewards of learning. They work together, assist each other, and develop a collaborative relationship with faculty, and the students are “turned on” constantly. They also describe problem-based learning as the method to help students develop problem-solving skills and the only method that ensures a match between content and task.

Although the term “problem-based learning” was not used in Christ’s day or in the time of Ellen White, the method was practiced. John Dewey, a contemporary of Ellen White, aptly described the method.

Methods which are permanently successful in formal education . . . go back to the type of situation which causes reflection out of school in ordinary life. They give pupils something to do, not something to learn; and the doing is of such a nature as to demand thinking, or the intentional noting of connections; learning naturally results. (Dewey, 1916/1944, p. 154)

Problem-based learning has been adopted in school improvement movements to increase student achievement (Delisle, 1997). It has been shown to help students develop problem-solving skills, to retain and apply learning in situations other than where the learning occurred, to think critically, to become self-directed learners, and to work cooperatively with others (Checkley, 1997).



## CHAPTER 3

### METHODOLOGY

Problem-based learning is a teaching methodology designed to engage students in the learning process. The literature supports the effectiveness of problem-based learning to help students become successful learners (Checkley, 1997; Delisle, 1997; Gallagher, Stepien, Sher, & Workman, 1995; Hartman, Decicco, & Griffin, 1994; Pierce & Lange, 2001; Sage, 1996; Savoie & Hughes, 1994; Stepien & Gallagher, 1993; Wiggins & McTighe, 1998).

The Seventh-day Adventist Church in North America (Curriculum Futures Commission, North American Division Office of Education, 1997) has recommended the adoption and use of problem-based learning in SDA K-12 schools. Levin (2001) posited that PBL is a viable method for teaching today's students, and that teachers should be trained to use the method effectively.

It was the purpose of this research to determine how ready and willing teachers are for the adoption and implementation of this strategy, and to what extent they feel they would be supported by administrators and other policy makers, parents, and colleagues. To determine perceptions of the teachers towards problem-based learning, their willingness to use the method as a preferred teaching practice for the ideal Seventh-day Adventist schools of the future (Curriculum Futures Commission, 1997, p. 10), and

factors teachers perceived that would hinder the successful adoption and implementation of the strategy, four research questions were addressed:

1. To what extent are SDA K-12 teachers aware of problem-based learning as a teaching methodology?
2. To what extent do SDA K-12 teachers support the underlying philosophy of problem-based learning?
3. To what extent do SDA K-12 teachers embrace each component of problem-based learning?
4. What factors emerge as impediments to the adoption and implementation of problem-based learning?

In this chapter, the methodology that was used to obtain the information is described. It includes a description of the research design, the population selected, and the sample. There is also information on the instruments that were used and their development, the data collection, and data analysis procedures.

### **Population and Sample**

The population for this study is Seventh-day Adventist K-12 teachers in the United States of America. However, the inability of the researcher to obtain a sample of the entire population, and the peculiar organizational structure of the Seventh-day Adventist educational system necessitated the use of a convenience sample. This sample consists of the teachers in 50 SDA K-12 schools primarily in the State of Florida.

In the United States, Seventh-day Adventist K-12 schools are organized into regions called conferences in the same way that public schools are divided into districts. The conferences are accountable to the same accreditation body. I used as my sample,

teachers in two regions, or conferences. These two administrative units cover the state of Florida. The total population of 315 teachers in 50 schools served as the convenience sample for this study.

The schools in a conference are usually isolated from each other. They ranged in size from a one-teacher, one-room school with fewer than 25 students in multi-grades, to a school with over 200 students, and a teacher for each grade. The convenience sample was chosen because it was manageable in terms of time, expenses, and accessibility. It was also chosen because it is similar to other Adventist schools in the United States in terms of curriculum and textbooks used, certification requirements and procedures, and hierarchical government. It was similar, too, in being multicultural.

Seventh-day Adventist K-12 schools are coeducational and students may or may not wear uniforms. The socioeconomic situations of the families may vary, but all parents do pay tuition, because these are privately funded schools. In the Southeastern section of the country, namely in Southeast Georgia and Florida, not only is English spoken, since it is the national language, but a growing multicultural student population includes Spanish-speaking and French- or Creole-speaking student body. There may be students who speak other languages, also. In some cases, the teacher may or may not speak languages other than English.

All teachers must meet the same certification requirements established by the education departments that govern the educational work nationwide. In some instances the teachers must also seek certification by the public school system of the state in which they work. The teachers may teach in single- or multi-grade schools, and sometimes may have the added function of being principal or head teacher. Often, there is no full-time

secretary, and if there is not a part-time one, or a volunteer, the teacher also carries that responsibility. The teachers' teaching experiences vary, as well as their teaching certification, and their age and gender.

### **Research Design**

To determine teachers' attitude towards, and readiness for, the adoption of problem-based learning, I conducted an ex post facto survey to answer four main research questions. The study included an investigation and description of the prevalence of four variables (i.e., Awareness, Philosophical support, Teaching preferences, and Perceived impediments) among the population. There was also an investigation of the extent to which the target group of Seventh-day Adventist teachers compared on the same variables with a comparison group of teachers trained in the use of problem-based learning. This survey involved the use of questionnaires to inquire about the teachers' knowledge of PBL, their teaching philosophy (traditional or student-centered), their disposition towards the student-centeredness of PBL, and their perceptions of what factors would pose impediments towards the adoption and successful implementation of a new instructional method that has the potential to help more of their students learn.

This study was not used to imply causation between variables and teacher readiness because an experiment was not being conducted. Data analyses were used to show the presence or absence of relatedness between such independent variables as age, gender, years of teaching experience, multi-grade teaching experience, and grade level the teacher was currently teaching and the dependent variables; namely, awareness, support of student-centered teaching philosophy, preference for student-centered components of PBL, and perceived impediments. Although generalizing the findings

may be limited, I hope they will prove to be useful to educators and others interested in education, and to the Seventh-day Adventist school system in Florida. Although the group of teachers was treated as a convenience sample, they can be considered as the entire population of Florida Seventh-day Adventist teachers. The findings may therefore be interpreted as a description of the population of Seventh-day Adventist K-12 teachers in Florida.

### **Variables**

Four primary variables were addressed in this study. They were:

1. Awareness: Teachers' awareness of problem-based learning
2. Philosophical support: Teachers' support of the underlying student-centered philosophy of problem-based learning
3. Teaching preferences: Teachers' preference for each student-centered component of problem-based learning
4. Perceived impediments: Factors perceived as potential barriers to the adoption and implementation procedures.

First, teachers' awareness of problem-based learning is defined as whether teachers know enough about the method to answer questions about its characteristics. This variable was measured by a 10-item Awareness Questionnaire (see Appendix E).

Second, teachers' support of the underlying philosophy of problem-based learning is defined as whether they accept the practice of allowing students the opportunity to be more actively involved in the learning process by exploring their interests, and to problem-solve as they think through alternatives, instead of merely accepting, without question, facts that teachers and other adults transmit to them. Caine

and Caine (1997), referring to Senge (1990), pointed out that every educator has a theory of learning, but that there is a disparity between what people profess and what they believe. In education, the difference can be expressed as mental models. They cited Senge's definition of mental models as

deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world and how we take action. We often are not consciously aware of our mental models or the effects they have on our behavior. (p. 21)

Caine and Caine (1997) declared that

many teachers, other educators, and the public have a mental model of learning and teaching formed and . . . physiologically entrenched by their early experiences in school. Five or six education courses in a post-baccalaureate program or college lecturing tend not to genuinely challenge teachers' mental models and do little to disturb these deeply held assumptions about schools, teacher roles, and learning. (p. 22)

The authors stated that innovative strategies are usually made to fit our current mental models, because mental models do not change.

This variable was measured by using a 31-item Teaching Philosophy Scale (see Appendix E). The instrument was designed to reflect the teachers' philosophy about teaching; whether they are entrenched in the traditional method where the teachers are in complete control of what happens in the classroom and transmit to the students what they think the students should learn; or whether the teachers are open to supporting student choice and active involvement in the learning process. Some items are typical of traditional education thinking, and others reflect the thinking of the teacher who is supportive of student autonomy. The items were prepared based upon the components PBL and also upon items characteristic of the traditional method of teaching and learning as described in the literature.

Third, teachers' preference for each teaching component of problem-based learning is defined as the degree to which teachers agree with all, some, or none of the characteristics of problem-based learning. The variable is the teachers' preference for each component of problem-based learning. This was determined by use of the Teaching Preference Questionnaire, a ranking scale (see Appendix E) with the components of problem-based learning, where the respondents ranked from 1 to 3, or 4 in the case of two items, whether the component is most preferred (1), less preferred (2), or least preferred (3/4). Some items reflect traditional views purely, PBL views purely, and a third choice which is neither all PBL nor all traditional.

Finally, the successful application of any new instructional approach, including PBL, will require much support from stakeholders; in this case, the parents, principals, school boards, superintendents, and conferences. The teachers, too, must be willing to make the change. Therefore, impediments that may arise as barriers refer to teachers' attitudes that may be in opposition to the student-centeredness of the method, or what the teachers would perceive as lack of support from leaders or decision and policy makers such as principals, school board leaders, and superintendents. Some parents may even offer resistance to a new program if they do not fully understand it, and especially to this program where tests and letter grades may give way to projects and portfolios. If, according to Senge (1990, cited in Caine & Caine, 1997), mental models are difficult to change or do not change, I also wanted to study whether there are ideas, models of learning, or personal factors so deeply entrenched that would either make it easy for teachers to adopt or incorporate problem-based learning as a new way to teach, or get in the way of their trying to change their usual ways of teaching.

The parents must also be willing to accept changes in the way their children will acquire information, in the structure of the classroom, and in the way student progress will be followed, reported, and documented. The policy makers and the principals must be willing also to support change in terms of providing financial and moral support and allowing teachers time for training and practice. The teachers themselves must be willing to commit to the time and preparation necessary to acquire proficiency, and be flexible and confident to investigate and embrace other views. The teachers' age, gender, years of teaching experience, areas of endorsement, and grade levels they were teaching at the time of the study may emerge as some factors that would be impediments to the adoption of PBL. The Problem-Based Impediment Scale (see Appendix E) was used to help determine the teachers' perception of impediments in the areas described.

### **Instrumentation**

This study involved the use of questionnaires to obtain information about the teachers' knowledge of PBL, their teaching philosophy (traditional or student-centered), their disposition towards the student-centeredness of PBL, and their perceptions of what factors would pose impediments towards the adoption and successful implementation of a new instructional method that has the potential to help more of their students learn. The instruments (Appendix E), were an awareness questionnaire, a teaching philosophy scale, a teaching preference questionnaire, and an impediment scale. The demographic information section (see Appendix G) was used to gather demographic information. These instruments were all prepared by the researcher and were used to collect data to answer the following questions:



1. To what extent are SDA K-12 teachers aware of problem-based learning as a teaching methodology?
2. To what extent do SDA K-12 teachers support the underlying philosophy of problem-based learning?
3. To what extent do SDA K-12 teachers embrace each component of problem-based learning?
4. What factors emerge as impediments to the adoption and implementation of problem-based learning?

The components of problem-based learning were identified by the researcher and verified by Dr. David Workman, one of the scholars who have pioneered PBL in the United States, at the Center for Problem-based Learning at the Illinois Mathematics and Science Academy (IMSA). After the components were verified, an innovation configuration checklist was prepared and administered to some Illinois teachers who had been trained in the use of PBL at the academy, and who practiced or were still practicing its use.

The teachers not only provided feedback on how they used PBL, but also gave comments regarding the clarity of items (see Appendix F). Based upon the feedback received from this group, the innovation checklist was modified and the instruments were prepared. These instruments were the Awareness Questionnaire (AQ), the Teaching Philosophy Scale (TPS), the Teaching Preference Questionnaire (TPQ), and the Problem-based Impediment Scale (PBIS).

### **Validity**

Content validity of the instruments was obtained for the Awareness Questionnaire (AQ), the Teaching Philosophy Scale (TPS), the Teaching Preference Questionnaire (TPQ), and the Problem-based Impediment Scale (PBIS) by expert review of the PBL

components and innovation configuration checklist by Dr. David Workman. In my introductory letter to these Illinois teacher, I had elicited comments regarding clarity of items, and their suggestions concerning how I could improve the format of the checklist. The teachers gave comments regarding the clarity of items (see Appendix F), and their comments were used to modify the items of concern. This established the face validity of the instruments. Face validity of the instruments was also established when the instruments were piloted among a group of Marion County Public School teachers and modifications were made based on feedback from the teachers.

### **The IMSA Comparison Group**

The IMSA teachers' feedback (Appendix F) provided interesting information on a group of practitioners who could not be described as a true criterion group but who came closer to the ideal for true practice of PBL. I therefore, used them as a comparison group to which I could compare the performance of the target group of Seventh-day Adventist teachers on the instruments and get a profile of the Adventist teachers. In exchange for a copy of the results of this study, an IMSA representative, Deb Gerdes circulated the questionnaires to the IMSA teachers.

### **Validity Estimates for the Problem-based Impediment Scale**

It was not convenient to compute construct validity of the Awareness Questionnaire, the Teaching Philosophy Scale, and the Teaching Preference Questionnaire by factor analysis because these instruments have no subscales. Construct validity for the Problem-based Impediment Scale using factor analysis, however, was conducted. Table 1 shows the results of the factor analysis. According to Tabachnick and Fidell (1989),

Principal components analysis (PCA) and factor analysis (FA) are statistical techniques applied to a single set of variables where the researcher is interested in discovering which variables in the set form coherent subsets that are relatively independent of one another. (p. 597)

To improve interpretability of the components, Tabachnick and Fidell (1989) have suggested rotation of the factors. If uncorrelated factors are desired, an orthogonal rotation such as varimax rotation is used. For this study, a principal components analysis was performed using SPSS on the 41 items of the PBIS. Both orthogonal and oblique rotations were performed. Although the two extractions were highly similar in terms of factor structure and loadings, the oblique rotation provided the clearest and most interpretable extraction. In addition, because the correlations between the factors were high ( $r > .55$ ), the oblique solution was used. The initial analysis yielded six factors with eigenvalues greater than 1. A scree plot of the eigenvalues indicated a clear screen at four factors. On analysis of the various solutions, the four-factor solution generated factor loadings that were the most interpretable. Subsequent principal components analyses were computed using only those items loading at .50 or above on factors with five or more items. The four factors combined to account for approximately 65% of the variance in the measure.

The results of the factor analysis demonstrated that four factors explain the variance of the PBIS scores. These factors were: (a) a perceived impediment factor from the school system, (b) a perceived impediment factor from parents, (c) a perceived impediment factor from colleagues, and (d) a perceived impediment factor from each teacher. Table 1 shows how the scores for each subscale are grouped together or correlate significantly, indicating construct validity for the four factors.

### Reliability

I estimated the reliability of the data obtained by determining the internal consistency. To accomplish this, I used the method of rational equivalence in which individual items on each questionnaire or checklist are measured using the Kuder-Richardson formulas K-R 20 or K-R 21. Borg and Gall (1996) point out that K-R 21 is "a simplified, easily calculated approximation of formula K-R 20" (p. 257). The K-R 21 formula was utilized to account for the items on the Awareness Questionnaire, the Teaching Philosophy Scale, and the Teaching Preferences Questionnaire instruments. The formula used was:

$$rk = \left( \frac{k}{k-1} \right) \left( 1 - \frac{M \times (K - M)}{K \times S^2} \right)$$

K-R 21 values range from 0 to 1, with 1 being a perfectly consistent measure. It is appropriate to use this K-R 21 formula when the questionnaire items are scored dichotomously as in the case of the Teaching Philosophy Scale, the Awareness Questionnaire, and the Teaching Preference Questionnaire. For the Problem-based learning Impediment Scale, I used the Cronbach's coefficient alpha, a modified form of the K-R 20, which is used for items that are not scored dichotomously. The formula used was:

$$a = \left( \frac{k}{k-1} \right) \left( 1 - \frac{\sum S^2_{item}}{S^2_{instrument}} \right)$$

Coefficient alpha values range from 0 to 1, with 1 being a perfectly consistent measure.

Internal consistency for all the items on the Awareness Questionnaire (AQ) was calculated using K-R 21 with a resulting reliability coefficient of 0.7748, which suggests

a high degree of consistency across items. Internal consistency of the Teaching Philosophy Scale (TPS) was calculated using K-R 21. The value achieved was 0.6963, which suggests a moderate degree of consistency across items. Internal consistency for the Teaching Preference Questionnaire (TPQ) was calculated using K-R 21. The value achieved for all items was 0.6846, which suggests a moderate degree of consistency across items.

Internal consistency for all four subscales of the PBIS was calculated using Cronbach's Alpha. The value achieved was 0.9671, which suggests a high degree of consistency across items. Subscale alphas were also high, ranging from 0.89 to 0.96, despite the fact that each consisted of only six to ten items. The reliability coefficient for the school system was 0.8946. The reliability coefficient for the parents' subscale was 0.9161. Next, the reliability coefficient for the colleagues' subscale was 0.9508. Finally, the reliability coefficient for individual teacher's subscale was 0.9564.

Table 1

*Rotation Varimax Factor Loadings of the PBIS*

Item	PBIS			
	System	Parents	Colleagues	Individual
1. To what extent would school system provide you with sufficient training to learn about PBL?	.631	-	-	-
2. To what extent would school system Give you release time from classes to prepare for PBL?	.800	-	-	-
3. To what extent would school system provide finances for PBL materials?	.798	-	-	-
4. To what extent would school system allow teachers to get together during the school day to plan PBL?	.797	-	-	-
5. To what extent would school system visit you in your classroom in helping you implement PBL?	.822	-	-	-
6. To what extent would school system appreciate children working in a loosely structured, sometimes noisy learning environment?	.656	-	-	-
7. To what extent would school system support a student assessment system without the use of tests, letter grades, or report cards?	.449	-	-	-
8. To what extent would school system address criticisms, problems, and issues that may result from this change?	.629	-	-	-
9. To what extent would school system be favorable toward the use of PBL?	.580	-	-	-
1. To what extent would parents appreciate children working in a loosely structured, sometimes noisy, learning environment?	-	.805	-	-
2. To what extent would parents accept a performance report other than a letter grade or report card?	-	.690	-	-
3. To what extent would parents allow children opportunity to explore non-traditional ways/resources for information?	-	.778	-	-
4. 1. To what extent would parents devote time to learn about the new instructional method?	-	.775	-	-
5. To what extent would parents be willing to help their children adapt to their new instructional method?	-	.781	-	-
6. To what extent would parents provide material their children may need to prepare the product of their research?	-	.754	-	-
7. To what extent would parents be willing to share their expertise and resources with students and teachers?	-	.704	-	-
8. To what extent would parents be favorable toward the use of PBL?	-	.798	-	-
1. To what extent would colleagues invest time to acquire proficiency in the use of PBL?	-	-	.804	-
2. To what extent would colleagues work in a loosely structured, sometimes noisy, learning environment?	-	-	.776	-
3. To what extent would colleagues allow students to choose the pace and content of what they learn?	-	-	.769	-
4. To what extent would colleagues assess learning without the use of tests, letter grades, or report cards?	-	-	.739	-
5. To what extent would colleagues use textbooks as resources, and not to dictate the sequence of curriculum coverage?	-	-	.793	-

Table 1--*Continued.*

6. To what extent would colleagues allow students' needs and interests to determine the sequence of curriculum coverage?	-	-	.813	-
7. To what extent would colleagues tolerate some noise that students working together will cause?	-	-	.732	-
8. To what extent would colleagues be facilitators of learning and not the authority figures in the room?	-	-	.746	-
9. To what extent would colleagues conduct workshops to inform their students' parents of PBL?	-	-	.788	-
10. To what extent would colleagues address criticisms, problems, and issues that may result from this change?	-	-	.815	-
11. To what extent would colleagues participate in coaching and feedback exercises to help their colleagues acquire proficiency?	-	-	.854	-
12. To what extent would colleagues be favorable toward the use of PBL?	-	-	.794	-
1. To what extent would you invest time to acquire proficiency in the use of PBL?	-	-	-	.859
2. To what extent would you work in a loosely structured, sometimes noisy, learning environment?	-	-	-	.838
3. To what extent would you allow students to choose the pace and content of what they learn?	-	-	-	.744
4. To what extent would you assess learning without the use of tests, letter grades, or report cards?	-	-	-	.748
5. To what extent would you use textbooks as resources, and not to dictate the sequence of curriculum coverage?	-	-	-	.822
6. To what extent would you allow students' needs and interests to determine the sequence of curriculum coverage?	-	-	-	.769
7. To what extent would you tolerate some noise that students working together will cause?	-	-	-	.771
8. To what extent would you be a facilitator of learning and not the authority figure in the room?	-	-	-	.845
9. To what extent would you conduct workshops to inform your students' parents of PBL?	-	-	-	.801
10. To what extent would you address criticisms, problems, and issues that may result from this change.?	-	-	-	.813
11. To what extent would you conduct coaching and feedback exercises to help other teachers acquire proficiency?	-	-	-	.811
12. To what extent would you be favorable toward the use of PBL?	-	-	-	.864

*Note.* PBIS\_S = Problem-Based Impediment Scale for School System, PBIS\_P = Problem-Based Impediment Scale for Parents, PBIS\_C = Problem-Based Impediment Scale for Colleagues, PBIS\_I = Problem-Based Impediment Scale for the Individual Teacher.

## Procedures

The Illinois Mathematics and Science Academy (IMSA), located in Aurora, Illinois, is an institution that helps students, teachers, and policymakers to improve and transform mathematics and science teaching and learning. It describes its mission as

To transform mathematics and science teaching and learning by developing ethical leaders who know the joy of discovering and forging connections within and among mathematics, science, the arts, and the humanities by means of an exemplary laboratory environment characterized by research, innovative teaching, and service. (Marks, 2001b, para. 3)

It was to advance this mission that IMSA established the Center for Problem-Based Learning (CPBL) in 1992 with a challenge grant provided by Neison Harris of The Harris Family Foundation. Harris described PBL as “a highly promising teaching strategy” and IMSA as “a visionary institution committed to serving not only its own students, but also educators and students throughout the state and nation” (Marks, 2001 a, para. 2).

The Center for Problem-Based Learning at IMSA engages in PBL research, information exchange, teacher training, and curriculum development in K-16 settings. It provides professional development training for schools, educational systems, and for teachers in the state of Illinois and beyond. The center connects and mentors individuals who are interested in problem-based learning, and maintains a nationwide network of PBL practitioners. Financial support is provided by The Harris Family Foundation and The Hitachi Foundation.

The Center for Problem-Based Learning mentors educators as they design and develop PBL learning materials, and helps them acquire the skill of coaching students engaged in PBL activities in K-16 and other educational settings. It also explores



problem-based learning strategies as the context in which knowledge is acquired, ethical decision-making is nurtured, and problem-solving skills are developed with learners of all abilities; and it uses numerous networking options to connect PBL educators.

In the summer of 1999, I visited IMSA and became acquainted with Dr. David Workman, physicist, author, and co-author of problem-based learning publications, faculty, and core team member of IMSA. He is also the professor on a problem-based learning training video for educational practitioners, prepared and produced by IMSA. In a conversation I had that day with Dr. Workman, he clarified questions I had about problem-based learning, and promised to be a resource for me from that time.

Subsequent to that meeting, I have had telephone conversations with Dr. Workman, and on one of those occasions he acknowledged that what I read to him as the components (Appendix B) really captured the characteristics of problem-based learning.

I used the components to prepare an innovation configuration following the recommendations of Hall and Hord (1987), and sent copies to Dr. Workman, requesting that he share them with teachers who, he knew, were practicing problem-based learning instruction in the State of Illinois, to validate the configuration as reflecting the components of problem-based learning.

Hall and Hord (1987) recommend that after reading about the desired innovation, the person who wants to develop an innovation configuration should interview the innovation developers, facilitators, and trainers concerning classroom practice to find out the intent of the developers, and also to determine what classroom practices are acceptable as satisfying the intent of the developers and which are useful variations. The first draft is made after this process has been followed. I tried to follow this suggestion. I

was unable to contact Dr. Howard Barrows, the developer of the innovation, but I have been working with Dr. Workman who is a facilitator and trainer in the use of problem-based learning.

I sent Dr. Workman 20 Innovation Configuration checklists (Appendix C), each with a letter from me (Appendix A). Deb Gerdes, Coordinator of PBL Initiatives at IMSA, also included with each checklist, a letter (Appendix A) that explained the purpose of the checklist and encouraged teachers to participate and return the responses. Ten responses were received. Of this number, six indicated that some items were unclear and needed explanation (see Appendix F). The items that seemed to have been unclear were rewritten following the IMSA group's recommendations (Appendix D). This modified checklist was used to prepare the instruments that were used in this study.

Following revisions based upon the PBL teacher tryouts, the survey instrument was piloted among a few teachers in the Marion County Public School System. The information gained from the pilot study was used to prepare the final instruments that were administered to the population of 315 teachers in 50 schools in Florida. These instruments were distributed to the school principals to be forwarded to teachers. Each teacher completed the survey, and after sealing it in the provided self-addressed envelope, delivered the sealed envelopes directly to the school office where the principal or secretary forwarded the group of sealed envelopes directly to me. No attempt was made to identify respondents or their schools in an effort to assure anonymity of the participants.

Forty of the revised instruments were also mailed to Deb Gerdes at the Illinois Mathematics and Science Academy for her to distribute to enough IMSA-trained teachers

to form the comparison group of teachers. I provided stamped self-addressed envelopes for all the teachers, with a letter of explanation (Appendix A) to the first group of 20 teachers who had initially been surveyed with the Innovation Configuration checklist, and another letter of introduction (Appendix A) to the added number of teachers. I requested to have the responses returned to Ms. Gerdes who, in turn, sent them to me. I felt that by doing it that way the response rate would be better, and faster, since the first group sent only 50% of the returns directly to me.

The education superintendent of one conference and an associate superintendent of the other were very supportive of me and assisted in the distribution and collection of the surveys. I made request in person to the superintendent and by telephone with the associate superintendent. They each provided me with a 2001-2002 mailing list of all the teachers in their conferences, and an endorsement letter in support of the research. This letter was to register their support for the study and to encourage the teachers to respond. Before I began collecting data, I also obtained clearance from the Andrews University Office of Scholarly Research to conduct the study.

### **The IMSA Comparison Group**

The IMSA teachers' feedback (Appendix F) provided interesting information on a group of practitioners who could not be described as a true criterion group but who came closer to the ideal for true practice of PBL. The analysis of the IMSA teachers' responses to the innovation configuration is shown in Appendix F. It revealed that the teachers differed in their use of PBL. For example, only three of ten indicated that they plan for PBL with other teachers (Question 1 on the innovation checklist). Also, only one teacher uses students' interests to plan curriculum (Question 11). Three of the 10 teachers allow students an indefinite time to resolve problems (Question 14), and 4 of 10 teachers, allow

students to choose how they would present the resolutions of the problems (Question 16). I, therefore, used them as a comparison group to which I compared the performance of the target group of Seventh-day Adventist teachers on the instruments and got a profile of the Adventist teachers. In exchange for a copy of the results of this study, an IMSA representative, Deb Gerdes circulated the questionnaires to the IMSA teachers.

### **Collection of Data**

The data were collected by use of questionnaires. To determine teachers' knowledge of problem-based learning, a questionnaire containing 10 items was used. It is the Awareness Questionnaire (Appendix E). Teachers' support of the underlying philosophy of problem-based learning was surveyed with another questionnaire, the Teaching Philosophy Scale. It contains 31 items (see Appendix E).

The Teaching Preference Questionnaire (Appendix E) determined the extent to which teachers prefer each component of problem-based learning. It is composed of 11 items. For each item the teacher ranked the component from 1-3, with 1 being the most preferred, and 3 being least preferred. There were two items that had four rather than three choices. In those cases, the teacher ranked selection 3 or 4 as the least preferred.

The Problem-Based Impediment Scale (Appendix E) is the instrument that measured perceived impediments to the adoption. It consists of 21 items. The questions are grouped into four sections. The first measures support by all administrators; the second section measures support by students' parents; the third part measures support from teachers' colleagues, and the fourth section measures readiness of the teachers.

I administered the pilot instruments, and teachers returned them within 2 weeks. After changes were made based upon the feedback from the pilot study, I sent the final

draft of the instrument along with a letter of introduction (Appendix A) with self-addressed envelopes to the sample population. These were hand-delivered to the principal of each school with a letter asking him/her to have teachers complete the questionnaires, place and seal them in the envelope provided each teacher, and then return the sealed envelope to the principal, who, in turn, mailed the envelope to me, or to the respective conference office of education. I provided each principal with a copy of the permission received from the education superintendent of his/her conference.

It had been arranged that each principal of one conference would return the surveys from his/her school to the associate superintendent at an area meeting to convene 3 weeks from the date the material was first given to the principals. Principals from the other conference would return theirs to the superintendent of education at an in-service that was held 6 weeks from the date of distribution. I did not call the group that was meeting in 2 weeks, but I did call to remind the group whose in-service was going to be 6 weeks from the time the material was distributed to the principals.

Since I had no way of identifying schools or teachers who returned their survey from those who did not, I called every week after the first 6 weeks to remind teachers to complete and return the surveys. I also did a second and a third mailing to those schools that advised me to do so. The return rate was approximately 44%.

### **Data Analysis**

As the data were returned, appropriate analyses were conducted using Statistical Program for Social Sciences (SPSS). To answer the research questions, cross tabulations, chi-square, calculations of group means, and *t* tests were conducted. Factor analyses were done to determine construct validity of the Problem-based Impediment Scale.

Reliability estimates were also calculated. Means and standard deviations were calculated to provide descriptive data for the target and comparison groups.

The *t*-test analysis was conducted because it is appropriate for small samples. Shavelson (1996) states that “one important feature of the *t* test is its ability to handle small samples as small as  $N=2$ ” (p. 338). The comparison sample had 18 subjects. The *t* tests were employed to compare the performance of the SDA and the comparison groups of teachers on all the instruments. Cross tabulations were computed to responses within different sub-groups of the targeted SDA teachers. Chi-square test of statistical significance sought to determine if observed differences among subgroups were greater than would be expected by chance.

To answer the first three questions, namely, (a) “To what extent are Seventh-day Adventist teachers aware of PBL as a teaching strategy?” (b) “To what extent do Seventh-day Adventist teachers support the underlying philosophy of PBL?” and (c) “To what extent do Seventh-day Adventist K-12 teachers embrace the components of PBL?” cross tabulations were computed to determine relationship among the independent variables such as age, years of teaching experience, multi-grade teaching experience, gender, and grade level the teachers were teaching, and the dependent variables. The dependent variables were awareness, teaching philosophy (student-centered or traditional), preference for PBL student-centered components, and perceived impediments. Chi-square was used as a test of statistical significance to determine if observed differences among subgroups were greater than would be expected by chance. To compare the comparison teachers’ performance on each instrument with the performance of the target group of Seventh-day Adventist teachers on the same instruments, *t* tests were computed for the first three questions.

To answer the fourth question, “What factors emerge as impediments to the adoption and implementation of PBL?” group means and *t* tests were calculated. The use of *t* tests was to determine if differences in mean scores for each teacher group were significant. Item-level analyses of the items on the PBIS instruments were conducted so that the impediments could be identified when the mean scores were placed in descending order.

For each instrument, a comparison of Adventist teachers’ performance against the comparison group’s performance on each item was calculated. The comparison provided a profile of the Adventist teachers.

### **Summary**

To find out how much teachers in Seventh-day Adventist K-12 schools in Florida knew about problem-based learning and if their teaching philosophy was consonant with the underlying student-centered philosophy of PBL, I conducted an ex post facto survey among them. I constructed and validated the instruments that were used, and administered them to the sample of teachers after the instruments had been piloted among a small group of public school teachers. The variables measured were awareness, teaching philosophy (student-centered or traditional), student-centered teaching preferences, and perceived impediments. I sought to answer the following questions:

1. To what extent are Seventh-day Adventist K-12 teachers aware of problem-based learning as a teaching methodology?
2. To what extent do Seventh-day Adventist K-12 teachers support the underlying philosophy of problem-based learning?
3. To what extent do Seventh-day Adventist K-12 teachers embrace each component of problem-based learning?

4. What factors emerge as impediments to the adoption and implementation of PBL?

I used the Statistical Program for Social Sciences (SPSS) program to compute cross tabulations, and chi-square to determine the presence of relationships between the dependent variables of awareness, teaching philosophy (student-centered or traditional), student-centered teaching preferences, and perceived impediments and such independent variables as age, years of teaching experience, multi-grade teaching experience, and gender; and the statistical significance of the relationships. I also calculated *t* tests to compare the Seventh-day Adventist teachers' performance on these variables with the performance of a comparison group of teachers on the same variables.

The teachers who comprised this comparison group were teachers who had been trained in the use of PBL and were part of a PBL network. They had been trained at the Illinois Mathematics and Science Academy (IMSA) in Aurora, Illinois. While I was preparing the instruments, I had obtained interesting data that indicated that these teachers could not be regarded as a PBL criterion group (see Appendix F which is a measure of their fidelity to PBL). However, they were used for comparison and provided a reasonable profile of the Adventist teachers' disposition to PBL.

To answer a fourth question, "What factors emerge as impediments to the adoption and implementation of problem-based learning?" I calculated mean values and standard deviations of four subscales of the instrument that were designed to measure factors the teachers perceived as impediments to the adoption. To determine significance of differences in mean scores, *t* tests were calculated. Group means, differences among them, and significance of the differences, were calculated on these four sub-tests for the target group of SDA teachers and an awareness group composed of the 43% of the SDA teachers who reported that they were aware of problem-based learning.



Impediments were identified by performing item-level analyses on all items on the four subscales of the instrument that measured perceived impediments, then placing them in descending order of mean scores. Based upon the answer choices of each item (0-6), a cut-off mean score of 3.5, above which factors were identified as impediments, was set.

## CHAPTER 4

### PRESENTATION OF THE FINDINGS

The purpose of this study was to determine the perceptions and attitudes of Seventh-day Adventist K-12 teachers towards problem-based learning (PBL), and what they perceive to be barriers towards their adopting and implementing the method as a preferred teaching strategy in their schools. The 139 teachers surveyed were in the state of Florida and were compared to a reference criterion group of 18 PBL teachers from the Illinois Mathematics and Science Academy (IMSA) in Illinois.

The Seventh-day Adventist (SDA) educational system has recommended problem-based learning as one method that may be effective in improving its educational program (NAD Curriculum Futures Commission, 1997) as the system tries to prepare students to “be thinkers rather than mere reflectors of other men’s thoughts” (White, 1902/1952, p. 17). The method would enable the students to develop and exercise their abilities to be critical thinkers, to discover, find meaning, make informed decisions, and apply knowledge for themselves.

In this study, I examined (a) teachers’ awareness of problem-based learning, (b) how much the teachers’ own philosophy of education compared with the philosophy underlying problem-based learning, (c) the teachers’ preference for each component of problem-based learning, and (d) the teachers’ perceived barriers towards the adoption of problem-based learning. Two groups of subjects were selected for this study. One group was the target group of K-12 SDA teachers, and the other group was the comparison group of

teachers who had been trained in the use of PBL at the Illinois Mathematics and Science Academy in Aurora, Illinois. The data collected from the target group of teachers were compared with data on these same measures collected from the comparison group of teachers.

Teachers from the target SDA group were compared on four dependent variables, namely, Awareness of PBL, Teaching Philosophy (traditional or student-centered), Teaching Preference (traditional or student-centered/PBL), and Impediments to Problem-based Learning (perceived support/lack of support from school system stakeholders, i.e., parents, colleagues, teachers themselves). The study attempted to show relationships between these variables and such independent variables as the teachers' years of teaching experience, age, gender, and multi-grade teaching experience.

In this chapter, the results are presented and the findings interpreted and discussed. Data were analyzed using the Statistical Program for Social Sciences (SPSS). Cross tabulations, chi square, and *t* tests were computed to answer the four research questions. For purposes of determining levels of statistical significance, the Type 1 error rate of .05 was established (Anastasi, 1986).

The population was treated as a convenience sample for purposes of testing statistical significance, although technically the study also could be construed as a descriptive study without inference to a larger population. For this reason both descriptive and inferential statistics were used.

### **Findings and Analyses**

Three hundred fifteen surveys were distributed to a sample of Seventh-day Adventist K-12 teachers in Florida. Responses were designed to be anonymous, so no personal identifiers were collected from the participants. One hundred forty-eight responses were returned, 9 of which had

to be excluded because none of the items had been answered. One hundred thirty-nine surveys are included for the target group of teachers and 18 surveys from the comparison group. There are altogether 157 surveys included in these analyses.

From a statistical sense, the response rate of 44% is defensible, because according to Olejnik (1984, cited in Gall, Borg, & Gall, 1996), to obtain a medium effect size at the .05 level of significance, a sample size of 100 for the independent samples *t* test is appropriate for two groups. It is also quite adequate for correlation coefficient determinations. Both of these statistical tests were performed on the data.

### Demographic Data

#### Seventh-day Adventist Teachers

Of the 139 SDA teachers who completed the survey, 37 were males and 99 were females. Three participants did not provide information on their gender. Females outnumber males in the classroom more than 2 to 1. See Table 2.

Table 2

#### *Gender of Teachers*

	SDA Teachers	PBL Comparison	Total
Male	37 (27%)	5 (28%)	42 (27%)
Female	99 (73%)	13 (72%)	112 (73%)
Total	136 (100%)	18 (100%)	154 (100%)

Younger people ages 20-35 are not highly represented in the teaching profession. The larger numbers represent those who are 36-45, 46-55, and 56 and older with the greatest number of teachers being in the 46-55-year-old categories. Also, 26 were in the 20-35 age range, 29 in the age range of

36-45 years, 45 in the 46-55-year-old category, and 32 were 56 years old and older. Seven teachers did not respond to this question. See Table 3.

Table 3

*Age of Teachers*

Age	SDA Teachers	PBL Comparison	Total
20-35	26 (20%)	0 (0%)	26 (17%)
36-45	29 (22%)	4 (22%)	33 (22%)
46-55	45 (34%)	10 (56%)	55 (37%)
56 +	32 (24%)	4 (22%)	36 (24%)
Total	132 (100%)	18 (100%)	150 (100%)

Thirty-seven (28%) of the teachers reported that they had taught or were teaching in a multi-grade setting, while 94 (72%) had not had any experience teaching in multi-grade classrooms. Nine respondents did not provide that information. See Table 4.

Ten of the participants reported that they had had most of their teaching experience in the pre-kindergarten and kindergarten grades, 50 in the primary (1-5) grades, 39 in middle school (Grades 6-8), and 34 in high school (Grades 9-12).

Table 4

*Experience in Multi-grade Teaching**Table 4-Continued.*

Experience in Multi-grade	SDA Teachers	PBL Comparison	Total
Yes	37 (28%)	2 (12%)	39 (26%)
No	94 (72%)	15 (88%)	109 (74%)
Total	131 (100%)	17 (100%)	148 (100%)

Since some of the teachers had taught or were teaching multi-grades, if a teacher reported that he or she had had most experience on two levels; for example, middle and high schools, and was currently teaching one of those grade ranges, I recorded for most experience the one the teacher was currently teaching. If the teacher was currently teaching the two grade ranges for which he or she reported the most experience, I selected one of them for the grade range of most experience, and I did the same thing for determining grade currently being taught. Thirteen of the teachers (10%) were teaching pre-kindergarten and kindergarten classes; 47 (35%) were teaching the primary grades; 36 (27%) were teaching middle school, and 38 (28%) were teaching high school. Six teachers did not give information on the grade they were teaching. See Table 5.

Table 5

<i>School Level Currently Being Taught</i>	<hr/>		
	SDA Teachers	PBL Comparison	Total
Pre-K, K	13 (10%)	0 (0%)	13 (9%)
Primary	47 (35%)	5 (29%)	52 (34%)
Middle	36 (27%)	3 (18%)	39 (26%)
High School	38 (28%)	9 (53%)	47 (31%)
Total	134 (100%)	17 (100%)	151 (100%)

There was a wide spread in years of teaching experience with four teachers reporting 1 year and one teacher reporting more than 40 years' teaching experience. Nine teachers did not answer this item. See Table 6.

Table 6

<i>Years of Teaching Experience</i>			
<i>Years Of Experience</i>	<i>SDA Teachers</i>	<i>PBL Comparison</i>	<i>Total</i>
0 – 10	41 (32%)	1 (6%)	42 (28%)
11-20	39 (30%)	6 (33%)	45 (30%)
21-30	29 (22%)	7 (39%)	36 (24%)
31 +	21 (16%)	4 (22%)	25 (17%)
Total	130 (100%)	18 (100%)	148 (100%)

#### PBL Comparison Group

The PBL comparison group was composed of 18 teachers who had been trained in the use of problem-based learning at the Illinois Mathematics and Science Academy (IMSA), located in Aurora, Illinois. Surveys were sent to 40 such teachers, and 18 (45%) responded. This return rate compares with the return rate of the SDA teachers (44%).

In many respects, the demographic profile of the two groups is similar, except that most of the teachers in the comparison group (53%) teach in high school and half of the IMSA teachers (50%) report that level as the range of most experience. One teacher reported 9 years' teaching experience and another teacher had taught for 35 years. Two teachers reported multi-grade teaching experience.

#### Research Questions

Four main research questions provided the framework for this study. They were (a) To what extent are SDA K-12 teachers aware of problem-based learning as a teaching methodology? (b) To what extent do teachers support the underlying philosophy of problem-

based learning? (c) To what extent do teachers embrace the components of problem-based learning? (d) What factors are perceived as impediments to the adoption and implementation of problem-based learning?

To answer these questions, I measured the following variables: (a) the teachers' awareness of PBL as a teaching strategy, (b) the teachers' teaching philosophy, (c) the teachers' preference for the components of PBL, and (d) the level of support teachers anticipated coming from the school system, the students' parents, the teachers' colleagues, and the individual teacher's own willingness to adopt the method.

### **Awareness of Problem-Based Learning**

The first research question was, "To what extent are SDA K-12 teachers aware of problem-based learning as a teaching methodology?"

The Awareness Questionnaire was designed to determine how much the teachers knew about problem-based learning. The 10 items were based on the components of problem-based learning. Each item allowed the teacher to make one of five choices, a-e, and only one of those choices truly reflected a component of problem-based learning as determined by Dr. David Workman, a notable PBL scholar and author, along with persons from the PBL Network in Illinois.

The highest possible score a teacher could receive was 10, assuming that respondents answered all 10 statements correctly. The mean score on this instrument for the SDA teachers was 4.68 with a standard deviation of 2.58. The comparison IMSA teachers' mean and standard deviation were 7.22 and 1.47, respectively. The teachers' scores were analyzed using cross-tabulation, chi-square, independent samples *t* tests, and item-level analyses.



## Results

The teachers' scores on the Awareness Questionnaire were placed into four categories. A score of 9-10 was categorized as "Very Much Awareness." A score of 6-8 was categorized as "Moderate Awareness." A score of 3-5 was categorized as "Moderate Lack of Awareness," and a score of 0-2 was "Little or No Awareness." Tables 7 through 15 demonstrate the teachers' performance on the awareness measurements.

## Entire Group

Table 7 summarizes the awareness scores for the entire group of SDA teachers. Only 3% of all K-12 SDA teachers were very much aware of PBL. Forty percent of the teachers were moderately aware of PBL principles. Thirty-six percent of the teachers had a moderate lack of awareness of PBL. The other 21% of the teachers knew little or nothing of PBL. More than half of the SDA teachers (57%) fell in the lower two categories (Lack of Awareness) whereas 43% were distributed in the Awareness categories.

Table 7

*Distribution of SDA Teachers' PBL Awareness Scores (N=139)*

Little/No Awareness	Moderate Lack of Awareness	Moderate Awareness	Very Much Awareness
29 (21%)	50 (36%)	56 (40%)	4 (3%)

The proportion of teachers in the top two categories (Very Much Awareness and Moderate Awareness) was compared to the proportion in the bottom two categories (Little or no awareness or Moderate lack of awareness) to give a rough measure of "Awareness" or

“Lack of Awareness.” Moreover, cells from the analysis were collapsed into these broader categories when it was determined that chi-square assumptions would be violated with excessive empty cells, or cells with less than the required minimum expected frequency.

### By School Level

Table 8 summarizes the awareness scores by school levels. In all school levels, more teachers fell into the lack of awareness categories than in the awareness categories. Although half of SDA high-school teachers were shown to be aware of PBL principles, and middle-school teachers appeared to have the largest percentage (67%) of teachers in the lack of awareness categories, these differences can be assumed to be due to random error.

Table 8

#### *Percentage of SDA Teachers' PBL Awareness by School Levels*

Level	Lack of Awareness	Awareness	Total
Pre-K, K	7 (54%)	6 (46%)	13 (100%)
Primary	26 (55%)	21 (45%)	47 (100%)
Middle	24 (67%)	12 (33%)	36 (100%)
H.S.	19 (50%)	19 (50%)	38 (100%)
Total	76 (57%)	58 (43%)	134 (100%)

*Note:* 5 cases missing.

Chi-square calculations of awareness/lack of awareness by school levels determined that differences among grade levels are not statistically significant ( $\chi^2_{(3)} = 2.231$ ,  $p = .526$ ), suggesting that awareness of PBL is not statistically related to teaching level.

### By Student-Centered Teaching Philosophy

Table 9 compares the awareness scores by the teachers' teaching philosophy. To form the student-centered philosophy categories, the scores obtained on the TPS instrument were grouped into four categories. If the teacher scored 24-30, the category was "Very Much Student-Centered Philosophy." A score of 16-23 formed the category "Moderate Student-Centered Philosophy." A score of 8-15 was "Moderate Lack of Student-Centered Philosophy," and a score of 0-7 formed the category "Little/No Student-Centered Philosophy." Because of excessive empty cells, the cells were collapsed into two categories, namely, "Lack of Awareness" and "Awareness." For the same reason, the cells for philosophy were collapsed together to form two categories of student-centeredness, namely, "Lack of Student-Centered Philosophy" and "Student-Centered Philosophy."

Of the teachers who lacked student-centeredness, 28% fell into the awareness category. Forty-six percent of the teachers in the student-centered philosophy category were aware of PBL components. It is important to note that more teachers who lacked a student-centered teaching philosophy fell in the lack of awareness category than did teachers who had a student-centered teaching philosophy (72% to 54%, respectively). These findings may indicate that there is a direct relationship between the teachers' student-centeredness and their awareness of PBL, although no significant relationship was found at the .05 level of significance.

Chi-square calculations of awareness/lack of awareness by student-centered philosophy indicate that there is no statistically significant difference among student-centered philosophy levels and the teachers' degree of awareness ( $\chi^2_{(1)} = 2.858, p = .091$ ). Teachers' awareness of PBL strategy is not determined by the student-centered philosophy.

Table 9

*Percentage of SDA Teachers' PBL Awareness  
by Level of Student-Centered Philosophy (N = 139)*

Level	Lack of Awareness	Awareness	Total
Lack of Student-Centered Philosophy	18 (72%)	7 (28%)	25 (100%)
Student-Centered Philosophy	61 (54%)	53 (46%)	114 (100%)
Total	79 (57%)	60 (43%)	139 (100%)

#### By Student-Centered Preferences

Table 10 summarizes the awareness scores by the teachers' student-centered preferences. The scores the teachers obtained on the Teaching Preferences Questionnaire instrument were categorized into four groups. The highest range of 9-11 formed the "Very Much Teaching Preferences" category. The "Moderate Teaching Preferences" category scores 6-8. The next category was the "Moderate Lack of Teaching Preferences" category that scored 3-5 on the instrument. The other category was 0-2 the "Little/No Teaching Preferences." Because of excessive empty cells, the cells in Table 10 were collapsed together to form two categories of awareness, namely, "Lack of Awareness" and "Awareness"; and two categories of teaching preferences, namely, "Lack of Student-Centered Preferences" and "Student-Centered Preferences."

Twenty-nine percent of the teachers who reported lack of student-centered preferences fell into the awareness category. Barely half of the teachers who fell into the "Student-Centered Preferences" categories also fell into the "Awareness" categories (51%). However, more than 70% of teachers who fell into the "Lack of Student-Centered Preferences" categories

also fell into the “Lack of Awareness” categories. These findings may indicate that there is a direct relationship between the teachers’ student-centered preferences and their awareness of PBL.

Chi-square calculations of awareness/lack of awareness by student-centered preferences indicate that there is a statistically significant difference among student-centered preference levels and the teachers’ degree of awareness ( $\chi^2_{(1)} = 6.211, p = .013$ ). The teachers’ level of awareness is statistically related to the teachers’ student-centered preferences. The majority of the teachers who lacked student-centered preferences (71%) also lacked awareness, while the majority of the teachers who had student-centered preferences (51%) fell into the awareness category.

Table 10

*Percentage of SDA Teachers’ PBL Awareness  
by Level of Student-Centered Preferences (N=139)*

Level	Lack of Awareness	Awareness	Total
Lack of Student-Centered Preferences	36 (71%)	15 (29%)	51 (100%)
Student-Centered Preferences	43 (49%)	45 (51%)	88 (100%)
Total	79 (57%)	60 (43%)	139 (100%)

By Teacher’s Multi-Grade Experience

Table 11 summarizes the awareness scores by the teachers’ multi-grade experience or lack of it. To ensure that assumptions regarding adequate cell frequencies for chi-square were met, the cells in Table 11 were collapsed together to form two categories of awareness, namely, “Lack of Awareness” and “Awareness.”

Forty-one percent of the teachers with multi-grade experience fell into the awareness category. Forty-eight percent of those who had no multi-grade experience fell into the awareness category.

Chi-square calculations of awareness/lack of awareness by multi-grade experience indicate that there is no statistically significant difference in awareness between teachers who have multi-grade experience and those who do not ( $\chi^2_{(1)} = .575, p = .448$ ). Awareness of PBL is not statistically related to whether or not the teacher has had multi-grade teaching experience.

Table 11

*Percentage of SDA Teachers' PBL Awareness  
By Multi-Grade Experience of Teachers (N=131)*

Multi-Grade Experience	Lack of Awareness	Awareness	Total
Yes	22 (59%)	15 (41%)	37 (100%)
No	49 (52%)	45 (48%)	94 (100%)
Total	71 (54%)	60 (46%)	131 (100%)

*Note.* 8 cases missing.

### By Sex of Teacher

Table 12 summarizes the teachers' awareness scores by the sex of the teacher. To ensure that assumptions regarding adequate cell frequencies for chi-square were met, the cells in Table 12 were collapsed together to form two categories of awareness, namely, "Lack of Awareness" and "Awareness."

More than half of the male teachers (54%) fell into the awareness category as compared to only 37% of female teachers in the same category. Chi-square calculations of awareness/lack of awareness by the gender indicated that there is no statistically significant difference in extent of awareness between male teachers and female teachers ( $\chi^2_{(1)} = 3.078, p = .079$ ). Knowing the teaching technique is not related to whether the teacher is male or female.

Table 12

*Percentage of SDA Teachers' PBL Awareness  
by Sex of Teachers (N=136)*

Sex	Lack of Awareness	Awareness	Total
Male	17 (46%)	20 (54%)	37 (100%)
Female	62 (63%)	37 (37%)	99 (100%)
Total	79 (58%)	57 (42%)	136 (100%)

*Note.* 3 cases missing.

### By Teacher's Age

Table 13 summarizes awareness scores by the age of the teacher. To ensure that assumptions regarding adequate cell frequencies for chi-square were met, the cells in Table 13 were collapsed together to form two categories of awareness, namely, "Lack of Awareness" and "Awareness."

Chi-square calculations of awareness/lack of awareness by the teacher's age indicate that there is no statistically significant difference among teacher's age and level of awareness ( $\chi^2_{(3)} = 1.523, p = .677$ ). That is, teachers' awareness of PBL is not significantly related to their ages. The apparent differences in mean scores are due to random error.

Table 13

*Percentage of SDA Teachers' PBL  
Awareness By Teacher's Age (N=132)*

Age	Lack of Awareness	Awareness	Total
20-35	14 (54%)	12 (46%)	26 (100%)
36-45	18 (62%)	11 (38%)	29 (100%)
46-55	22 (49%)	23 (51%)	45 (100%)
56 +	19 (59%)	13 (41%)	32 (100%)
Total	73 (55%)	59 (45%)	132 (100%)

*Note.* 7 cases missing.

**Comparison of SDA Teachers With the PBL Comparison  
Group on the Awareness Questionnaire**

**By Awareness Items**

Table 14 summarizes the performance of the target group of teachers and the comparison group on each item of the Awareness Questionnaire. It also shows the difference in performance by both groups and the statistical significance of each difference.



Table 14

*Item Comparison, Teachers' Awareness Questionnaire*

Item #	Correct Comparison %	Correct SDA %	Difference %	$\chi^2$
1. PBL is structured around interdisciplinary study	56	43	13	0.990
2. PBL is student-centered/problem-based	100	66	34	8.687**
3. PBL students acquire information through research (traditional and non-traditional)	72	23	49	18.867**
4. In PBL problems initiate learning	56	32	24	3.763*
5. PBL teacher is a facilitator/guide	94	77	17	2.928
6. PBL addresses curricular requirements and student interests simultaneously	94	73	21	4.050*
7. In PBL learning is evaluated through embedded assessment and a final product	89	38	51	16.668**
8. In PBL students find the best/most defensible solution to their problem	94	68	26	5.533*
9. In PBL students choose how to present the resolution of their problem	44	31	11	1.326
10. In PBL there is no set time for the resolution of the problem	22	17	5	0.267

\*  $p < .05$ . \*\*  $p < .01$ .

There is no statistically significant difference between comparison and target groups on items 1, 5, 9, and 10. There is a statistically significant difference between comparison and target groups on items 2, 6, and 8 at the .05 alpha level. There is also a statistically significant difference between comparison and target groups on items 3, 4, and 7 at the .01 level of alpha.

Item #10 raises an interesting issue. The item asks whether a definite time should be set for resolution of the problem and whether teacher or student should set that time. Both the Criterion and SDA teachers scored very low (22% and 17% respectively). The nature of the scores raises the question as to the validity of the item itself and whether the acceptable

response was within or without the configuration of what could be truly considered a PBL principle.

#### By *t* Test of Differences

The *t*-test result for Research Question 1 is shown in Table 15. The mean score on awareness was 4.68 with a standard deviation of 2.58 for the target group. The mean score on awareness was 7.22 with a standard deviation of 1.48 for the comparison group. The result of the analysis indicates that a statistically significant difference does exist between the target and comparison groups, because  $t(155) = 6.17$  does exceed  $t_{.05/2, 155} = 1.980$ . Thus, the comparison group, as was expected, has more awareness of problem-based learning than does the target group.

Table 15

*Mean and Standard Deviation and t Score for Teachers' Awareness*

	Mean	SD	<i>t</i>	<i>p</i> (sig)
Target Group ( <i>N</i> =139)	4.68	2.58	6.17	0.00
Comparison Group ( <i>N</i> =18)	7.22	1.48		

*Note.* Equal variances not assumed (Levene's Test for Equality of Variances  $F = 6.75, p = .01$ ).

### **Summary**

Less than one-half of the entire group of SDA teachers was aware of PBL principles. This finding was true of all grade levels.

At the 0.05 level of significance, the difference in awareness between student-centered teaching preferences and a lack of student-centered teaching preferences was statistically significant. Teachers who are student-centered in their teaching preferences are more likely to know about PBL than teachers who are not. On the other hand, when the teachers lacked student-centered preferences, the level of awareness of PBL was low, indicating a relationship between student-centered preferences and awareness.

### **The Teachers' Teaching Philosophy**

The second research question was, "To what extent do SDA teachers endorse the underlying philosophy of problem-based learning?"

The Teaching Philosophy Scale was designed to measure the teachers' tendency towards being traditional in teaching habit, or student-centered, as the teacher who would choose to use problem-based learning methods would have to be. There were 31 items on the questionnaire, but item 26 was not included in the analyses because it was ambiguous. The remaining 30 items were identified as 12 student-centered and 18 traditional. If the respondent answered "yes" for the student-centered item, he/she received a score of 1; a "no" received a zero. If the respondent answered "yes" for a traditional item, he/she received a score of zero (meaning not student-centered). A "no" answer for traditional (yes for student-centered) received a score of 1.

The highest possible score one could receive on this instrument was 30. The mean score for the SDA population was 18.73 with a standard deviation of 3.87. The mean for the criterion group

was 21.89 with a standard deviation of 4.46. The teachers' scores were used to calculate cross tabulations, *t* tests, inter-correlations, chi-square, and item-level analyses.

### Results

The scores were grouped into four categories. If the teacher scored 24-30, the category was "Very Much Student-Centered Philosophy." A score of 16-23 formed the category "Moderate Student-Centered Philosophy." A score of 8-15 was "Moderate Lack of Student-Centered Philosophy," and a score of 0-7 formed the category "Little/No Student-Centered Philosophy." Tables 16 to 24 demonstrate the teachers' performance on the Teaching Philosophy Scale.

The proportion of teachers in the top two categories ("Moderate and Very Much Student-Centeredness") was compared to the proportion in the bottom two categories ("Little/No" and "Moderate Lack of Student-Centeredness") to give a rough measure of congruence with the student-centered, PBL philosophy.

### Entire Group

Table 16 summarizes the teaching philosophy scores for the entire group of SDA teachers. Only a little over half (52%) of the SDA teachers as a whole fell into the two student-centeredness categories, indicating congruence with the PBL philosophy. A large percentage (48%), however, fell into the lack of student-centeredness categories. So there are almost as many SDA teachers who do not embrace a student-centered teaching philosophy as there are SDA teachers who do.

A large percentage (48%), however, fell into the lack of student-centeredness categories. Consequently, there are almost as many SDA teachers who do not embrace a student-centered teaching philosophy as there are SDA teachers who do.

Table 16

*Distribution of SDA Teachers' Student-Centered Teaching Philosophy Scores (N=139)*

Little/No Student-Centered Philosophy	Moderate Lack of Student-Centered Philosophy	Moderate Student-Centered Philosophy	Very Much Student-Centered Philosophy
7 (5%)	60 (43%)	65 (47%)	7 (5%)

#### By School Levels

Table 17 summarizes the teachers' teaching philosophy by school levels.

To ensure that assumptions regarding adequate cell frequencies for chi-square were met, the cells in Table 17 were collapsed together to form two categories of student-centeredness, namely, "Lack of Student-Centeredness" and "Student-Centeredness." Among primary teachers it appeared that more of the teachers (70%) were in the Student-Centeredness categories and seemed to be far more than any of the categories (46%, 42%, and 42% respectively).

Chi-square calculations of student-centered philosophy/lack of student-centered philosophy by the school level where the teacher teaches, indicate that there is no statistically significant difference among teachers' school levels and the student-centeredness teaching philosophy at the  $\alpha = 0.05$  level of significance ( $\chi^2_{(3)} = 3.421, p = .331$ ).

#### By the Sex of the Teachers

Table 18 summarizes the teachers' student-centered scores by their sexes. To ensure that assumptions regarding adequate cell frequencies for chi-square were met, the cells in Table

Table 17

*Percentage of SDA Teachers' Student-Centered Teaching Philosophy by School Levels (N=134)*

Level	Lack of Student-Centered Philosophy	Student-Centered Philosophy	Total
Pre-K, K	7 (54%)	6 (46%)	13 (100%)
Primary	14 (30%)	33 (70%)	47 (100%)
Middle	21 (58%)	15 (42%)	36 (100%)
H.S	22 (58%)	16 (42%)	38 (100%)
Total	64 (48%)	70 (52%)	134 (100%)

*Note.* 5 cases missing.

18 were collapsed together to form two categories of student-centeredness, namely, "Lack of Student-Centeredness" and "Student-Centeredness."

Although it appeared that slightly more than half of the female teachers indicated a student-centered teaching philosophy (55%), and slightly less than half the males (45%) indicated the same, chi-square calculations of student-centered philosophy/lack of student-centered philosophy by the sex of the teacher indicate that there is no statistically significant difference between male and female teachers on level of teaching philosophy ( $\chi^2_{(1)} = .017, p = .895$ ). The apparent mean differences are due to random error. The teacher's support of student-centered teaching is not statistically related to the sex of the teacher.

#### By Teacher's Age

To ensure that assumptions regarding adequate cell frequencies for chi-square were met, the cells in Table 19 were collapsed together to form two categories of student-centeredness,

Table 18

*Percentage of SDA Teachers' Student-Centered Teaching Philosophy by Sex (N=136)*

Sex	Lack of Student-Centered Philosophy	Student-Centered Philosophy	Total
Male	20 (54%)	17 (46%)	37 (100%)
Female	45 (45%)	54 (55%)	99 (100%)
Total	65 (48%)	71 (52%)	136 (100%)

*Note.* 3 cases missing.

namely, "Lack of Student-Centeredness" and "Student-Centeredness."

A majority of teachers 20-35 and 46-55 years of age indicate a student-centered philosophy (65% and 71% respectively). A clear minority of the other groups (36-45 and 56+) indicated the same (34% and 41% respectively).

Chi-square calculations of student-centered philosophy/lack of student-centered philosophy by the age of the teacher indicate that there is a statistically significant difference on level of teaching philosophy ( $\chi^2_{(3)} = 10.295, p = .016$ ) by teachers' ages. It is interesting to note that the age categories do not show a trend, although distinct differences were observed. Teachers 20-35 and 46-55 have high student-centered teaching philosophy, while those in the age categories 36-45 and 56 and older have a more traditional teaching philosophy.

Table 19 summarizes the teachers' teaching philosophy scores by the age of the teacher.

#### By Years of Teaching Experience

To ensure that assumptions regarding adequate cell frequencies for chi-square were met, the cells in Table 20 were collapsed together to form two categories of

Table 19

*Percentage of SDA Teachers' Student-Centered Teaching Philosophy by Teacher's Age (N=132)*

Age	Lack of Student-Centered Philosophy	Student-Centered Philosophy	Total
20-35	9 (35%)	17 (65%)	26 (100%)
36-45	19 (66%)	10 (34%)	29 (100%)
46-55	13 (29%)	32 (71%)	45 (100%)
56 +	19 (59%)	13 (41%)	32 (100%)
Total	60 (45%)	72 (55%)	132 (100%)

*Note.* 7 cases missing.

student-centeredness, namely, "Lack of Student-Centered Philosophy" and "Student-Centered Philosophy."

Table 20 summarizes the teaching philosophy scores by the teachers' years of teaching experience. Chi-square calculations of student-centered philosophy /lack of student-centered philosophy by the teachers' years of teaching experience indicate that there is no statistically significant difference among teachers' years of teaching experience and the level of support of the underlying philosophy of PBL ( $\chi^2_{(3)} = 3.094, p = .377$ ). It appears that teachers' years of teaching experience does not relate statistically to the teachers' level of student-centered teaching philosophy. Any difference in frequencies observed were due to random error.



Table 20

*Percentage of SDA Teachers' Student-Centered Teaching Philosophy by Years of Teaching Experience (N=130)*

Years of Teaching Experience	Lack of Student-Centered Philosophy	Student-Centered Philosophy	Total
0 – 10	13 (32%)	28 (68%)	41 (100%)
11-20	21 (54%)	18 (46%)	39 (100%)
21-30	12 (41%)	17 (59%)	29 (100%)
31 +	13 (62%)	8 (38%)	21 (100%)
Total	59 (45%)	71 (55%)	130 (100%)

*Note.* 9 cases missing.

#### By Multi-Grade Experience

Table 21 summarizes the teachers' teaching philosophy scores by their multi-grade experience. To ensure that assumptions regarding adequate cell frequencies for chi-square were met, the cells in Table 21 were collapsed together to form two categories of student-centeredness, namely, "Lack of Student-Centeredness" and "Student-Centeredness."

Chi-square calculations of student-centered philosophy /lack of student-centered philosophy by the teachers' multi-grade teaching experience indicate that there is no statistically significant between the teachers who have multi-grade experience and those who do not ( $\chi^2_{(1)} = 1.943, p = .163$ ), on their level of student-centered teaching philosophy. Observed differences in frequency distributions are due to random error.

Table 21

*Percentage of SDA Teachers' Student-Centered Teaching Philosophy by Multi-Grade Experience of Teachers (N=131)*

Multi-grade Experience	Lack of Student-Centered Philosophy	Student-Centered Philosophy	Total
Yes	13 (35%)	24 (65%)	37 (100%)
No	47 (50%)	47 (50%)	94 (100%)
Total	60 (46%)	71 (54%)	131 (100%)

*Note.* 8 cases missing.

#### By Student-Centered Preferences

Table 22 summarizes teachers' teaching philosophy scores by their level of student-centered preferences. The teachers' scores on the Teaching Preferences Questionnaire was organized into categories. The highest range of 9-11 formed the "Very Much Teaching Preferences" category. The "Moderate Teaching Preferences" category scores 6-8. The next category was the "Moderate Lack of Teaching Preferences" category that scored 3-5 on the instrument. The other category was 0-2 the "Little/No Teaching Preferences." Because of excessive empty cells, the cells in Table 22 were collapsed together to form two categories of student-centeredness, namely, "Lack of Student-Centered Philosophy" and "Student-Centered Philosophy"; and two categories of teaching preferences, namely, "Lack of Student-Centered Preferences" and "Student-Centered Preferences."

The teachers' scores on the Teaching Preferences Questionnaire were organized into categories. The highest range of 9-11 formed the "Very Much Teaching Preferences" category.

Table 22

*Percentage of SDA Teachers' Student-Centered Teaching Philosophy by Level of Student-Centered Preferences (N=139)*

Level	Lack of Student-Centered Philosophy	Student-Centered Philosophy	Total
Lack of Student-Centered Preferences	31 (61%)	20 (39%)	51 (100%)
Student-Centered Preferences	36 (41%)	52 (59%)	88 (100%)
Total	67 (48%)	72 (52%)	139 (100%)

The “Moderate Teaching Preferences” category scores 6-8. The next category was the “Moderate Lack of Teaching Preferences” category that scored 3-5 on the instrument. The other category was 0-2 the “Little/No Teaching Preferences.” Because of excessive empty cells, the cells in Table 22 were collapsed together to form two categories of student-centeredness, namely, “Lack of Student-Centered Philosophy” and “Student-Centered Philosophy”; and two categories of teaching preferences, namely, “Lack of Student-Centered Preferences” and “Student-Centered Preferences.”

The connection between student-centered teaching philosophy and student-centered teaching preferences is predictably clear. A majority of teachers (59%) in the student-centered teaching preferences group scored in the student-centered philosophy category. On the other hand, a majority of teachers (61%) in the lack of student-centered preferences category also lacked a student-centered philosophy, compared to 41% of those who had student-centered preferences. Only 39% of teachers who lacked student-centered preferences fell in the student-centered philosophy category.

Chi-square calculations of student-centered philosophy/lack of student-centered philosophy by the teachers' student-centered teaching preferences indicate that there is a statistically significant difference among student-centered preference levels ( $\chi^2_{(1)} = 5.108, p = .024$ ) and student-centered philosophy. Teachers with high or moderate levels of student-centered preferences have high or moderately high levels of student-centered philosophy.

### **Comparison of SDA Teachers With Comparison Group on Teaching Philosophy Scale**

#### **By Teaching Philosophy Items**

An examination of the items on the Teaching Philosophy Scale indicates varying levels of agreement between SDA and comparison teachers as indicated in Table 23.

There is a statistically significant difference at the  $\alpha = 0.05$  level among items #10, 12, 16, 18, 22, 25, and 28. At the  $\alpha = 0.01$  level, there is a statistically significant difference among items #2, 5, 8, 14, 21, and 31.

Of special note are items #2, 22, and 25 because they are both significantly different between the two groups, and the SDA teachers rate higher rather than lower than the comparison group. Item 2 states, "Instruction should be guided primarily by true-to-life experiences of students." Item 22 states, "Effective feedback lets students know immediately if their responses are right or wrong." Item 25 states, "Children must be educated more for the future than for the present."

Table 23

*Item Comparison, Teaching Philosophy Scale*

Item #	% Correct Comparison	% Correct SDA	% Difference	$\chi^2$
1. Students' interests should determine both the time and the manner in which curriculum is covered.	39	53	-14	1.314
2. Instruction should be guided primarily by true-to-life problems of students.	44	77	-33	8.608**
3. Curriculum is best determined by what teachers and other mature, experienced adults think is most appropriate for students.	39	44	-5	.162
4. The best teachers take their cues from students' responses to questions.	100	93	7	1.383
5. The students' role is to receive knowledge	89	57	32	6.852**
6. Ideal teachers construct practical problem situations and then use frequent questions to help students solve those problems.	89	93	-4	.346
7. The best learning environment is one where students solve their own problems.	94	81	13	2.092
8. The teacher should be a strong authority figure in the classroom.	83	33	50	16.931**
9. Allowing student choice to determine the curriculum tends to "water down" classroom instruction.	83	73	10	.831
10. Teachers should allow students to take charge of the manner and pace of their learning.	67	38	29	5.349*
11. A test is most useful when administered at the end of a unit to evaluate how much has been learned.	72	54	18	2.158
12. The best teachers are skillful transmitters of knowledge.	72	43	29	5.409*

Table 23—Continued.

Item #	% Correct Comparison	% Correct SDA	% Difference	$\chi^2$
13. The most effective learning environment is non-structured rather than structured.	39	27	12	1.040
14. The most effective curriculum is organized into specific subjects, such as math, English, history, health, etc.	100	66	34	8.687**
15. Students should be active participants in all or almost all the classes they take.	100	98	2	.396
16. The best teaching technique is the inquiry method.	89	66	23	4.028*
17. There are essential bodies of knowledge that each student must receive.	17	5	12	3.615
18. Most classroom instruction should center around presentations, demonstrations, and multi-media instruction.	72	45	27	4.872*
19. Students should be allowed to choose the method by which they acquire knowledge.	72	64	8	.470
20. A well-constructed pencil-and-paper test is the most useful way to evaluate student learning.	94	94	0	.001
21. The primary purpose of education is to transmit values from one generation to the next.	78	40	38	9.445**
22. Effective feedback lets students know immediately if their responses are right or wrong.	61	86	-25	6.718*
23. Curriculum coverage by the end of the school year should determine students' readiness for promotion to the next grade.	78	65	13	1.210
24. School-age children are too inexperienced to know what is the best curriculum for them.	44	40	4	.158
25. Children must be educated more for the future than for the present.	17	41	-24	3.999*
26. Giving students very much input into curriculum development is unwise.	78	84	-6	.360

Table 23—Continued.

Item #	% Correct Comparison	% Correct SDA	% Difference	$\chi^2$
27. In the best learning environment, children should be quiet and orderly.	100	80	20	4.413*
28. The lecture method is the best way to teach large groups of learners so all can have the same opportunity to learn.	89	90	-1	.019
29. Real learning begins with the learners' experiences.	94	92	2	.126
30. Textbooks provide an ideal framework for organizing and sequencing what students should learn.	94	54	40	10.768**

\*  $p < .05$ . \*\*  $p < .01$ .

#### By $t$ -Test of Differences

Table 24 shows  $t$ -test comparison for the target and comparison groups for Research Question 2. The mean score on teachers' philosophy was 18.73 with a standard deviation of 3.87 for the target group. The mean score on teachers' philosophy was 21.89 with a standard deviation of 4.46 for the comparison group. The result of the analysis indicates that a statistically significant difference does exist between the target and comparison groups, because  $t(155) = 3.20$  does exceed  $t_{05/2, 155} = 1.980$ . Thus, the comparison group has a more student-centered philosophy in line with PBL than the target group and would be more likely to adopt problem-based learning than the target group.

Table 24

*Mean and Standard Deviation and t Score  
for Teachers' Philosophy*

	Mean	SD	t	p (sig)
Target Group (N=139)	18.73	3.87	3.20	0.00
Comparison Group (N=18)	21.89	4.46		

### Summary

A little more than half of the entire group of SDA teachers (52%) embrace a student-centered teaching philosophy; a large percentage (48%) still does not. The relationship between the teacher's age and student-centered teaching philosophy was shown to be statistically significant. Most of the teachers in the age groups 20-35 and 46-55 embraced a student-centered teaching philosophy (65% and 71%, respectively), while only 34% of the teachers in the range of 36-45, and 41% of those 56 years and older had a student-centered teaching philosophy.

The analyses clearly indicated that there is a direct relationship between student-centered teaching philosophy and student-centered teaching preferences. Teachers with high or moderate student-centered teaching philosophy have high or moderately high levels of student-centered teaching preferences.

### The Teachers' Teaching Preference

The third research question was, "To what extent do SDA K-12 teachers prefer the components of problem-based learning?"



The Teaching Preference Questionnaire was used to measure the teachers' preference for each component of problem-based learning. The teachers would rank-order three or four choices for each question, but only one of those would indicate a component of problem-based learning as verified by expert opinion from the Illinois Mathematics and Science Academy. Therefore, there was only one correct response. There were 11 items, so the highest possible score was 11. The mean score on this instrument was 5.90 with a standard deviation of 1.59. The criterion group mean was 7.56 with a standard deviation of 2.09. Cross tabulations, item-level analyses, chi-square, and *t* tests were computed.

### **Results**

To facilitate the computation of cross tabulations, the scores the teachers obtained on this instrument were categorized into four groups. The highest range of 9-11 formed the "Very Much Teaching Preferences" category. The "Moderate Teaching Preferences" category scores 6-8. The next category was the "Moderate Lack of Teaching Preferences" category that scored 3-5 on the instrument. The other category was the "Little/No Teaching Preferences," with scores of 0-2. Tables 25 to 31 demonstrate the teachers' performance on the Teaching Preference Questionnaire.

The proportion of teachers in the top two categories (Very Much Teaching Preferences for PBL and Moderate Teaching Preferences for PBL) was compared to the proportion in the bottom two categories (Little/No Teaching Preferences for PBL and Moderate Lack of Teaching Preferences for PBL) to give a rough measure of teachers' preference for PBL or lack of preference for PBL.

## Entire Group

Table 25 summarizes the teacher preference scores for the entire group of SDA teachers. Less than half of the SDA teachers (38%) fell into the preference for PBL categories. Well over half of them (62%) fell into the lack of PBL preferences categories. This indicates that the majority of SDA teachers do not embrace the components of PBL.

The proportion of teachers in the top two categories (Very Much Teaching Preferences for PBL and Moderate Teaching Preferences for PBL) was compared to the proportion in the bottom two categories (Little/No Teaching Preferences for PBL and Moderate Lack of Teaching Preferences for PBL) to give a rough measure of teachers' preferences for PBL or lack of preferences for PBL.

Table 25

*Distribution of SDA Teachers' Teaching Preferences Scores (N=139)*

Little/No Teaching Preferences	Moderate Lack of Teaching Preferences	Moderate Teaching Preferences	Very Much Teaching \ Preferences
9 (7%)	77 (55%)	52 (37%)	1 (1%)

## By School Levels

Table 26 summarizes the teaching preferences scores by school levels. To ensure that assumptions regarding adequate cell frequencies for chi-square were met, the cells in Table 26 were collapsed together to form two categories of student-centeredness, namely, "Lack of Student-Centered Preferences" and "Student-Centered Preferences."

Chi-square calculations of student-centered teaching preference/lack of student-centered teaching preference by school levels indicate that there is no statistically significant difference

among level of the school on teaching preferences levels ( $\chi^2_{(3)} = 2.480, p = .479$ ). The grade levels where the teachers teach have no statistical relationship to the teachers' student-centered teaching preferences, and observed differences were due to random error.

Table 26

*Percentage of SDA Teachers' Teaching Preferences By School Levels (N=134)*

Level	Lack of Student-Centered Preferences	Student-Centered Preferences	Total
Pre-K, K	6 (46%)	7 (54%)	13 (100%)
Primary	27 (573%)	20 (43%)	47 (100%)
Middle	27 (75%)	9 (25%)	36 (100%)
H.S	24 (63%)	14 (37%)	38 (100%)
Total	84 (63%)	50 (37%)	134 (100%)

*Note.* 5 cases missing.

#### By Multi-Grade Experience

Table 27 summarizes the teachers' teaching preference scores by their multi-grade experience. To ensure that assumptions regarding adequate cell frequencies for chi-square were met, the cells in Table 27 were collapsed together to form two categories of student-centeredness, namely, "Lack of Student-Centered Preferences" and "Student-Centered Preferences."

Chi-square calculations of student-centered teaching preference/lack of student-centered teaching preference by multi-grade experience indicate that there is no statistically significant difference between the teachers who have multi-grade experience and those who do not ( $\chi^2_{(1)} =$

.487,  $p = .485$ ). They perform similarly on the Teaching Preference for PBL instrument, indicating that multi-grade teaching experience is not statistically related to the teachers' preference for the components of PBL. Any differences observed were due to random error.

Table 27

*Percentage of SDA Teachers' Student-Centered Teaching Preferences by Multi-Grade Experience of Teachers (N = 131)*

Multi-grade Experience	Lack of Preferences Student-Centered	Student-Centered Preferences	Total
Yes	24 (65%)	13 (35%)	37 (100%)
No	56 (60%)	38 (40%)	94 (100%)
Total	80 (61%)	51 (39%)	131 (100%)

*Note.* 8 cases missing.

### By Sex

Table 28 summarizes the student-centered teaching preference scores by the teacher's sex. To ensure that assumptions regarding adequate cell frequencies for chi-square were met, the cells in Table 28 were collapsed together to form two categories of student-centeredness, namely, "Lack of Student-Centered Preferences" and "Student-Centered Preferences."

Although less than half of the female teachers (44%) fell into the preferences categories, that percentage was twice as much as the percentage (22%) of male teachers that fell into the same categories. A large majority of the male teachers (78%), compared to 56% of the female teachers, lack PBL preferences.

Chi-square calculations of student-centered teaching preferences/lack of student-centered teaching preferences by the sex of the teacher indicate that there is a statistically

significant difference between male and female teachers on level of teaching preferences ( $\chi^2_{(1)} = 5.94, p = .015$ ). The teacher's sex is statistically related to the teacher's student-centered teaching preferences. Female teachers have more appreciation for student-centered learning environments.

Table 28

*Percentage of SDA Teachers' Student-Centered Teaching Preferences by Sex (N=136)*

Sex	Lack of Student-Centered Preferences	Student-Centered Preferences	Total
Male	29 (78%)	8 (22%)	37 (100%)
Female	55 (56%)	44 (44%)	99 (100%)
Total	84 (62%)	52 (38%)	136 (100%)

*Note.* 3 cases missing.

#### By Teacher's Age

Table 29 summarizes the teachers' student-centered teaching preference scores by the teacher's age. To ensure that assumptions regarding adequate cell frequencies for chi-square were met, the cells in Table 29 were collapsed together to form two categories of student-centeredness, namely, "Lack of Student-Centered Preferences" and "Student-Centered Preferences."

Table 29

*Percentage of SDA Teachers' Student-Centered Teaching Preferences by Teacher's Age (N=132)*

Age	Lack of Student-Centered Preferences	Student-Centered Preferences	Total
20-35	17 (65%)	9 (35%)	26 (100%)
36-45	17 (59%)	12 (41%)	29 (100%)
46-55	28 (62%)	17 (38%)	45 (100%)
56 +	18 (56%)	14 (44%)	32 (100%)
Total	80 (61%)	52 (39%)	132 (100%)

*Note.* 7 cases missing.

Chi-square calculations of student-centered teaching preference/lack of student-centered teaching preference by the age of the teacher indicate that there is no statistically significant difference among teachers' age groups on levels of teaching preferences ( $\chi^2_{(3)} = 4.940, p = .176$ ). The teacher's age is not statistically related to the teacher's student-centered teaching preference, and any observed differences in frequency distributions, were caused by random error.

**Comparison With the Comparison Group By Items on the Teaching Preference Questionnaire**

Table 30 summarizes the results of the comparison of the SDA teachers with the comparison group on the Teaching Preference Questionnaire. There is no statistically significant difference between the comparison and target groups on items 4, 5, 6, 8, and 10. There is statistically significant difference between the comparison and target groups on items 1, 2, 3, 7, 9, and 11 when type I error is less than .05.

### By *t* Test of Differences

Table 31 shows the independent samples *t* test for the SDA and the comparison groups of teachers. The mean score on teachers' preference was 5.90 with a standard deviation of 1.59 for the target group. The mean score on teachers' preference was 7.56 with a standard deviation of 2.09 for the comparison group. The result of the analysis indicates that a statistically significant difference does exist between the target and comparison groups, because  $t(155) = 3.24$  does exceed  $t_{05/2, 155} = 1.980$ . Thus, the comparison group shows more preference for problem-based learning components than the target group does.

### Summary

Only 38% of the entire group of SDA K-12 teachers indicated a preference for the components of PBL. This finding shows that the majority (62%) of the teachers do not embrace PBL components.

There is a statistically significant relationship between gender and student-centered teaching preferences. Twice as many females as males (44% and 22%, respectively) indicated a preference for the student-centered components of PBL.

### Problem-Based Impediments

The fourth research question was, "What factors are perceived as impediments to the adoption and implementation of problem-based learning?" To determine teachers' perception of factors that would arise as impediments toward the adoption and implementation of PBL, the Problem-Based Impediment Scale was used. The scale measured teachers' perceptions of the supportiveness of stakeholders through four sub-scales: (a) the school system, (b) students'

Table 30

*Item Comparison, Teachers' Preferences Questionnaire*

Item #	% Correct Comparison	% Correct SDA	% Difference	$\chi^2$
1. I prefer teaching structured around interdisciplinary study.	61	32	29	6.076*
2. I believe that the most effective kind of learning is student-centered/problem-based.	94	69	25	5.089*
3. I think knowledge is best acquired when students conduct research using traditional and non-traditional sources of obtaining information.	83	58	25	4.213*
4. I believe that problems aid learning best when they are used to initiate learning.	89	68	21	3.247
5. I believe that the teacher should function as a facilitator of learning, or guide.	83	82	1	0.004
6. I prefer a teaching method where instruction is driven by curricular requirements and students' interests.	83	93	-10	1.883
7. I believe that the best way to assess learning is by use of embedded assessment and the student's final product.	89	64	25	4.446*
8. I believe that the best type of learning occurs when students find the best or most defensible answer to a problem they have to solve.	89	73	16	2.053
9. I believe that students should always be allowed to choose how they present the outcome of the problem they work on.	44	21	23	4.920*
10. I believe that the student should determine the length of time the resolution of the problem takes.	16	22	-6	0.298
11. I prefer to teach in an environment that is loosely structured and loosely disciplined.	22	6	16	5.204

$p < .05$ . \*\*  $p < .01$ .



Table 31

*Mean and Standard Deviation  
and t Score For Teachers' Preferences*

	Mean	SD	t	p (sig)
Target Group (N=139)	5.90	1.59	3.24	0.00
Comparison Group (N=18)	7.56	2.09		

*Note.* Equal variances not assumed (Levene's Test for Equality of Variances  $F = 4.62$ ,  $p = .03$ ).

parents, (c) teachers' colleagues, and (d) the teachers' own willingness to adopt and implement PBL.

Table 32 summarizes the results of the analyses of the data for the subscales of the Problem-Based Impediment Scale (PBIS).

Table 32

*Perceived Impediments Scale*

Subscale	Support Scores Total Possible	SDA Support Scores (N= 139)		SDA Support Score for Awareness Group (N=60)	
		Mean	SD	Mean	SD
School system	54	30.86	11.71	29.57	11.76
Parents	48	25.06	10.03	24.32	10.62
Other teachers	72	42.15	16.27	40.93	15.21
Teachers themselves	72	51.45	16.52	53.88	17.07

## Results

### Supportiveness by Categories

#### Perception of School System's Support

There were 9 questions on the school system subscale. Each item could receive a score of 0 to 6 (0 = "Not Willing," and 6= "Very Willing"). The maximum score possible on this subscale was 54, which would indicate no impediment. The scores obtained from the PBIS instrument for this subscale were categorized into four levels of responses. They were (a) Very High Impediment, 0-13 points, (b) Moderately High Impediment, 14-31 points, (c) Moderately Low Impediment, 32-41, and (d) Little/No Impediment, 42-54 points.

SDA teachers' mean score was 30.86, with a standard deviation of 11.71. When the means were calculated for the 43% of the teachers who expressed that they were aware of PBL, the school system mean was 29.57, with a standard deviation of 11.76. Since the value of possible responses ranged from 0 to 6, then a mean value of 32 or less would signify an impediment for the school system. Therefore, both for the target group of 139 and for the teachers who were aware of PBL (43%), the school system was an impediment.

#### Perception of Parental Support

There were 8 questions on the parent subscale. Each item could receive a score of 0 to 6 (0 = "Not Willing," and 6= "Very Willing"). The maximum score possible on this subscale was 48, which would indicate no impediment. The scores obtained from the PBIS instrument for this subscale were categorized into four levels of responses. They were (a) Very High Impediment, 0-12 points, (b) Moderately High Impediment, 13-28 point, (c) Moderately Low Impediment, 29-36, and (d) Little/No Impediment, 37-48 points.

SDA teachers' mean score was 25.06, with a standard deviation of 10.03. When the means were calculated for the 43% of the teachers who expressed that they were aware of PBL, the parent mean was 24.32, with a standard deviation of 10.62. Since the value of possible responses ranged from 0 to 6, then a mean value of 28 or less would signify an impediment for the parents. Therefore, both for the target group of 139 and for the teachers who were aware of PBL (43%), the parents were an impediment.

### **Perception of Colleague Support**

There were 12 questions on the colleague subscale. Each item could receive a score of 0 to 6 (0 = "Not Willing," and 6= "Very Willing"). The maximum score possible on this subscale was 72, which would indicate no impediment. The scores obtained from the PBIS instrument on this subscale were categorized into four levels of responses. They were (a) Very High Impediment, 0-18 points, (b) Moderately High Impediment, 19-42 points, (c) Moderately Low Impediment, 43-54, and (d) Little/No Impediment, 55-72 points.

SDA teachers' mean score was 42.15, with a standard deviation of 16.27. When the means were calculated for the 43% of the teachers who expressed that they were aware of PBL, the colleagues mean was 40.93, with a standard deviation of 15.21. Since the value of possible responses ranged from 0 to 6, then a mean value of 42 or less would signify an impediment for the school system. Therefore, both for the target group of 139 and for the teachers who were aware of PBL (43%), the colleagues were an impediment.

### **Perception of Individual Teacher's Support**

There were 12 questions on the individual teacher subscale. Each item could receive a score of 0 to 6 (0 = "Not Willing," and 6= "Very Willing"). The maximum score possible on this subscale was 72, which would indicate no impediment. The scores obtained from the PBIS

instrument on the Individual Teacher's Support subscale were categorized into four levels of responses. They were (a) Very High Impediment, 0-18 points, (b) Moderately High Impediment, 19-42 points, (c) Moderately Low Impediment, 43-54, and (d) Little/No Impediment, 55-72 points.

SDA teachers' mean score was 51.45, with a standard deviation of 16.52. When the means were calculated for the 43% of the teachers who expressed that they were aware of PBL, the individual teacher mean was 53.88, with a standard deviation of 17.07. Since the value of possible responses ranged from 0 to 6, then a mean value of 42 or less would signify an impediment for the school system. Therefore, both for the target group of 139 and for the teachers who were aware of PBL (43%), the individual teacher was not an impediment to the adoption.

#### ***t* Test to Compare Means Differences**

Table 33 is a summary of *t*-tests to determine whether differences in PBIS mean scores between the teachers who were aware of PBBL (43%) and the teachers who were not aware of PBL (57%) in Table 32 above were significant. The *t* value for PBIS\_S was 1.14, which does not exceed  $t_{.05/2, 155} = 1.658$ . Therefore, the difference between the school system means for the SDA teachers who were aware of PBL and those who were unaware of PBL is not statistically significant. Both groups perform about the same on this instrument. They do not expect to be supported by their school systems.

The *t* value for PBIS\_P was .76, which does exceed  $t_{.05/2, 155} = 1.658$ . Therefore, the difference between the parent means for the SDA teachers who were aware of PBL and those who were unaware of PBL is not statistically significant. Both groups perform about the same on this instrument. They do not expect to be supported by their students' parents.

Table 33

*Perceived Impediment Scale t Test*

School System	Mean	Standard Deviation	<i>T</i>	<i>p</i> (sig)
No awareness group ( <i>n</i> =79)	31.85	11.66	1.14	0.26
Awareness group ( <i>n</i> =60)	29.57	11.76		
Parents	Mean	Standard Deviation	<i>T</i>	<i>p</i> (sig)
No awareness group ( <i>n</i> =79)	25.62	9.59	.76	0.45
Awareness group ( <i>n</i> =60)	24.32	10.62		
Colleagues	Mean	Standard Deviation	<i>T</i>	<i>p</i> (sig)
No awareness group ( <i>n</i> =79)	43.08	17.07	0.77	0.44
Awareness group ( <i>n</i> =60)	40.93	15.21		
Individual	Mean	Standard Deviation	<i>T</i>	<i>p</i> (sig)
No awareness group ( <i>n</i> =79)	49.61	15.95	-1.52	0.13
Awareness group ( <i>n</i> =60)	53.88	17.07		

The  $t$  value for PBIS\_C was .77, which does not exceed  $t_{.05/2, 155} = 1.658$ . Therefore, the difference between the colleague means for the SDA teachers who were aware of PBL and those who were unaware of PBL is not statistically significant. Both groups perform about the same on this instrument. They do not expect to be supported by their colleagues.

The  $t$  value for PBIS\_P was  $-1.52$ , which does not exceed  $t_{.05/2, 155} = 1.658$ . Therefore, the difference between the individual means for the SDA teachers who were aware of PBL and those who were unaware of PBL is not statistically significant. Both groups perform about the same on this instrument and will not pose a barrier to the adoption of PBL.

### **Impediments Identified**

An item-level analysis was conducted on all the items on the four subscales of the Problem-Based Impediment Scale; namely, PBIS\_S, PBIS\_P, PBIS\_C, and PBIS\_I to place them in descending order as they were perceived to be impediments. The results are shown in Tables 34 to 41.

### **Perceived School System Impediments**

An item-level analysis of the system-support subscales of the perceived impediment scale revealed that the items shown in Table 34 were perceived as impediments. They are presented in descending order. For the purpose of this study, items with a mean of less than 3.5 would be considered as indicating impediment.

The maximum score a teacher could receive if he or she perceived that the school system would support each item was 54, since the range of scores for each item was 0-6. A score of 0 meant "Not Willing," while a score of 6 meant "Very Willing." The mean score of each item in descending order shows the factors that the teacher perceived as perceived as highest to lowest impediment.

Item #7 has a mean of 2.68 with a standard deviation of 1.75. The teachers perceive this component of PBL as the one that the school system would be least willing to support. The teachers feel that the principals, school board members, and superintendent of schools would not be very willing to support a student assessment method that does not use tests, letter grades, and report cards.

Other factors that would prove to be impediments in the teachers' estimation of the school system support, although not as much as the assessment issue, were the financial support for purchase of PBL materials (Item #3), release time from classes to prepare for PBL (Item #2), and for teachers to get together during the school day to plan together (#4). The teachers also felt that their principals, school board members, and the superintendents would not be very willing to visit the teachers' classrooms to assist the teachers in implementing PBL (Item #5). Nor would they appreciate students working in a loosely structured, sometimes noisy classroom (Item #6).

Table 35 shows how the group of 60 teachers who were aware of PBL identified the items on the school-system subset as impediments. When the results of the entire target groups are compared with the results of the awareness group, it is observed that both groups of Adventist teachers identified the same items as impediments for their school systems. However, the awareness group did not believe the school systems would want to deal with criticisms or other issues that could arise with the adoption of PBL.

Table 34

*Means and Standard Deviations for SDA Teachers' PBIS\_S Scale (N=139)*

PBIS_S			
To what extent do you think your school system would be willing to:	<i>N</i>	Mean	<i>SD</i>
1. Support a student assessment system without the use of tests, letter grades, or report cards?	139	2.68	1.75
2. Provide finances for PBL materials?	139	3.18	1.74
3. Give you release time from classes to prepare for PBL?	139	3.26	1.90
4. Allow teachers to get together during the school day to plan PBL?	139	3.27	1.97
5. Visit you in your classroom in helping you implement PBL?	139	3.29	1.78
6. Appreciate children working in a loosely structured, sometimes noisy learning environment?	139	3.47	1.73
7. Address criticisms, problems, and issues that may result from this change?	139	3.68	1.63
8. Be favorable toward the use of PBL?	139	3.75	1.69
9. Provide you with sufficient training to learn about PBL?	139	4.29	1.67



Table 35

*Means and Standard Deviations for SDA Teachers' PBIS\_S Scale Awareness Group (N=60)*

PBIS_S			
To what extent do you think your school system would be willing to:	<i>N</i>	Mean	<i>SD</i>
1. Support a student assessment system without the use of tests, letter grades, or report cards?	60	2.33	1.78
2. Give you release time from classes to prepare for PBL?	60	2.92	1.93
3. Visit you in your classroom in helping you implement PBL?	60	3.02	1.73
4. Provide finances for PBL materials?	60	3.08	1.77
5. Allow teachers to get together during the school day to plan PBL?	60	3.20	1.94
6. Appreciate children working in a loosely structured, sometimes noisy learning environment?	60	3.37	1.78
7. Address criticisms, problems, and issues that may result from this change?	60	3.43	1.69
8. Be favorable toward the use of PBL?	60	3.72	1.57
9. Provide you with sufficient training to learn about PBL?	60	4.50	1.61

### Summary

The impediments that were identified indicate that the school systems would only be willing to provide initial training for the adoption of PBL. Most of the student-centered principles of PBL and the demands the adoption could place on the systems would be unacceptable to the school systems. The teachers believed that their principals, school boards, and superintendents would not be willing to accept a change in the method of assessing and reporting student learning without the use of tests, letter grades, and report cards; and in the

amount of freedom students would have to talk together and move around. They also think that the systems would not want to address criticisms that might arise as a result of the adoption and implementation of PBL.

The teachers also identified time and financial support as impediments. Although the school system would provide the training, they would not allow the teachers time for practice and preparation in order to implement PBL, and these stakeholders would not be willing to visit teachers' classrooms to assist them in gaining proficiency with the implementation. Nor would the systems provide finances for PBL materials to be purchased.

#### Perceived Parent Impediments

An item-level analysis of the parent-support subscale of the perceived impediment scale, as shown in Table 36, revealed how the entire group of Adventist teachers perceived the items as impediments in descending order. The maximum score a teacher could receive on the 8-item scale if he or she perceived that the parents would support each item was 48, since the range of scores for each item was 0-6. A score of 0 meant "Not Willing," while a score of 6 meant "Very Willing." The mean score of each item in descending order shows the factors that the teachers perceived as highest to lowest impediment. For the purpose of this study, items with a mean of less than 3.5 would be considered as indicating impediment.

Table 36

*Means and Standard Deviations for SDA Teachers' PBIS\_P Scale (N=139)*

PBIS_S			
To what extent do you think your school system would be willing to:	<i>N</i>	Mean	<i>SD</i>
1. Accept a performance report other than a letter grade or report card?	139	2.68	1.72
2. Appreciate children working in a loosely structured, sometimes noisy, learning environment?	139	2.76	1.61
3. Devote time to learn about the new instructional method?	139	2.96	1.53
4. Be willing to help their children adapt to their new instructional method?	139	3.02	1.63
5. Be favorable towards the use of PBL?	139	3.09	1.67
6. Provide material their children may need to prepare the product of their research?	139	3.33	1.45
7. Allow children opportunity to explore non-traditional ways/resources for information?	139	3.60	1.48
8. Be willing to share their expertise and resources with students and teachers?	139	3.60	1.61

Table 37 shows how the group of 60 teachers who were aware of PBL identified the items as impediments. When the results of the entire target groups are compared with the results of the awareness group, it is observed that both groups of Adventist teachers identified the same items as impediments for their students' parents.

Table 37

*Means and Standard Deviations for SDA Teachers' PBIS\_P Scale (N=60)*

PBIS_S			
To what extent do you think your school system would be willing to:	<i>N</i>	Mean	<i>SD</i>
1. Accept a performance report other than a letter grade or report card?	60	2.52	1.70
2. Appreciate children working in a loosely structured, sometimes noisy, learning environment?	60	2.72	1.70
3. Devote time to learn about the new instructional method?	60	2.82	1.48.
4. Be favorable toward the use of PBL?	60	2.93	1.67
5. Be willing to help their children adapt to their new instructional method?	60	3.00	1.45
6. Provide material their children may need to prepare the product of their research?	60	3.13	1.47
7. Be willing to share their expertise and resources with students and teachers?	60	3.53	1.52
8. Allow children opportunity to explore non-traditional ways/resources for information	60	3.67	1.54

Teachers perceived item #2 as the greatest impediment; that is, the parents would not be very willing to accept a performance report other than a letter grade or a report card. The mean score for this item was 2.68 and the standard deviation was 1.72.

The next factor that scored high as an impediment was item #1. It asked the teachers how willing they thought the parents would be to accept their children working in a loosely structured, sometimes noisy learning environment. The mean score was 2.76 with a standard

deviation of 1.61. The teachers did not believe that parents would appreciate a loosely structured, noisy classroom.

Item #4, "How willing would parents be to devote time to learn about the new instructional method?" also scored high as an impediment. The mean score was 2.96 with a standard deviation of 1.53. The teachers did not believe that parents would be willing to take the time to learn about PBL.

Items 5, 8, and 6 also seemed to be areas of concern that teachers perceived that parents would have. The parents would not be very willing to help their children adapt to the use of PBL method. Nor would they be favorable towards its use, or to provide materials for their children to prepare the product of their research.

### Summary

The analyses indicated that the teachers thought that their students' parents would be a hindrance to the adoption of PBL. An item-level analysis of the items, on the parent subscale of the PBIS\_P instrument, identified the factors that the teachers believed the parents would not be willing to do or accept.

The teachers believed that the parents would be willing to share their expertise and resources with the schools, and would support their children's effort in conducting research. However, this group of stakeholders would not appreciate any of the student-centered components of PBL. They would not settle for any assessment method that excludes paper-and-pencil tests, letter grades, and report cards. Nor would parents want to visit the schools and find children working in classrooms that seemed to lack structure, or are noisy. Although in the teachers' estimation the parents would not spend the time to learn about PBL and help their children adapt to it, or provide materials for the children to present their findings, the

parents would support their children's effort in conducting research. They would be willing also to share their expertise with the school.

### **Perceived Colleague Impediments**

An item-level analysis of the colleague-support subscale of the perceived impediment scale revealed that the entire group of Adventist teachers perceived the items in Table 38 as impediments in the order listed. The maximum score a teacher could receive if he or she perceived that his or her colleagues would support each item was 72, since the range of scores for each item was 0-6. A score of 0 meant "Not Willing," while a score of 6 meant "Very Willing." The mean score of each item in descending order shows the factors that the teachers perceived as highest to lowest impediment. For the purpose of this study, items with a mean of less than 3.5 would be considered as indicating impediment.

The item which the teachers perceived would be the biggest impediment for their colleagues was Item #4. It sought an answer to the question, "To what extent do you believe your colleagues would be willing to assess learning without the use of tests, letter grades, or report cards?" The mean score for this item was 3.10 and the standard deviation was 1.69. The teachers perceived this component as the one that the colleagues would be least willing to support.

The next items in descending order were numbers 3, 2, 6, and 12 whose mean scores were close: 3.20, 3.27, 3.30, and 3.49. The teachers believed their colleagues would not be very willing to allow students to choose the pace and content of what they learn; work in a loosely structured, sometimes noisy, learning environment; or allow students' needs and interests to determine the sequence of curriculum coverage. They did not believe that their colleagues would be favorable towards the use of PBL techniques.

Table 39 shows how the group of 60 teachers who were aware of PBL identified the items on the colleagues subset of the PBIS as impediments. When the results of the entire target groups are compared with the results of the awareness group, it is observed that both groups of Adventist teachers identified the same items as impediments for their colleagues. However, whereas item #5 was not an impediment for the larger group of Adventist teachers, it was an impediment for the group of teachers that were aware of PBL. That group believed their colleagues would want textbooks to dictate curriculum coverage, and not be used only as resources.

### **Summary**

The teachers indicated that their colleagues would be a hindrance to the adoption and implementation of PBL. They would be opposed to accepting the student-centered components of PBL. The teachers identified alternative assessment and reporting of student learning without report cards as an impediment for their colleagues. They also named student choice in the pace and content of their learning, and the sequence of curriculum coverage based on students' needs and interests as barriers for their colleagues. Additionally, the teachers believed that their colleagues would not accept working in a loosely structured, noisy classroom and would not be favorable towards implementing PBL. Besides, the group of teachers who were aware of PBL thought that their colleagues are textbook driven for curriculum coverage.

Table 38

*Means and Standard Deviations for SDA Teachers' PBIS\_C Scale (N=139)*

To what extent do you think your colleagues would be willing to:	<i>N</i>	Mean	<i>SD</i>
1. Assess learning without the use of tests, letter grades, or report cards.	139	3.10	1.69
2. Allow students to choose the pace and content of what they learn.	139	3.20	1.57
3. Work in a loosely structured, sometimes noisy, learning environment.	139	3.27	1.71
4. Allow students' needs and interests to determine the sequence of curriculum coverage.	139	3.30	1.62
5. Conduct workshops to inform their students' parent of PBL.	139	3.45	1.77
6. Be favorable toward the use of PBL.	139	3.49	1.69
7. Use textbooks as resources, and not to dictate the sequence of curriculum coverage.	139	3.51	1.69
8. Participate in coaching and feedback exercises to help their colleagues acquire proficiency.	139	3.67	1.69
9. Address criticisms, problems, and issues that may result from this change.	139	3.70	1.71
10. Invest time to acquire proficiency in the use of PBL.	139	3.75	1.68
11. Be facilitators of learning and not the authority figures in the room.	139	3.78	1.62
12. Tolerate some noise that students working together will cause.	139	3.94	1.58



Table 39

*Means and Standard Deviations for SDA Awareness Teachers' PBIS\_C Scale (N=60)*

To what extent do you think your colleagues would be willing to:	<i>N</i>	Mean	<i>SD</i>
1. Assess learning without the use of tests, letter grades, or report cards.	60	2.92	1.51
2. Allow students to choose the pace and content of what they learn.	60	3.08	1.46
3. Allow students' needs and interests to determine the sequence of curriculum coverage.	60	3.20	1.36
4. Use textbooks as resources, and not to dictate the sequence of curriculum coverage.	60	3.25	1.57
5. Be favorable toward the use of PBL.	60	3.37	1.56
6. Work in a loosely structured, sometimes noisy, learning environment.	60	3.38	1.56
7. Conduct workshops to inform their students' parent of PBL.	60	3.47	1.62
8. Address criticisms, problems, and issues that may result from this change.	60	3.52	1.60
9. Participate in coaching and feedback exercises to help their colleagues acquire proficiency.	60	3.58	1.59
10. Be facilitators of learning and not the authority figures in the room.	60	3.60	1.52
11. Tolerate some noise that students working together will cause.	60	3.77	1.48
12. Invest time to acquire proficiency in the use of PBL.	60	3.80	1.47

### **Perceived Individual Impediments**

An item-level analysis of the individual teacher-support subscale of the perceived impediment scale revealed that the entire group of Adventist teachers perceived the items in Table 40 as impediments in the order listed. There were 12 items, each of which could receive a range of scores from 0-6. A score of 0 meant “Not Willing,” while a score of 6 meant “Very Willing.” The mean score of each item in descending order shows the factors that the teachers perceived as highest to lowest impediment. For the purpose of this study, items with a mean of less than 3.5 would be considered as indicating impediment.

The teachers did not identify any item that would prevent them from adopting and implementing PBL. The mean score of each item exceeded the 3.5 criterion for identifying impediment items.

Table 41 shows how the group of 60 teachers who were aware of PBL identified the items on the individual-teacher subset of the PBIS as impediments. When the results of the entire target groups are compared with the results of the awareness group, it is observed that both groups of Adventist teachers did not identify any items as impediments to their adopting and implementing PBL. The mean score of each item exceeded the 3.5 criterion for identifying impediment items.

### **Summary**

The teachers reported that they are willing to support PBL. They did not identify any factor that would be a barrier to their adopting and implementing the strategy in their classrooms. All the items had mean scores that exceeded the cut-off mean of 3.5.

Table 40

*Means and Standard Deviations for SDA Teachers' PBIS\_I Scale (N=139)*

To what extent would you be willing to:	<i>N</i>	Mean	<i>SD</i>
1. Allow students to choose the pace and content of what they learn?	139	3.71	1.72
2. Assess learning without the use of tests, letter grades, or report cards?	139	3.99	1.96
3. Allow students' needs and interests to determine the sequence of curriculum coverage?	139	4.04	1.65
4. Conduct workshops to inform your students' parents of PBL?	139	4.06	1.82
5. Conduct coaching and feedback exercises to help other teachers acquire proficiency?	139	4.22	1.67
6. Work in a loosely structured, sometimes noisy, learning environment?	139	4.32	1.64
7. Address criticisms, problems, and issues that may result from this change?	139	4.34	1.65
8. Be favorable toward the use of PBL?	139	4.42	1.69
9. Invest time to acquire proficiency in the use of PBL?	139	4.43	1.67
10. Use textbooks as resources, and not to dictate the sequence of curriculum coverage?	139	4.58	1.56
11. Tolerate some noise that students working together will cause?	139	4.62	1.59
12. Be a facilitator of learning and not the authority figure in the room?	139	4.73	1.50

Table 41

*Means and Standard Deviations for SDA Awareness Teachers' PBIS\_I Scale (N=60)*

To what extent would you be willing to:	<i>N</i>	Mean	<i>SD</i>
1. Allow students to choose the pace and content of what they learn?	60	3.97	1.60
2. Assess learning without the use of tests, letter grades, or report cards?	60	4.13	1.87
3. Allow students' needs and interests to determine the sequence of curriculum coverage?	60	4.25	1.66
4. Conduct workshops to inform your students' parents of PBL?	60	4.28	1.80
5. Address criticisms, problems, and issues that may result from this change?	60	4.37	1.71
6. Conduct coaching and feedback exercises to help other teachers acquire proficiency?	60	4.40	1.65
7. Be favorable toward the use of PBL?	60	4.63	1.59
8. Use textbooks as resources, and not to dictate the sequence of curriculum coverage?	60	4.68	1.53
9. Work in a loosely structured, sometimes noisy, learning environment?	60	4.70	1.54
10. Invest time to acquire proficiency in the use of PBL?	60	4.75	1.49
11. Tolerate some noise that students working together will cause?	60	4.83	1.40
12. Be a facilitator of learning and not the authority figure in the room?	60	4.88	1.46

## CHAPTER 5

### SUMMARY, INTERPRETATIONS, AND RECOMMENDATIONS

#### **Summary of the Study**

##### Introduction

Many years ago Dewey (1916/1944) wrote that education should engage learners' natural tendencies to create and investigate in doing something that made the learners observe and acquire information, and think. Dewey said that teachers should not give students facts to memorize but activities to engage them in reflective thinking in and out of school.

White (1903/1952), a pioneer in the development of the Seventh-day Adventist education system, had earlier remarked that students should learn to be thinkers and not reflectors of the thoughts that men had expressed or written. Instead, students should acquire information for themselves through researching the vast field of nature and revelation.

Later, Delisle (1997) declared that when teachers dispense facts to students and not allow students opportunity to form their own questions or to investigate, then "students may memorize material but will not fully understand or be able to use it" (p. 1). He said that students today, years after Dewey (and White) proposed learning by doing, "still learn best by doing and thinking through problems" (p. 2).

### Statement of the Problem

Seventh-day Adventist education embraces very high principles regarding a practical curriculum, and development of critical thinking in students. In spite of these clear principles, however, many educators express feelings of inadequacy to teach students to be thinkers (Brantley & Ruiz, 2001-2002).

Additionally, traditional education, also continued to instruct students through lecture and memorization of knowledge, long after White (1903/1952) and Dewey (1916/1944) recommended that students be actively engaged in activities that foster student-initiated thought. In medical schools, for example, student doctors were required to memorize information they received through lectures and then apply the information in clinical situations. Although the students were able to memorize and regurgitate information on tests, they soon forgot it and did not know how to apply it to real-life situations.

This problem that led Barrows, a physician and medical educator at McMaster University in Hamilton, Ontario, Canada to begin creating a series of problems that allowed student doctors to acquire medical information, not through the usual lecture method, but through researching, questioning, and problem solving. Barrows and Tamblyn (1980) said that through the problem-solving approach, students developed clinical reasoning and the ability to learn how to apply what they knew to patients in real clinical situations.

Since the early 1960s when this problem-based learning approach to learning began at McMaster University, its application has spread to many medical schools and, subsequently to many K-12 schools to increase student achievement, retention, and

problem-solving skills, among other benefits (Checkley, 1997; Delisle, 1997). In 1997, the Seventh-day Adventist Church recommended that problem-based learning be adopted to improve its education program (NAD Futures Commission Report, 1997). However, there is little information concerning teachers' perception of the strategy, or what factors may become potential barriers to the adoption and implementation.

### Purpose of the Study

In order for schools, administrators, and teachers to make informed choices concerning any new learning method, and concerning PBL in particular, research on PBL must be available. The Seventh-day Adventist Church has recommended that problem-based learning be adopted as a preferred teaching strategy to improve its education program and to help prepare students for life in the 21<sup>st</sup> century (Futures Commission Report, 1997).

This research is meant to add to the data available on PBL. Its purpose was to determine how much SDA K-12 teachers knew about PBL, and what kind of teaching philosophy and preference prevailed among them. The goal was to ascertain whether they were student-centered in a way that would cause them to be willing to adopt and use PBL strategies in their classrooms. The study was also to determine what factors teachers perceived would be impediments to the successful adoption and implementation of the strategy.

### Review of the Literature

Almost a decade ago, Brooks and Brooks (1993) wrote that politicians and educators are troubled that American students are unable to perform on context area tests

as well as students from other nations do. Other concerns related to students' inability to understand and find meaning in what they read.

Ten years prior to the writing of these comments by Brooks and Brooks; in 1983, the United States Department of Education's National Commission on Excellence in Education published its report, *A Nation at Risk*, the gist of which could be summed up in this quotation:

If an unfriendly power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war. As it stands, we have allowed this to happen to ourselves. We have even squandered the gains in achievement made in the wake of the Sputnik challenge. Moreover, we have dismantled essential support systems which helped make those gains possible. We have, in effect, been committing an act of unthinking, unilateral educational disarmament. (p. 5)

Among the numerous subsequent publications that proposed solutions to the educational dilemma was the *America 2000 Sourcebook* published by the United States Department of Education and released by President George Bush on April 18, 1991. In this book six education goals were outlined and four strategies to accomplish them.

Caine and Caine (1997) wrote that all sectors of society, "Newspapers, documentaries, teachers and administrators, businesspeople, and parents-all voice their opinions and concerns" about education, and that despite multiple reform efforts and many changes and much research on good teaching and on learning, "*much stays the same*" (p. 3).

An explanation for the continued lack of improvement in education may be due to what Brooks and Brooks observed. They said that the proposals did not go deep enough, because they did not address "the education system's underlying suppositions about what it means to learn . . . the processes of teaching and learning. . . . Educational reform must start with *how* students learn and *how* teachers teach, not with legislated outcomes" (pp. 3, 4).



Eastin (1999) declared that “education is the United States first line of defense in the 21st century. . . . We must all be in the business of preparing our students for the 21st century. We must all make sure the right stuff gets mastered” (p. 24).

Eastin also posited that by the year 2008, changes in the workforce will require “well-educated people who are self-directed problem solvers and team players.” So schools should consider the recommendation by Perkins (cited in Nagel, 1996) that education should produce knowledge that functions in people’s lives to “help them understand and deal with the world” by actively engaging them in research and inquiry.

The prevailing instructional practice in today’s schools views students as passive recipients of knowledge, which a teacher, who is regarded as the repository of information, dispenses. This method of instruction does not give students experience in solving problems, making decisions, researching or finding information for themselves (Checkley, 1997). Delisle (1997) posited that in order for students to learn, understand and retain information, they must grapple with situations that give them problems to solve, that is, they must be actively engaged.

When students are required to learn information that teachers teach them, then reproduce this information on tests, the students may perform well by recalling information, but they soon forget the information and quite often cannot apply what they learned (Barrows & Tamblyn, 1980). On the other hand, when students’ education allows them opportunity to apply information as they acquire it, through active involvement, they will retain the information and understand it.

White (1903/1952) over 100 years ago directed educators to teach students in a practical way so that they would learn to think. She declared that every individual was

made with the power to think and that that power should be developed through true education. She defines true education as the, “harmonious development of the physical, the mental, and the spiritual powers” (p. 13). She said that it trains youth to be

thinkers, and not mere reflectors of other men’s thought. Instead of confining their study to that which men have said or written, let students be directed to the sources of truth, to the vast fields opened for research in nature and revelation. (p. 17)

White posited that for too long education has been mostly memory work that crowds the mind with knowledge that is never usually used. The student does not practice independent thought and sacrifices reasoning and judgment. She recommended practical education that engages the student.

Later Dewey (1916/1944) issued similar statements when he stated that teachers should appeal to learners’ natural tendencies to create and investigate in doing something that made them observe and acquire information, and think. Dewey said that teachers should not give students facts to memorize but activities to engage them in reflective thinking in and out of school.

Montessori (1966) also wrote that students have a natural predisposition to develop and learn, but that adults interfere with and repress this tendency by imposing on children what adults think that students should learn. She stated that children’s potential to learn is released when adults detach themselves from being all-knowing and put on “the vesture of humility” (p. xx). Checkley (1997), Delisle (1997), Schwartz et al. (2001), and Torp and Sage (1998) described problem-based learning as a teaching strategy that can help students learn by doing.

### **Problem-Based Learning**

Problem-based learning was first developed in the 1960s for student doctors in medical schools to enable them to apply knowledge in real patient cases, to improve their problem-solving skills, and to retain information (Barrows & Tamblyn, 1980; Checkley, 1997). The method has since then been employed in colleges and universities (Levin, 2001) and in other settings including K-12 schools (Delisle, 1997; Stepien, Gallagher, & Workman, 1993; Torp & Sage, 1998).

Problem-based learning is an instructional approach that presents students with a scenario from which they identify a problem to be solved (Delisle, 1997). The scenario is created around the curriculum so that by the time the children solve the problem they have acquired curricular information. The problem has no one right answer for the students to find. Instead, students identify the problem, gather additional information, hypothesize about possible solutions, conduct research to test their hypotheses, and then evaluate and identify the most defensible solution.

In PBL, students are usually allowed as much time as they need to solve the problem, can acquire information in a style with which they learn best, and can choose the method by which they present the solution to the problem. Through the use of PBL, students develop problem-solving skills, communication skills, and become self-directed learners. The teacher then acts as a guide, and, using an appropriate questioning technique, does not give students answers but leads them to find answers for themselves thus helping the students to move along.

The teaching method is supported by the theory that when students are actively engaged in learning so that their natural instincts to investigate and create are appealed to

(Dewey, 1916/1944), and are given choices or options as to what and how they learn (Glasser, 1998) so that they feel that they are in control, and someone else does not control them (deCharms, 1976, 1984; Ryan & Grolnick, 1986), they will develop their own understanding of the concept, based on their prior understanding of it (Piaget, cited in Ginsburg & Opper, 1988).

White (1952/1903) said that true education should develop youth to be thinkers and not mere reflectors of the thoughts of others. To accomplish this noble goal, she said that students must be directed to the vast fields opened for research in nature and not confined to the written works and thoughts of men. Montessori (1966) posited that universally a child is born with an absorbent mind that naturally absorbs the language spoken around him/her along with the culture of that time and place. The child needs to continue to use his/her mind in exploration, using the endowed sensory materials. The child, she said, passes through sensitive periods of development, and at each stage displays “an insatiable hunger” for intellectual exploration.

In PBL, students do not acquire information by listening to teachers lecture (Checkley, 1987) but work on their own problems and are allowed choice concerning what and how they learn. Once the problem scenario has been described to them, students assume responsibility for identifying and directing the method and pace of solving the problem through the inquiry process. They also choose how to present their resolution of the problem.

Schwartz, Mennin, and Webb (2001) cite the work of Albanese and Mitchell (1993); Schmidt et al. (1987), and Vernon and Blake (1993), the evidence of which suggests that students of PBL strategies develop the ability to study for understanding

and not for short-term recall on tests, long-term retention of information, and motivation for learning. Stepien and Gallagher (1993) describe the practice of PBL at The Center for Problem-Based Learning at IMSA with such benefits as increased understanding, the ability to recall information when needed, the ability to solve problems, and to be self-directed learners. Mettetal (2001) used PBL in classroom action research for staff development in two school districts in Indiana. The two primary reasons for the use were to help teachers learn the inquiry method and also to improve student learning when the teachers had to find out what teaching methods worked best in their classrooms. Besides accomplishing the goals, the teachers also improved their critical thinking skills and expanded their perspectives on issues. The teachers, as students, also increased collegiality because they had to work in teams. Barrows (cited in Checkley, 1997) says that as students search for solutions to the ill-structured problems, they gain experience in solving problems, learn to be self-directed learners, and learn how to work with others collaboratively.

The Seventh-day Adventist Church operates an educational system worldwide. This includes K-12 schools, colleges, universities, schools of medicine and health sciences, and schools of education. In 1994 a 16-member team of educators and others interested in education began its first of six meetings over a 27-month period to formulate changes for the improvement of Seventh-day Adventist education. This team had formerly been commissioned by the North American Division Office of Education to “develop suggested changes for curriculum reaching into the 21st century in Seventh-day Adventist secondary schools” (Curriculum Futures Commission, 1997, p. 2).

In 1997 this Curriculum Futures Commission published its report of suggested changes. Classroom instruction was one of nine areas of preferred practice where SDA education would seek to be exemplary. Problem-based learning was suggested as a method of instruction that would make SDA education exemplary. Later, Brantley and Ruiz (2001-2002) in their Profile '01 Studies discovered that 75% of elementary teachers and 50% of high school teachers knew very little about PBL.

### **Method**

An ex post facto survey was conducted among a convenience sample of SDA K-12 teachers in Florida during the 2001-2002 school year to determine their readiness for the adoption of PBL. Their performance on four measures was compared with the performance on the same measures by a comparison group of teachers who had been trained in, and use PBL techniques in the state of Illinois. Four research questions were examined:

1. To what extent are SDA K-12 teachers aware of PBL as a teaching methodology?
2. To what extent do SDA K-12 teachers support the underlying philosophy of PBL?
3. To what extent do SDA K-12 teachers embrace the components of PBL?
4. What factors emerge as impediments to the adoption and implementation of PBL?

### **Data Collection**

Four instruments were prepared and used to obtain the data. The Awareness Questionnaire (AQ) was used to gather information to answer Research Question 1. The Teaching Philosophy Scale (TPS) was used to gather information to answer Research Question 2. The Teaching Preference Questionnaire (TPQ) was used to gather

information to answer Research Question 3. The Problem-Based Impediment Scale (PBIS) was used to gather information to answer Research Question 4. The perceived impediments (support/ lack of support) were divided into impediments from the school system (S), from the students' parents (P), from the teachers' colleagues (C), and from the individual teacher (I). So there were four sub-scales to this instrument. They were PBIS\_S, PBIS\_P, PBIS\_C, and PBIS\_I.

The instruments were piloted among a group of public school teachers in Marion County, Florida. After they were modified based upon feedback received from the pilot group of teachers, the instruments were administered to the target group of SDA teachers.

### **Data Analysis**

Cross tabulations, chi-square, *t* tests, and calculations of group means were done to answer the research questions. For the *t* tests, the independent variable was group-the SDA target group and the Illinois comparison group and the dependent variables were awareness, teaching philosophy, and teachers' teaching preferences (traditional or student-centered/PBL). Perceived impediments were divided into four subgroups, and each was designed to get the teacher to record on a scale from 0 to 6, (0 meaning "Unwilling to support" and 6 meaning "Very willing to support" the teachers' adoption of PBL), their expectation for support from the school system (PBIS\_S), from the students' parents (PBIS\_P), from the teachers' colleagues (PBIS\_C), and from the individual teachers themselves (PBIS\_I). Group means, differences among them, and significance of the differences, were calculated on these four sub-tests for the target group of SDA teachers and an awareness group composed of the 43% of the SDA teachers who reported that they were aware of problem-based learning. To determine

statistical significance of differences of the group means for the two groups on the four sub-scales, *t* tests were computed. Analyses were done using the Statistical Program for Social Sciences (SPSS) at the 0.05 level of significance.

### **Summary of the Findings**

Findings from the analyses are grouped under the headings of Awareness, Support for the Underlying Philosophy, Student-Centered Preferences, and Perceived Impediments to PBL Adoption. The impediments were divided into four sections; namely, support or lack of support from the teachers' school systems (principals, school boards, and superintendents of education), from the students' parents, from the teachers' colleagues, and the individual teacher's own willingness or lack of willingness to adopt PBL.

#### **Awareness**

Cross tabulations, chi-square, and a *t* test were conducted to determine how aware SDA teachers were of PBL as a teaching methodology. The results of the cross tabs calculations revealed that more than half of the SDA K-12 teachers (57%), were not very knowledgeable of problem-based learning. Chi-square indicated that awareness was related to the teachers' preference for student-centered teaching.

For the *t* test determination the dependent variable was awareness and the independent variable was group. One group was the target group of SDA K-12 teachers, and the other group was the comparison group to which the target group was compared. The comparison group mean was greater than the SDA teachers' group mean.

The analyses indicated that this difference between the target group mean and the comparison group mean on awareness of PBL as a teaching strategy was statistically



significant. This implied that the target group did not know as much about PBL as the comparison group did, and that their training and experience in PBL gave the comparison group a better awareness of the methodology (as was to be expected).

#### Support for Underlying Student-Centered Philosophy

Cross tabulations, chi-square, and a *t* test were used to determine the extent to which SDA teachers supported the underlying student-centered philosophy of PBL. The results of the cross-tab calculations revealed that only a little over one-half (52%) of the SDA K-12 teachers embraced a student-centered teaching philosophy.

Chi-square indicated that the teacher's age was significantly related to the teacher's teaching philosophy. Teachers 20-35 and 46-55 had high student-centered teaching philosophy, while those in the age categories 36-45 and 56 and older had a more traditional teaching philosophy. It was also observed that teachers with high or moderately high degree of student-centered preferences also had high or moderately high degree of student-centered philosophy. Teachers who lacked student-centered preferences scored lower on student-centered philosophy.

A *t* test to determine the statistical significance of the difference between group means for the SDA teachers and the comparison teachers at the .05 level of significance was conducted. The dependent variable was teaching philosophy, and the independent variable was group-SDA target group, or the comparison group.

The results of the *t* test indicated that the comparison group mean was greater than the mean for the target SDA group, and the difference in mean student-centered teaching philosophy scores between the SDA K-12 teachers and the comparison group of teachers was statistically significant. The comparison group reported a greater student-centered teaching philosophy than the SDA group. The target group did not have the kind of

student-centered philosophy that supports the adoption of PBL to the extent that the comparison teachers did. A large percentage still embraced a traditional teaching philosophy.

### Student-Centered Preferences

Cross tabulations, chi-square, and a *t* test were done to determine the extent to which SDA teachers preferred the student-centered components of PBL. The results of the cross-tab calculations revealed that less than half (38%) of the SDA K-12 teachers prefer a student-centered teaching environment. The majority of them do not embrace the student-centered components of PBL. Chi-square indicated that the teachers' student-centered teaching preference is related to the teachers' gender. Female teachers are more student-centered in their teaching preferences than are male teachers.

A *t* test to determine the statistical significance of the difference between two group means for the SDA teachers and the comparison group of teachers at the .05 level of significance was conducted. The dependent variable was teachers' preference for PBL components. The independent variable was group, target or comparison group.

The results of the *t* test showed that a statistically significant difference in the means existed. The comparison group showed a higher preference for the components of PBL than did the target group. This signified that SDA K-12 teachers did not favor the student-centered components of PBL as much as the comparison group did. Many of them were more traditional in their teaching preferences.

### Perceived Impediments

Calculations of group means and *t* tests were used to determine factors SDA teachers perceived as barriers to the adoption of PBL under the sub-sections of school system, parents, colleagues, and individual teacher. Since only 43% of the target group of Seventh-day Adventist teachers were aware of problem-based learning, the performance of the entire group of 139 Adventist teachers on all four subscales of the PBIS Scale was compared with the performance, on the same instruments, of the 43% that were aware of PBL. However, for calculations of the *t* tests to determine significance of group mean differences, comparison was made between the 43% ( $N=60$ ) who were aware of PBL and the 57% ( $N=79$ ) who were unaware of PBL principles.

The main variable was perceived impediments. Perceived impediments were divided into four sub-groups. The first was the impediment perceived to be caused by the school system's level of support, PBIS\_S. Scores between 32 and 54 would indicate support, and, therefore, lack of impediment. The second sub-group was perceived impediment caused by a lack of support from the students' parents, PBIS\_P. Scores between 29 and 48 would indicate support, and, therefore, lack of impediment. The third perceived impediment would be a lack of support from the teachers' colleagues, and the fourth perceived impediment would be a lack of support if the individual teacher is unwilling to adopt and implement the strategy. In both cases, scores of 43 to 72 would indicate support and, therefore, lack of impediment.

Differences in group mean scores for the entire group of SDA teachers and the group (43%) that was aware of PBL on the four sub-tests were observed. Four *t* tests were calculated to determine whether the differences in mean scores for the target group of SDA teachers and the aware group on the four subtests, namely PBIS\_S, PBIS\_P,

PBIS\_C, and PBIS\_I, were significant. Significant differences were not observed. The expectation of support for both groups was the same.

#### School System Support

The first sub-question was answered using group means to measure the support the teachers perceived that they could expect from their school system. A *t*-test computation was done to determine significance of difference in group means for the SDA teachers who were unaware of PBL and the awareness group of teachers. The *t* test indicated no statistically significant difference in means. The results of the calculations revealed that the SDA K-12 teachers do not expect to receive support from their school systems.

#### Parental Support

The next sub-question was answered using group means to measure the support the teachers perceived that they could expect from their students' parents. A *t*-test computation was done to determine significance of difference in group means for the SDA teachers who were unaware of PBL and the awareness group of teachers. The *t* test indicated no statistically significant difference in means. The results of the calculations revealed that the SDA K-12 teachers do not expect to receive support from their students' parents.

#### Collegial Support

The third sub-question was answered using group means to measure the support the teachers perceived that they could expect from their colleagues. A *t*-test computation was done to determine significance of difference in group means for the SDA teachers who were unaware of PBL and the awareness group of teachers. The *t* test indicated no

statistically significant difference in means. The results of the calculations revealed that the SDA K-12 teachers do not expect to receive support from their students' parents.

#### Teacher's Own Willingness to Adopt

To answer the fourth sub-question, group means and a *t* test were computed to measure the individual teacher's own willingness to support the adoption of PBL. A *t*-test computation was done to determine significance of difference in group means for the SDA teachers who were unaware of PBL and the awareness group of teachers. The *t* test indicated no statistically significant difference in means.

The results of the calculations revealed that a very large percentage of the SDA K12 teachers are willing to adopt and implement PBL, despite the findings that many of them have limited awareness or no awareness of PBL, do not support the student-centered philosophy, nor embrace the components.

#### Interpretations of the Results

In this study, I endeavored to answer four questions related to an innovative student-centered teaching/learning strategy called problem-based learning (PBL). Using results of the analyses in this chapter, I will discuss and answer each question and provide possible interpretations for the findings.

#### Awareness of Problem-Based Learning

Brantley and Ruiz (2001-2002) in their survey observed that only a small number of SDA teachers had an awareness of PBL, and an even smaller number reported using the strategy in their delivery of instruction. Therefore, it was not surprising to find that less than 50 % of the teachers in this study were aware of PBL.

I went into the study believing that multi-grade experience, and teachers' gender and age may have been factors that would influence the teachers' awareness of PBL and willingness to adopt the strategy. I thought that it was quite possible that the younger generation of teachers between the age groups of 20-35 and 36-45 would have had training in PBL as part of their teacher education programs. Of course, not all those entering the classrooms usually have prior experience with teacher education training. However, the findings indicated that teachers' awareness of PBL is not dependent upon teachers' age or whether they had taught in multi-grade settings.

It was unexpected that multi-grade experience was not related to awareness. It was my occupation with multi-grade teaching responsibilities that compelled me to search for methods of delivering instruction in a way that allowed all my students to learn. I thought that a teacher instructing a multi-grade class with students of varying learning levels would be anxiously seeking ways to teach all the students and would have read or heard about PBL. My searching led me to problem-based learning in the *Curriculum Update* from *Association for Supervision and Curriculum Development* in the summer of 1997. Also, when I read that the use of PBL may reduce discipline and performance problems, I questioned why seasoned teachers who are now faced with unchallenged and unmotivated students would *not* have sought for and found what I found to be the solution: PBL. Could it be that the teachers' desire for a teaching solution is related to their underlying philosophy of teaching practice?

Analyses indicated that a significant relationship does exist between awareness of PBL and the teachers' student-centered preferences, and that there is a relationship between student-centered preferences and student-centered philosophy. Teachers who believe in conducting a class based on students' choice and interests or in such a way as

would allow students freedom to move about, research, and talk together as they are actively engaged in authentic learning activities, are likely to know more about PBL than teachers who do not believe in conducting their classes in that manner.

### **Support for the Underlying PBL Philosophy**

PBL is undergirded by a philosophy that supports student autonomy. Students' needs and interests drive the curriculum, which is designed into authentic problems for students to solve. Teachers share classroom control with students and allow them choices concerning how they acquire information to solve their problems and how they will present the solution to their problems. Children assume responsibility for the pace of their learning and may use any source to obtain information. Children's learning is not assessed by methods that seem to ask, "How much do you know this material?" but by methods that ask, "How much do you know?"

Analyses indicated that little more than half (52%) of the teachers support the student-centered philosophy that is consonant with PBL. Support for PBL philosophy was significantly related to the teacher's student-centered preferences and age. Teachers with high or moderately high levels of student-centered preferences have high or moderately high levels of student-centered philosophy.

Teachers 20-35 and 46-55 years of age have high student-centered teaching philosophy, while those in the age categories 36-45 and 56 years of age and older have a more traditional teaching philosophy. The *t* test that compared the target group of SDA teachers with the comparison group of teachers showed that the comparison group embraced the student-centered philosophy of PBL more than the SDA teachers did.

Although the findings indicated that some of the SDA K12 teachers in Florida support a student-centered classroom, they also indicated that many support a teacher-

centered, traditional classroom (52% to 48%). Forty-eight percent is a large group of teachers who do not support autonomy in children, but prefer to be authoritative.

Item #8 of the TPS Item Comparison Table (Table 23) asked whether teachers agreed with the statement that the teacher should be an authority figure in the classroom. Sixty-seven percent of the SDA teachers compared to 17% of the comparison teachers agreed with this item.

Responses to item #31 of the TPS Item Comparison Table (Table 23) indicated that 54% of the SDA teachers compared to 94% of the comparison teachers believe that students' needs and interests, not textbooks, should provide a sequence for curriculum coverage. Only 38% of the SDA teachers compared to 67% of the comparison teachers believe that students should be allowed to take charge of how and when they learn skills and acquire knowledge (item #10 of the TPS Item Comparison Table).

Many SDA teachers believe that students should accept what the teachers or textbooks say and not research to find answers for themselves. Forty-three percent of SDA teachers compared to 11% of the comparison teachers affirmed the statement that the students' role is to receive knowledge (item #5 of the TPS Item Comparison Table), and 57% of SDA teachers compared to 28% of the comparison teachers agreed with item #12 of the TPS Item Comparison Table that the best teachers are skillful transmitters of knowledge.

### **Support for the Teaching Components of PBL**

The instrument provided a clear indication of where the teachers stood between being traditional and being student-centered. It in effect asked teachers if they were willing to share classroom control with their students, and allow students the choice to learn in their own style; if the teachers were willing to allow students to be actively involved in



learning; and if the teachers were willing to withdraw from center stage and facilitate student learning.

Less than one-half of the teachers preferred the components of PBL (38%). It appears that the majority of SDA K-12 teachers in Florida prefer to work in classrooms that are teacher-centered, rather than in classrooms that are student-centered. They want to be the sole owners of authority, not willing to share authority with the students. Some of the components and the manner in which the SDA teachers responded compared to the comparison teachers show that many of the SDA teachers are entrenched in the traditional mode of teaching.

The teachers' student-centered preferences were found to be significantly related to the teacher's gender. The comparison group of teachers who had been using or had been trained in the use of PBL, showed more preference for the components of PBL. I do not know if they were this way before their formal exposure to PBL, or if this characteristic occurred subsequent to the training, but it seems that awareness of the method improves acceptance of its components. The components separated and discussed below provided interesting comparisons for the two groups of teachers (see Table 30).

#### Inter-Disciplinary Study

More SDA teachers prefer highly structured classrooms where single subjects are studied than those who prefer interdisciplinary instruction. Only 32% of the SDA teachers compared to 61% of the comparison teachers said that they prefer interdisciplinary study (item #1, Table 30). This is yet another indication that the majority of Seventh-day Adventist K-12 teachers have a traditional orientation towards teaching.

### Acquisition of Knowledge Through Research

Only a small percentage (58%) of SDA teachers compared to 83% of the comparison teachers support student research for knowledge acquisition (item #3, Table 30). There are still 42% who do not prefer this component. They prefer to be the repositories and transmitters of knowledge, with students being passive recipients.

### Alternative Assessment

Less than half of the SDA teachers seemed to prefer administering tests as means of assessing learning. Compared to 89% of the comparison teachers, 64% of the SDA teachers prefer evaluating student learning by embedded assessment and the students' final product (item #7, Table 30).

The SDA teachers' performance on this item was unexpected since pencil-and-paper tests are used traditionally. However, since the majority of the Adventist teachers were unaware of PBL strategies, they may not even understand embedded assessment or what the students' final product may mean. The teachers may simply be expressing their opposition to tests. One may need to determine why they oppose tests. It cannot be assumed that the teachers would be willing to allow students to choose how they would present evidence of their learning, since the teachers expressed an unwillingness to let students' interests determine curriculum coverage.

However, on the impediment scale, this item ranked as the highest or second highest objection (impediment) for the school system, parents, and the teachers' colleagues. This inconsistency needs to be cleared up.

### Perceived Impediments to the Adoption of PBL

The impediments instrument, the Problem-Based Impediments Scale (PBIS), was subdivided into four subsections, each to measure impediments from four main stakeholders/sources. PBIS\_S measured impediments the teachers perceived being posed by their principals, school boards, and superintendents of education. PBIS\_P measured perceived impediments from the students' parents. PBIS\_C measured perceived impediments posed by the teachers' colleagues, and PBIS\_I measured the perceived barriers posed by the individual teacher. Each subsection identified some barriers, some of which are common to all stakeholders. Perceived impediments are described below.

### Method of Grading and Assessment in PBL

The teachers indicated that the school system, the parents, and the colleagues would regard the alternative assessment and reporting of student progress as the greatest, or one of the greatest objection.

An explanation for this factor being an impediment might be that, traditionally, evaluation was accomplished with the use of multiple-choice tests which are readily available, or can be quickly prepared to match what has been taught, are easy to score, and are understood by most parents. Parents readily understand the letter grades and where their children rank with others. Brooks and Brooks (1995) wrote that "most multiple-choice tests are readily accessible, come with templates, and are easy to administer and score. . . . It's almost always easier to teach and test the curriculum than to mediate and assess learning" (p. 97). Caine and Caine (1997) remarked that teachers feel that the test results indicate that by their hard work teachers have covered the curriculum. Grades are also what institutions of higher learning use to award scholarships or to predict which students will be successful.

## Resources

The teachers perceived that the school system would not be willing to provide financial support for purchase of PBL materials, or provide the teachers with release time for preparation for and practice of PBL. Yet they believed that the school system would provide sufficient training. It might be that the teachers are unaware that for them to acquire proficiency in the use of PBL for it to transfer to classroom use, teachers need to have time to practice, and that is part of training.

## Parental Support

Teachers view the parents as so entrenched in their traditional education principles that the teachers do not believe that the parents would appreciate students working in a loosely structured, sometimes noisy environment. This was the second highest impediment on the Parent subscale of the PBIS instrument. Parents and many others regard a classroom where there is much movement and where students communicate together a lot as lacking discipline. Montessori (1964) states, however, that discipline is active and that an individual is not disciplined only when “he has been rendered as artificially silent as a mute and as immovable as a paralytic” (p. 86). She regards discipline as being able to regulate one’s conduct through habit and practice to follow some rule of life.

The greatest perceived impediment on the Parent subscale of the PBIS was the concept of parents accepting a performance report other than a report card. Teachers believed that parents want their children to have tests and report cards. The third and fourth impediments identified on the parent subscale are the teachers’ beliefs that parents would not want to spare the time to learn about the new method and they were not willing to help their children adapt to its use.

The teachers, themselves, do not want to conduct workshops for the parents either. It may be that parents do not usually attend Parent/Teachers meetings or show support for other school activities, so that teachers may feel that parent workshops would be a waste of time. On the other hand, teachers may not have the time to do this additional activity.

#### Student Choice

The teachers perceive their colleagues and even themselves to be reluctant to cover curriculum according to students' needs and interests, and to give students a choice in the pace and content of their learning. These components rank very high as impediments on the Colleagues and Individual subscales of the PBIS. Levy (1996) posited that teachers are so set on covering the curriculum that they do not take time to allow students to construct their own knowledge and "develop habits and skills so important in creating thoughtful and responsible independent thinkers and learners" (p. 27).

#### Teacher's Own Willingness

The teachers expressed a desire to learn about the strategy, although they did not seem willing to engage in some of the activities that would ensure the acquisition of proficiency. One activity, for example, in which they were not willing to engage was in providing coaching for peers (item #11 of the PBIS\_I scale); but for staff development to effect transfer of skills to the classroom and result in student achievement, teachers must experience practice, feedback, and coaching (Joyce & Showers, 1988). Teachers were also unwilling to conduct workshops for parents (item #9 of the PBIS\_I scale) so the parents can help their children adapt to and be successful in use of the strategy.

The teachers' greatest objection was to let students choose the pace and content of their learning (item #3 on PBIS\_I scale). The teachers also are unprepared to allow student needs and interest to direct curriculum coverage (item #6 on the PBIS\_I scale).

Items 6 and 3 are reflective of the student-centered components of problem-based learning. Since the majority of the teachers are not aware of PBL they seem not to appreciate these characteristics. The overwhelming willingness to adopt PBL, indicates that the letter that accompanied the survey or some of the items in the survey may have conveyed to the teachers that PBL has the potential to satisfy some felt needs that the teachers may have. It may be the ability of PBL to help the teachers free up some of the time they have been expending in teaching as students take on more responsibility for their learning. However, teachers will need to learn about the method and be willing to accept its student-centered characteristics for it to be successful.

The majority of the teachers reported that they are willing to adopt PBL. However, the study clearly revealed that many of the teachers do not want all the principles of PBL, because some conflict with their espoused theories of what comprises good learning/education. It appears that the teachers may not understand the implications that they would have to be prepared to do some things differently if they should adopt PBL as a preferred teaching practice. A traditional philosophy does not support student autonomy.

It should be noted that alternative assessment is a matter of concern for the school system, parents, and teachers' colleagues. For successful adoption to take place, this matter should be addressed. Of concern to these stakeholders too, in the teachers' opinion, are the matters of allowing students' needs and interests to determine when curricular items are taught, and the pace at which they are covered. While there are other factors that the teachers feel would pose hindrance to the adoption, these mentioned are

based on a student-centered philosophy. Therefore administrators, policy makers, and practitioners must be aware that in adopting this strategy, some individuals are being asked to practice a method of instruction that is contrary to their very philosophy of education, which means that for such teachers, this innovation may not last for a long time, or will not work at all.

Teachers with a traditional philosophy may experience difficulty adjusting to the student-centered requirements of PBL instruction and may revert to “business as usual.” It is therefore, necessary to determine how much variation may be allowed for the method to yet be regarded as problem-based learning.

The comparison group of teachers from the Illinois Mathematics and Science Academy (IMSA) have been trained to use PBL and were either using or had used the method in their practice of teaching. The summary of their performance (Appendix F) on the Innovation Configuration Checklist (Appendix C) and the comparisons of their performance on the Awareness Questionnaire (Table 14), on the Teaching Philosophy Scale (Table 23), on the Teaching Preference Questionnaire (Table 31) all indicate that the method may be practiced without perfect adherence to all of its attributes. The comparison group did not obtain a perfect score on all of the items.

Most of the Seventh-day Adventist teachers had indicated that they have less preferences for the student-centered components of PBL than the comparison group did, so it should not be anticipated that they will exercise more faithfulness to PBL than the comparison group does. Levin, Dean, and Pierce (2001) stated that PBL works best when the framework includes the following critical elements:

1. Interpreting and defining the problem
2. Generating questions that need to be answered about the problem
3. Conducting research to find answers to the questions

4. Proposing a variety of hypotheses and potential problem solutions that are warranted by the data collected
5. Discussing the pros and cons of these potential solutions
6. Selecting and presenting potential problem solutions to a real audience (pp. 122-123).

Barrows (1985, cited in Schwartz et al. 2001, p. 2) established that in practicing

PBL students should

1. encounter a problem 'cold' without doing any preparatory study in the area of the problem
2. interact with each other to explore their existing knowledge as it relates to the problem
3. form and test hypotheses about the underlying mechanism that might account for the problem (up to their current levels of knowledge)
4. identify further learning needs for making progress with the problem
5. undertake self-study between group meetings to satisfy the identified learning needs
6. return to the group to integrate the newly gained knowledge and apply it to the problem
7. repeat steps 3 to 6 as necessary
8. reflect on the process and on the content that has been learnt.

When the framework proposed by Levin, Dean, and Pierce (2001) is compared with the "pure" form of PBL that was originally proposed by Barrows, one can agree that if the critical elements are included in the practice, one can claim to be practicing PBL. Besides, Schwartz et al. (2001) claimed that the wide use of PBL in medical schools in a short time after it was first introduced in the 1960s indicated an evolution in the meaning of problem-based learning.

Teachers indicated that they would be willing to adopt PBL. These teachers do not realize that they are being called to question their very philosophy of teaching. Will



they be willing to implement PBL strategies, and for how long? Will they be prepared to give up single-subject teaching for interdisciplinary teaching? Will they be willing to give up traditional ways of testing to more “authentic” methods of evaluating students’ learning? Will they be willing to allow students to move around freely and discuss together creating noise, and the appearance of an unstructured classroom? Will they be willing to allow students’ interests and needs to determine curriculum content and pace of covering? While there are evidences that some of these principles may be modified (see Appendix F, and Comparison Tables 14, 23, and 31), without sacrificing PBL, teachers must be aware that students’ autonomy must be supported. Before the adoption, the conferences should engage teachers in some practice exercises to determine what level of use they would be comfortable with, and ascertain from the experts if such use would qualify to be called PBL.

Since assessment is definitely a barrier, the conferences may follow the examples included in some of the resources mentioned under *Recommendations for Practice*. As part of their assessment procedures, Mergendoller et al. (2000) employed unit-specific and general knowledge tests in their study. One should remember, however, that one of the desirable attributes of PBL is that it allows students’ creativity, practical skills, problem-solving skills, critical thinking skills, and collaborative skills to be developed, and these cannot be measured with multiple-choice tests. Also Sternberg (1998) stated that the continued dependence on tests that only identify students with analytical skills, amounts to throwing away talents. He also implied that the group of students classified as bright, with the use of traditional assessment methods, will not be diversified socioeconomically or ethnically.

## Recommendations

The purpose of this study was to determine how much SDA K-12 teachers knew about PBL and its student-centered philosophy, and how much they appreciated the student-centered components of PBL. It was also the purpose of the study to ascertain what factors the teachers would perceive as barriers to the adoption and implementation of PBL in response to the NAD Curriculum Futures Commission recommendation that PBL be adopted as a preferred teaching practice. I hope that the findings of this study might be useful to the practice of education generally, and to the Seventh-day Adventist education system in particular as it engages in the process of change. The following recommendations are made to increase the usefulness of this study.

### Recommendations for Research

The sample of Florida teachers used in this study was not randomly selected but was a convenience sample. The number of subjects in both groups was not equivalent, and may have affected the results. For a medium size effect and a 0.7 power level, for the independent samples  $t$  test, according to Olejnik (cited in Borg & Gall, 1996), the two groups should have an equal number of 50 samples each. Although the results of this study do provide information that should be useful to SDA educational leaders in Florida if they are planning to adopt the strategy as recommended, I recommend that additional research be done.

1. A broader study of more Adventist teachers and a larger comparison sample would increase the power of the study, and would make the findings more generalizable to SDA education throughout the North American Division. Power would even be greater if a true criterion group of teachers were available for comparison with the Adventist teachers.

2. To expand the body of literature available on PBL, and because there is not much empirical data on student achievement and PBL, future studies should investigate student performance in PBL as compared to conventional teaching methodologies. Considering that the PBL approach has other student benefits than increased test scores, if PBL students perform higher than, or the same as non-PBL students, then this study would support the efficacy of PBL.
3. Future studies should also survey SDA educational administrators to determine their awareness and understanding of PBL and its components, and their readiness to support the teachers' adoption of PBL. The study revealed that teachers believed that administrators would provide training, but not resources for the teachers to successfully adopt and implement PBL. Teachers also perceived that parents would not give enough support. However, Caine and Caine (1997) and Joyce and Showers (1995) describe the need for systemic support when new strategies are adopted. School administration would have a better understanding of the strategy and the need to provide resources for its adoption when they learn about it. Administration would then be more willing to help inform other stakeholders such as parents and students about the innovation.
4. Additional studies should determine if use of PBL is facilitated by special subject areas or grade levels. I had thought that the teachers' subject area endorsement would be related to the teachers' awareness of PBL and, perhaps, willingness to adopt PBL. Additionally, many of the classroom activities available on PBL seem to be in the disciplines of science and social studies. This factor was not studied in this investigation and may be observed in a future investigation.

5. Of special concern were items 2, 22 and 25, and 26 on the Teaching Philosophy Scale. On the Item Comparison Table, Table 23, these items denoted a significant difference between the comparison group and the SDA group of teachers, and the SDA teachers ranked higher than the comparison teachers. It appears that the way the items were worded may have been misleading to the groups. Item #2 read, "Instruction should be guided *primarily* by true-to-life problems of students." The SDA teachers may have interpreted this question from a spiritual point of view that, if children have real problems, then teachers should address those problems. On the other hand, the comparison teachers may be misled by the term "Instruction" and "Problems of student." Usually the problems are true-to-life but not necessarily centered around the children, but the curriculum.

Item 22 said, "Effective feedback lets students know immediately if their responses are right or wrong." The comparison teachers who are student-centered do not rate problems as right or wrong. On the other hand, the more traditional SDA teachers do rate students' work as right or wrong.

Item #25 read, "Children must be educated more for the future than for the present" and is not a student-centered idea. Dewey (1916/1944) said that children's education should prepare them not only for the future but to successfully live in the present. The SDA teachers' educational philosophy from a religious perspective educates students for the future life in the hereafter. White (1952) wrote that true education not only prepares students for this life but for the life to come. The SDA teachers may have interpreted this item from a spiritual perspective with a focus on the hereafter.

Item #26 which read, "With the ever-changing demographics of students and their families, it is impossible for every student's learning needs to be met," could not be clearly identified as a student-centered or traditional item and so was excluded from the analyses. For future use, it may be necessary to rewrite these items to fully convey the characteristics of problem-based learning, without the ambiguity of meaning and have a better Teaching Philosophy Scale.

6. Dr. Workman said that IMSA's students are gifted and work as if what they do is what they are supposed to do. His experience with PBL causes him to believe that PBL works best with underachieving students because the new way of learning turns them on and gives them reasons to learn. I recommend that a study be conducted to determine whether PBL works best for underachieving students.

#### Recommendations for Practice

The Seventh-day Adventist Church has recommended the adoption of PBL in its K-12 system of education. This study has determined that some preparatory work is necessary to be done before the adoption can occur. Therefore, I have developed the following eight recommendations:

##### **Teacher Training**

First, teachers should be trained to use PBL before PBL principles are adopted. The Seventh-day Adventist educational system has suggested that PBL be adopted and implemented as a preferred teaching practice in its institutions of learning. It is believed that this strategy will improve Adventist education and help prepare citizens to live successfully in the 21st century to make the school system an exemplary one.

This study and that of Brantley and Ruiz (2001-2002) have clearly indicated that SDA K-12 teachers in Florida do not know enough about problem-based learning to adopt it as a teaching strategy in their classrooms. I found in this study that little over 50% of them support the student-centered philosophy of PBL, and less than that number would appreciate teaching in a student-centered teaching environment.

However, most are willing to adopt and implement the strategy. In the Profile studies of Brantley and Ruiz (2001-2002, most of the teachers did express a desire to acquire proficiency in the use of PBL.

When the impediments were identified in descending order, the three top components that the teachers opposed were (a) assessing and reporting student progress without pencil-and-paper tests and report cards, (b) allowing student interest to determine the sequence of curriculum coverage, and (c) giving students control of the pace and content of their learning. The teachers felt that parents and administration would not only be opposed to the first two components mentioned above, but that, in addition, parents and administration would not appreciate students working in an environment that would sometimes be noisy and loosely structured as students interacted to accomplish the solution of their problem.

Since PBL is a student-centered teaching strategy, teachers should be willing to conduct their classes so that students choose the pace and content of what they learn; to assess learning without the use of tests, letter grades, or report cards; and to allow students' needs and interests to determine the sequence of curriculum coverage. The SDA teachers do not embrace such a teaching/learning preference, but may appreciate the student-centered nature of PBL when the method is better known through training.

Levin (2001), in the book *Energizing Teacher Education and Professional Development with Problem-Based Learning*, recommended that schools of education should include PBL, not only as a strategy for teachers to study, but for teachers to experience as students in their pre-service training. She and other authors described university schools of education where beginning and experienced teachers are learning about PBL as students of PBL. PBL may be introduced into the curriculum of schools of education in Adventist colleges and universities. PBL training may also be offered at workshops/in-services.

As part of the training, teachers must acquire skill in asking the right kinds of questions that will lead children on. Dr. Workman (personal communication, July 2000) said that in their effort not to give children answers, but to encourage them to find answers for themselves, teachers usually tend to avoid students' questions. This is bad practice. Instead teachers should ask questions that help students to rethink and look at "What Ifs."

Questions about PBL use usually include whether curriculum will be covered. In designing a problem, the practitioner should align content and skill that will be taught with PBL with the district's and state's curriculum (Marlowe & Page, 1998).

#### Training possibilities

IMSA conducts two institutes every summer for teachers from all over the world who wish to learn about PBL. One of these is 2 weeks long. During the first week, the teachers as students are immersed in a PBL unit that is presented to them. The next week, they have to teach that unit to middle-school students. That institute is called Summer Sleuths. The other institute is the Harris Institute, named after its benefactor. In this 1-week program, teachers are introduced to a PBL unit and taught about how it was

designed, after which they have to design a unit. So this is really a design program. That may be an option to consider or it may be more financially feasible to invite a trainer to go to the teachers.

In Florida there are some schools where PBL teachers work who have been trained at IMSA. The conferences may make arrangements, as I did, for teachers to visit the schools where these teachers work to observe PBL in use. There may be grants available to promote student achievement through PBL as an innovation. One school I visited in Orlando was using such a grant to teach science through PBL.

### **Teacher Practice for Proficiency**

Second, teachers need opportunity to practice for proficiency. Wherever they receive training, teachers must be allowed opportunities to experience PBL as students, and to create ill-structured problems (Levin, 2001; D. Workman, personal communication, November 1, 2002). After teachers have had training, teachers should have opportunity to acquire facility in the use of PBL through repeated frequent practice, coaching, and feedback. Then there will be transfer of the practice to the classroom for improved student achievement (Joyce & Showers, 1995). Even after the acquisition of the technique, teachers should continue to practice and coach each other. They may form study groups among teachers from within the same school or from nearby schools so that they could get together at least once per month to practice the strategy so they may become proficient in its use (Henriquez-Rourke, 1995).

### **Level of Use of Innovation**

Third, conferences should create an Innovation Configuration for their use of PBL. Little more than half of the teachers reported that they support the student-centered



philosophy of PBL and less than half embrace a student-centered teaching preference. Senge (1990, cited in Caine & Caine, 1997) stated that we have espoused theories about how children learn, and that these theories are entrenched in us based on our own experiences in school and even post-baccalaureate education. They say also that we have mental models, which are our theories in use, and there is dissonance between our espoused theories and our mental models, because what we profess is different from what we practice.

Although many of the teachers do not embrace a student-centered teaching philosophy, they may still be able to practice PBL, according to Schwartz et al. (2001). These authors said that Barrows, one of the developers of PBL, has, on occasion, implied that to be called PBL, a learning process must allow students to:

- encounter a problem ‘cold’, without doing any preparatory study in the area of the problem
- interact with each other to explore their existing knowledge as it relates to the problem
- form and test hypotheses about the underlying mechanisms that might account for the problem (up to their current levels of knowledge)
- identify further learning needs for making progress with the problem
- undertake self-study between group meetings to satisfy the identified learning needs
- return to the group to integrate the newly gained knowledge and apply it to the problem
- repeat steps 3 to 6 as necessary
- reflect on the process and on the content that has been learned. (Barrows, 1985, cited in Schwartz et al., 2001, p. 2)

Schwartz et al. (2001) said that, by 1986, Barrows had proposed that PBL did not refer to a specific method of teaching and that there was a classification of methods that could be termed PBL. This suggests that it might be possible to replace the components that the teachers, parents, and administration find objectionable with appropriate ones and still have a PBL approach. The authors say that Barrows (1986, cited in Schwartz et al. 2001) claims that the importance of PBL is the main benefit. These include

the structuring of knowledge for use in clinical contexts, development of an effective clinical reasoning process, the development of self-directed learning skills, and increased satisfaction with and motivation for learning. To these can be added the development of interpersonal, teamwork and communication skills. (Schwartz et al., 2001, p. 3)

The eight steps above may be accomplished without the identified objections.

I, therefore, recommend that teachers be given an opportunity to try a commercially prepared unit that aligns to the curriculum, and at an in-service become sufficiently skillful to implement the unit in the classroom. At the in-service teachers should practice using coaching and feedback with each other until they are comfortable with its use. They should brainstorm on how they would assess and report student progress, and how they would address the barriers that ask them to share some control with students, and to which they objected. An innovation configuration that addresses the taxonomy of PBL and includes the way the SDA teachers propose to use it may be prepared and verified by Dr. Barrows, or Dr. Workman.

### **All Stakeholders to Be Informed**

Fourth, all stakeholders should be informed prior to use of PBL in schools. Before the innovation is implemented, other faculty and staff, parents, students, and other stakeholders should be informed of the innovation and how it might impact everyone. The cost of time, material, and other resources should be explained.

Parents and other stakeholders need to be educated concerning the benefits to children. The teachers in this study reported that they believed parents would be reluctant to attend workshops to learn about PBL. The teachers also expressed unwillingness to conduct workshops to acquaint parents with PBL. At the same time, the report was that parents would be willing to share their expertise with their children's schools, and they do want their children to conduct research. It is obvious from this information that parents

want their children to do well, and if that is what the outcome of PBL will be, parents may support its use. So the teachers should learn as much as they can about the benefits of PBL to the child and sell this to the parents. Initially engaging parents in a simple PBL activity may be the best way to get the parents to appreciate this strategy.

### **Start Small**

Fifth, start small. Although it would be optimal if PBL were adopted by the entire system, that is not attainable, so every teacher in the same school does not have to embrace PBL for its implementation to be successful. Nor does the teacher have to adapt the entire curriculum to PBL. Stepien (cited in Checkley, 1997) said that it is unrealistic for the teacher to convert an entire curriculum for PBL technique, but that a teacher should have a good experience with one problem initially. Therefore, I do recommend that teachers start small with a few problems, especially until they observe the resulting effects on the students. Woods (1991) recommended that before students are placed in PBL groups, they should be trained to practice problem-solving because they cannot develop that skill by simply being placed in PBL environments. PBL offers an opportunity to develop the skill.

While some teachers may be concerned about not covering the curriculum in a timely manner, others may appreciate the problem-solving skills the students develop, and the way they assume responsibility for their learning. Many problem-based curricular materials are available commercially, so that teachers need only practice using the materials following the developers' instructions and not "re-invent the wheel".

**Determine Participants' Readiness for Innovation**

Sixth, determine how student-centered people are. I recommend that before an innovation such as PBL is implemented, that a test that measures teachers' readiness for the innovation be administered. It would provide important information on how much people know of the innovation, their own philosophy about teaching and learning, their attitudes towards the innovation, and problems they might encounter or perceive that they might encounter with the adoption.

**Administrative Support Needed**

Seventh, administrative support is needed. The teachers expressed that they did not believe that their administrators would be willing to help them financially to procure PBL materials. They also felt that they would not be given time off from work to practice PBL. To lessen the negative effect of cost and insufficient practice time, administration should assist with expenses for materials and make arrangements for teachers to have time for practice. Parent volunteers or members of the administrative staff may watch teachers' classes so teachers may be free to meet together. Weekend in-services may be arranged for teachers, or teachers could get together once or twice per month in their study groups.

To encourage practice meetings outside of work hours, administration may need to provide some incentives. For every hour that administration may ask teachers to donate their time to training, administration may match with a paid hour for training.

**Assessment Needs**

Eighth, brainstorm new methods of assessing and reporting students' academic growth. Since, in PBL, students acquire more than a collection of facts (Checkley, 1997),

creative methods of assessment that can capture all the learning that occurs must be employed. Assessment of student learning needs to reflect PBL. Students acquire information and skills that cannot be measured by tests. That component of PBL was an impediment for administration, parents, and colleagues. In Levin's book (2001) suggestions are made concerning group presentations, individual written papers, student logs, a course portfolio, written tests, and self and peer evaluations.

### Resources

The *Curriculum Update* of Summer 1997 is an excellent resource for the person who wants to learn about the characteristics and definition of PBL, a brief history of its development, its advantages, and how to get started. Levin (2001), Marlowe and Page (1998), Nagel (1996), Schwartz et al. (2001), Delisle (1997), and Torp and Sage (1998) provide excellent resources for anyone seeking models for adoption of PBL and answers to some frequently asked questions about PBL. The Center for Problem-Based Learning at IMSA is an invaluable resource for PBL materials. The sample activities in the *Curriculum Update* of Summer 1997, in Delisle (1997), and in Torp and Sage (1998) are appropriate for K-12 settings, while those in Schwartz et al. (2001), and Levin (2001) are suited to higher education.

In Levin's book (2001) suggestions are made concerning group presentations, individual written papers, student logs, a course portfolio, written tests, and self and peer evaluations. This book may be a resource for assessment alternatives.

Some concerns that teachers, parents, and others may have relate to covering the curriculum. Schwartz et al. (2001) offer some solutions. Levin, Dean, and Pierce (2001), Marlowe and Page (1998), and Schwartz et al. (2001) state that PBL should not conflict with, but support, the required curriculum. In designing a problem, the practitioner

should align content and skill that will be taught with PBL with the district's and state's curriculum.

APPENDIX A

LETTERS

## FIRST LETTER TO IMSA PROBLEM-BASED LEARNING TEACHERS

January 25, 2000

P.O. Box 294  
Silver Springs, FL 34489

Dear Teacher,

I have been informed that you are a teacher who likes to be innovative. At some time in your career you have used or inquired about using Problem-based learning as an approach to delivering instruction. If you have used or are using the method, please take the time to complete the checklist and return it in the enclosed envelope.

Simply put a (✓) by the part of the question that shows how **you** use the method; not how you think it should be used, or what others do. At this stage I am only piloting the checklist so I may make corrections. It will also be of great benefit to me if you could include a note indicating items that are not clear, are redundant, or need modifying, along with suggestions how you think they should be changed.

Since you are helping to pilot this project, you are part of a small number so it is very important that you return this checklist to me in the enclosed envelope. I am willing to share the results of the survey with you at your request. Thanks for your assistance.

Gratefully,

Eileen Pilliner



Support Letter from Deb Gerdes (Dr. Workman) at IMSA

April 27, 2000

Dear IPBLN member,

Eileen Pilliner is a doctoral student who is doing her dissertation on Problem-Based Learning. Dr. David Workman here at IMSA has been one of her resources. He has asked me on her behalf to send this survey to 20 of our network members. Your name was selected to give a balanced mixture of experience levels. Your taking the time to complete this checklist will help Ms. Pilliner in this endeavor. You do not have to sign your name. The results of this survey will be shared with those requesting it. She is hoping to collate the results by the end of this school year.

Thank you for assisting her.

Sincerely,

Deb Gerdes  
Coordinator of PBL Initiatives  
The Center @ IMSA  
Dgerdes@imsa.edu

(This is a typewritten copy of the letter.)

## Second Letter to IMSA Problem-Based Learning Teachers

November 6, 2001  
P. O. Box 294  
Silver Springs, FL 34489

Dear Teacher:

Your response to the 1<sup>st</sup> questionnaire was greatly appreciated, and led to the creation of the second, enclosed. If you did not participate in the first survey, we still welcome your participation in this phase.

I am grateful for the participation of teachers such as you who are so familiar with PBL. That is what makes your input so invaluable, because your responses will provide the criteria for the comparison with my target population.

To provide you with some more information that may give you a better understanding of what I am trying to accomplish, I will attach a copy of the letter that will go to my target population.

Please complete this instrument and return in the enclosed, stamped, self-addressed envelope by January 31.

Your participation is again valued.

Gratefully,

Eileen Pilliner

## Letter to SDA K-12 Teachers

January 13, 2002  
PO Box 294  
Silver Springs, FL 34489

Dear Teacher:

I am a doctoral student in the Curriculum and Instruction Program in the School of Education at Andrews University in Berrien Springs, Michigan. I have also taught for over 20 years and have noticed the trends in education and the challenges teachers face from day to day.

I am conducting research on the "*Perceptions of Problem-Based Learning and Attitudes Towards its Adoption among Teachers in Seventh-day Adventist Schools in Florida.*" Problem-based learning is an instructional method that seems to have the potential to help students assume responsibility for their learning, learn better, acquire deeper understanding, experience better retention, exercise higher order thinking, learn to solve problems, work cooperatively with each other, and become self-directed learners. Using this method, the teacher becomes a facilitator of learning, a guide or a coach. You will experience less disciplinary problems, will have more time to work with students who may need a "push" to get started, and time to do some things you could not find time to do before.

You may already be using this method of instruction, but I want to determine the perceptions that teachers in the Southern Union have towards this instructional strategy and whether they would want to learn to include it in their repertoire of skills. In its 1997 report on how to improve SDA schools, the Futures Commission recommended Problem-based learning as an innovative teaching method that could improve SDA education.

It is our intention to share this method with teachers according to their requests, or at workshops and in-services. Before that can be done, however, we need teachers' responses to the enclosed questionnaires. We would appreciate it if you would complete the enclosed instrument and, after sealing it in the envelope provided, return it to your principal. I would like to ask you NOT to sign the instrument.

Any information released will be summarized so that no individual responses could be identified. Your responses will be held in the strictest confidence and will assist us in helping teachers to better equip students for the 21st century. Please include any comments you may have concerning aspects not covered in this letter, and direct any questions to me at (352) 236-3683.

Gratefully,

Eileen Pilliner

APPENDIX B  
PROBLEM-BASED LEARNING COMPONENTS

## **Problem-Based Learning Components**

### **Teachers:**

Present just enough information for students to grasp the problem.  
 Coach students and facilitate learning.  
 Learn along with students.  
 Guide students to inquire, think, and search to find answers.  
 Present problems to students.  
 Are not the disseminators of information.  
 May work in teams to design problems.  
 Use questioning technique as a tool in coaching.

### **Students:**

Define problem for themselves.  
 Actively grapple with the problem.  
 Propose own hypothesis.  
 Do their own hypothesis testing.  
 Gather information to solve the problem they define.  
 Make the problem their own - become stakeholders.  
 Set their conditions for resolving the problem.  
 Learn as they work with the problem.  
 Work cooperatively with each other to solve problem.  
 Seek the input of experts in the field they are investigating.  
 Are colleagues with teachers/facilitators.  
 May work in heterogeneous groups or individually  
 Choose problem resolution in their learning style.  
 Construct meaning for themselves.  
 Write a problem statement that clarifies the issue and the conditions necessary for appropriate resolution.  
 Generate several possible solutions for each problem.  
 Evaluate and choose best solution for each problem.  
 May offer solutions to real stakeholders in the problem.

### **Problems**

Are ill structured and messy.  
 Contain a problem that students need to define.  
 Initiate learning and learning activities.  
 Have more than one solution.  
 Are presented in a way students would meet them in real life.  
 May change as more information is gathered.  
 May take weeks or months to solve.  
 Are designed so students cover the academic curriculum in order of Relevance to students' investigation.  
 Are designed so parents and other adults may be resource for students.  
 Integrate subject areas.

**Assessment:**

Evaluates learning and understanding

Is on going - embedded

Dependent on standards students set for resolution of the problem.

Is not a test

May be a portfolio, an oral presentation, an audio-visual presentation, a combination of these or some other student-described performance.

**Technology:**

Inherently integrated as a way of finding and presenting information.

## APPENDIX C

### PROBLEM-BASED LEARNING INNOVATION CONFIGURATION



### **Problem-Based Learning Innovation Configuration**

- 1) Planning
  - a) Teachers always work in teams to plan interdisciplinary lessons
  - b) Teachers sometimes work in teams to plan lessons
  - c) Teachers never plan lessons together
- 2) Coaching
  - a) Coaching is used to guide students' work
  - b) Coaching is seldom used
  - c) Coaching is never used
- 3) Problem
  - a) Problem initiates students' learning and research
  - b) Problem is assigned to reinforce lesson taught
  - c) Problem is not usually assigned
- 4) Problem
  - a) Students have to find the real problem given a problematic situation
  - b) Problem is somewhat tricky
  - c) Problem is clearly defined and explained
- 5) Problem
  - a) Problem is always true-to-life
  - b) Problem is sometimes true-to-life
  - c) Problem is make-believe
- 6) Solution
  - a) Students find the best or most defensible solution to their hypothesis
  - b) Students find a solution the teacher wants
  - c) Students find the right solution
- 7) Evaluation
  - a) Learning is assessed throughout the unit through discussion, or from the developing final product, and shows understanding
  - b) Learning is determined by a project
  - c) Learning is assessed by a final test
- 8) Information
  - a) Students always seek information for themselves by doing their own research from traditional and non-traditional sources
  - b) Students sometimes gain information by researching
  - c) Students' main source of information is the teacher

9) Information

- a) Information for solution is learned as problem is solved
- b) Information to solve problem is partly given before problem is solved
- c) Information to solve problem is always given before problem is solved

10) Information

- a) Students are never given all the information they need to solve the problem
- b) Students are given some of the information they need to solve the problem
- c) Students are always given all the information they need to solve the problem

11) Curriculum

- a) Curricular area addressed depends on relevance to students' interest
- b) Curricular area addressed determined by teacher and sometimes students' choice
- c) Curricular area addressed depends on teacher's plans

12) Motivation

- a) Students meet the problematic situation from the perspective of a stake holder in the situation
- b) Students meet the assignment as a project
- c) Students meet the assignment as something teacher wants done

13) Motivation

- a) Work is driven by the problem
- b) Work is driven by student's desire to compete
- c) Work is driven by the time teacher sets

14) Timeline

- a) Problem has no definite time for resolution; may take weeks, months, a year
- b) Teacher and student set definite end to lesson
- c) Teachers set time for work to conclude

15) Questions

- a) Teachers ask probing and challenging questions to move students along
- b) Teachers try to evade some of students' questions or tell them to find answers for themselves
- c) Teachers never answer students' questions

16) Students

- a) The students always choose the resolutions of the problem in a style that they are comfortable with
- b) The students sometimes can choose how to present the final work
- c) The students must resolve the problem in the way the teacher dictates

APPENDIX D  
MODIFIED INNOVATION CONFIGURATION FOR  
PROBLEM-BASED LEARNING

### **Modified Innovation Configuration for Problem-Based Learning**

- 1) Planning
  - a) Lessons are always interdisciplinary
  - b) Lessons are sometimes interdisciplinary
  - c) Lessons are never interdisciplinary
- 2) Coaching
  - a) Coaching is used to guide students' work
  - b) Coaching is seldom used
  - c) Coaching is never used
- 3) Problem
  - a) Problem initiates students' learning and research
  - b) Problem is assigned to reinforce lesson taught
  - c) Problem is not usually assigned
- 4) Problem
  - a) Students have to find the real problem, given a problematic situation
  - b) Problem is somewhat tricky
  - c) Problem is clearly defined and explained
- 5) Problem
  - a) Problem is always true-to-life
  - b) Problem is sometimes true-to-life
  - c) Problem is make-believe
- 6) Solution
  - a) Students find the best or most defensible solution to their hypothesis
  - b) Students find a solution the teacher wants
  - c) Students find the right solution
- 7) Evaluation
  - a) Learning is assessed throughout the unit through discussion, or from the developing final product, and shows understanding
  - b) Learning is determined by a project
  - c) Learning is assessed by a final test
- 8) Information
  - a) Students always seek information for themselves by doing their own research from traditional and non-traditional sources
  - b) Students sometimes gain information by researching
  - c) Students' main source of information is the teacher
- 9) Information
  - a) Information for solution is learned as problem is solved

- b) Information to solve problem is partly given before problem is solved
- c) Information to solve problem is always given before problem is solved

10) Information

- a) Teachers never teach students all the information students need to solve the problem
- b) Teachers teach students some of the information students need to solve the problem
- c) Teachers teach students all of the information students need to solve the problem

11) Curriculum

- a) Curricular area addressed depends on relevance to students' interest
- b) Curricular area addressed determined by teacher and sometimes students' choice
- c) Curricular area addressed depends on teacher's plans

12) Motivation

- a) Students meet the problematic situation from the perspective of a stakeholder
- b) Students meet the assignment as a project
- c) Students meet the assignment as something teacher wants done

13) Motivation

- a) Work is driven by the problem
- b) Work is driven by the time teacher sets
- c) Work is not driven by a problem

14) Timeline

- a) Problem has no definite time for resolution; it may take weeks, months, a year to be resolved
- b) Teachers set time for work on the problem to conclude
- c) Students set time for work on the problem to conclude

15) Questions

- a) In response to students' questions, teachers ask probing and challenging questions to move students along
- b) Teachers try to evade some of students' questions or tell them to find answers for themselves.
- c) Teachers never answer students' questions.

16) Resolution

- a) Students are always allowed to choose to present the resolution of the problem in a style they are comfortable with.
- b) Students are sometimes allowed to choose to present the resolution of the problem in a style they are comfortable with.
- c) Students are never allowed to choose to present the resolution of the problem in a style they are comfortable with.

APPENDIX E  
INSTRUMENTS

## **Instruments**

### **Awareness Questionnaire**

This instrument measures teachers' knowledge of Problem-based learning. Circle the correct answer. If you do not know the answer choice that makes the statement correct, please choose "I do not know". DO NOT sign your name or conference.

1. Problem-based learning is
  - a) interdisciplinary structured
  - b) single-subject structured
  - c) both a and b
  - d) none of the above
  - e) I do not know
  
2. Problem-based learning is
  - a) student-centered/subject-based
  - b) teacher-centered/subject-based
  - c) student-centered/problem-based
  - d) teacher-centered/problem-based
  - e) I do not know
  
3. For knowledge/information to be acquired in problem-based learning
  - a) teachers instruct students, then students work on a problem.
  - b) students conduct peer tutoring then, they work on a problem.
  - c) students conduct research using traditional and non-traditional sources, as they work on a problem.
  - d) (a and b), (a and c), (b and c)
  - e) I do not know
  
4. In problem-based learning, problems are
  - a) used to reinforce information the teacher provides the students through instruction.
  - b) used to initiate learning
  - c) used as a test of students' learning
  - d) (a and b), (a and c), (b and c)
  - e) I do not know
  
5. In problem-based learning, the teacher functions as
  - a) an instructor/teacher
  - b) a mentor
  - c) a facilitator and guide
  - d) a stakeholder
  - e) I do not know

6. The design of problems in problem-based learning is to
  - a) address curricular requirements only
  - b) address students' interests only
  - c) address curricular requirement and students' interest simultaneously
  - d) address no curricular requirement or student interest
  - e) I do not know
  
7. In problem-based learning, learning is assessed
  - a) by a project students produce
  - b) by a final test
  - c) by embedded assessment and the final product
  - d) (a and b), (a and c), (b and c), (none of these)
  - e) I do not know
  
8. In problem-based learning, students are required to
  - a) find the right solution to the problem
  - b) find the best or most defensible solution to their hypothesis of the problem
  - c) avoid a wrong answer to the problem
  - d) guess the answer
  - e) I do not know
  
9. Problem-based learning
  - a) sometimes allows students choice of how the resolution of the problem is presented
  - b) always allows students choice of how the resolution of the problem is presented
  - c) never allows students choice of how the resolution of the problem is presented
  - d) does not require students to present resolution of the problem.
  - e) I do not know
  
10. In problem-based learning
  - a) The teacher sets and adheres to a definite time for the resolution of the problem
  - b) The student sets and adheres to a definite time for the resolution of the problem
  - c) There is no definite time for the resolution of the problem
  - d) There is no problem to be resolved
  - e) I do not know



### Teaching Philosophy Scale

Circle the response (YES or NO) that comes closest to your ideas for each item below. There are no wrong or right answers.

- |     |  |     |    |
|-----|--|-----|----|
| 1.  | Students' interests should determine both the time <i>and</i> the manner in which curriculum is covered.                     | YES | NO |
| 2.  | Instruction should be guided <i>primarily</i> by true-to-life problems of students.  | YES | NO |
| 3.  | Curriculum is best determined by what teachers and other mature, experienced adults think is most appropriate for students.  | YES | NO |
| 4.  | The best teachers take their cues from students' responses to questions.   | YES | NO |
| 5.  | The students' role is to receive knowledge.  | YES | NO |
| 6.  | Ideal teachers construct practical problem situations and then use frequent questions to help students solve those problems. | YES | NO |
| 7.  | The best learning environment is one where students solve their own problems.  | YES | NO |
| 8.  | The teacher should be a strong authority figure in the classroom.  | YES | NO |
| 9.  | Allowing student choice to determine the curriculum tends to "water down" classroom instruction.                             | YES | NO |
| 10. | Teachers should allow students to take charge of the manner and pace of their learning.                                      | YES | NO |
| 11. | A test is most useful when administered at the end of a unit to evaluate how much has been learned.                          | YES | NO |
| 12. | The best teachers are skillful transmitters of knowledge.  | YES | NO |
| 13. | The most effective learning environment is non-structured rather than structured.  | YES | NO |
| 14. | The most effective curriculum is organized into specific subjects, such as math, English, history, health, etc.              | YES | NO |
| 15. | Students should be active participants in all or almost all the classes they take.   | YES | NO |
| 16. | The best teaching technique is the inquiry method.   | YES | NO |

- |     |  |     |    |
|-----|--|-----|----|
| 17. | There are essential bodies of knowledge that each student must receive.  | YES | NO |
| 18. | Most classroom instruction should center around presentations, demonstrations, and multi-media instruction.                        | YES | NO |
| 19. | Students should be allowed to choose of the method by which they acquire knowledge.  | YES | NO |
| 20. | A well-constructed pencil-and-paper test is the most useful way to evaluate student learning.                                      | YES | NO |
| 21. | The primary purpose of education is to transmit values from one generation to the next.  | YES | NO |
| 22. | Effective feedback lets students know immediately if their responses are right or wrong.   | YES | NO |
| 23. | Curriculum coverage by the end of the school year should determine students' readiness for promotion to the next grade.            | YES | NO |
| 24. | School-age children are too inexperienced to know what is the best curriculum for them.  | YES | NO |
| 25. | Children must be educated more for the future than for the present.  | YES | NO |
| 26. | With the ever-changing demographics of students and their families, it is impossible for every student's learning needs to be met. | YES | NO |
| 27. | Giving students very much input into curriculum development is unwise.   | YES | NO |
| 28. | In the best learning environment, children should be quiet and orderly.  | YES | NO |
| 29. | The lecture method is the best way to teach large groups of learners so all can have the same opportunity to learn.                | YES | NO |
| 30. | Real learning begins with the learners' experiences.   | YES | NO |
| 31. | Textbooks provide an ideal framework for organizing and sequencing what students should learn.                                     | YES | NO |

### Teaching Preference Questionnaire

Rank each item below in 1 - 2 - 3 order according to your preference. The number "1" represents most preferred, the number "2" represents less preferred, and the number "3" represents least preferred.

1. I prefer teaching structured around:
  - single-subject study
  - interdisciplinary study
  - both a and b
  
2. I believe that the most effective kind of learning is:
  - student-centered/problem-based.
  - teacher-centered/subject-based.
  - teacher-centered/problem-based.
  - student-centered/subject-based.
  
3. I think that knowledge/information is best acquired when:
  - students conduct research using traditional and non-traditional sources of obtaining information.
  - students conduct peer tutoring, then they work on a problem.
  - teachers instruct students, then students work on a problem.
  
4. I believe that problems aid learning best when they are:
  - used to initiate learning.
  - used as a test of students' learning.
  - used to reinforce information the teacher provides the students through instruction.
  
5. I believe that the teacher should function as:
  - a mentor.
  - a facilitator of learning, or guide.
  - a transmitter of information.
  
6. I prefer a teaching method where instruction is driven by:
  - curricular requirements only.
  - students' interests only.
  - curricular requirements and students' interests.
  
7. I believe that the best way to assess learning is by use of:
  - embedded assessment and the student's final product.
  - a project students produce.
  - a final test.

8. I believe that the best type of learning occurs when:  
\_\_\_\_\_ students have to find the right answer to a problem they are given to solve.  
\_\_\_\_\_ students find the best or most defensible solution to a problem they have to solve.  
\_\_\_\_\_ students must avoid getting the wrong answer to a problem.
9. I believe that students should:  
\_\_\_\_\_ always be allowed to choose how they present the outcome of the problem they work on.  
\_\_\_\_\_ sometimes be allowed to choose how they present the outcome of the problem they work on.  
\_\_\_\_\_ never be allowed to choose how they present the outcome of the problem they work on.
10. I believe that:  
\_\_\_\_\_ the teacher should determine the length of time the resolution of the problem takes.  
\_\_\_\_\_ the student should determine the length of time the resolution of the problem takes.  
\_\_\_\_\_ there should be no definite time determined for the resolution of the problem.
11. I prefer to teach in an environment that is:  
\_\_\_\_\_ highly structured and strictly disciplined.  
\_\_\_\_\_ loosely structured and strictly disciplined.  
\_\_\_\_\_ loosely structured and loosely disciplined.  
\_\_\_\_\_ highly structured and loosely disciplined.

### Problem-Based Impediment Scale

**NOTE: Please complete pages 1, 2, and 3 before referring to this page.**

Problem-based learning (PBL), is an instructional method that differs considerably from the traditional method of the teacher transmitting, and the student passively receiving information to be recalled on a test. The SDA educational system has recommended this method as a preferred teaching practice for the improvement of education. Any new approach such as PBL requires a lot of support from many people: *your school system (conference, school board, principal), parents, colleagues, and of course, you.* Suppose you were implementing PBL in your classroom, how much support would you expect to receive from such key persons?

**From what you know about PBL, please circle on the scales that follow, the number which you believe reveals the best representation of the extent to which your *SCHOOL SYSTEM* would: ("6" Very Willing; "0" Not Willing)**

- |  |   |   |   |   |   |   |   |
|--|---|---|---|---|---|---|---|
| 1. Provide you with sufficient training to learn about PBL.                                      | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 2. Give you release time from classes to prepare for PBL.  | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 3. Provide finances for PBL materials.   | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 4. Allow teachers to get together during the school day to plan PBL.                             | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 5. Visit you in your classroom in helping you implement PBL                                      | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 6. Appreciate children working in a loosely structured, sometimes noisy learning environment.    | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 7. Support a student assessment system without the use of tests, letter grades, or report cards. | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 8. Address criticisms, problems, and issues that may result from this change.                    | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 9. Be favorable toward the use of PBL.   | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

Please circle the number, which best represents the extent to which you believe *PARENTS* would:  
("6" Very Willing; "0" Not Willing)

- |    |   |   |   |   |   |   |   |   |
|----|---|---|---|---|---|---|---|---|
| 1. | Appreciate children working in a loosely structured, sometimes noisy, learning environment. | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 2. | Accept a performance report other than a letter grade or report card.                       | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 3. | Allow children opportunity to explore non-traditional ways/resources for information.       | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 4. | 0   | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 5. | Be willing to help their children adapt to their new instructional method.                  | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 6. | Provide material their children may need to prepare the product of their research.          | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 7. | Be willing to share their expertise and resources with students and teachers.               | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 8. | Be favorable toward the use of PBL.   | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

Please circle the number that best represents the extent to which you believe your *COLLEAGUES*:  
("6" Very Willing; "0" Not Willing)

- |    |   |   |   |   |   |   |   |   |
|----|---|---|---|---|---|---|---|---|
| 1. | Invest time to acquire proficiency in the use of PBL                                  | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 2. | Work in a loosely structured, sometimes noisy, learning environment.                  | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 3. | Allow students to choose the pace and content of what they learn.                     | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 4. | Assess learning without the use of tests, letter grades, or report cards.             | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 5. | Use textbooks as resources, and not to dictate the sequence of curriculum coverage.   | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 6. | Allow students' needs and interests to determine the sequence of curriculum coverage. | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 7. | Tolerate some noise that students working together will cause.                        | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 8. | Be facilitators of learning and not the authority figures in the room.                | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 9. | Conduct workshops to inform their students' parents of PBL.                           | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

- |  |   |   |   |   |   |   |   |
|--|---|---|---|---|---|---|---|
| 10. Address criticisms, problems, and issues that may result from this change.                   | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 11. Participate in coaching and feedback exercises to help their colleagues acquire proficiency. | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 12. Be favorable toward the use of PBL.  | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

**Your enthusiasm for PBL will make all the difference; how willing would *YOU* be to try a new approach such as PBL, which may differ so much from your usual way of instructing?**

Please circle the number that best represents the extent to which *YOU* are willing to adopt PBL in the following ways: ("6" Very Willing; "0" Not Willing)

- |  |   |   |   |   |   |   |   |
|--|---|---|---|---|---|---|---|
| 1. Invest time to acquire proficiency in the use of PBL.                                 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 2. Work in a loosely structured, sometimes noisy, learning environment.                  | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 3. Allow students to choose the pace and content of what they learn.                     | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 4. Assess learning without the use of tests, letter grades, or report cards.             | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 5. Use textbooks as resources, and not to dictate the sequence of curriculum coverage.   | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 6. Allow students' needs and interests to determine the sequence of curriculum coverage. | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 7. Tolerate some noise that students working together will cause.                        | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 8. Be a facilitator of learning and not the authority figure in the room.                | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 9. Conduct workshops to inform your students' parents of PBL.                            | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 10. Address criticisms, problems, and issues that may result                             | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 11. Conduct coaching and feedback exercises to help other teachers acquire proficiency.  | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 12. Be favorable toward the use of PBL.  | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

What are some comments you would like to include? Add them in the space below, or use an additional page.



APPENDIX F  
IMSA TEACHERS' RESPONSE TO PROBLEM-BASED LEARNING  
INNOVATION CONFIGURATION

**IMSA Teachers' Response to Problem-Based Learning  
Innovation Configuration**

Item	No. Using PBL In Pure Form	No. Using Variations	Items Not Answered	Problems/Questions
1	3	7		
2	9	1		
3	9	1		(1) "Initiates" is unclear
	6 1/2	3, 1/2		
5	4, 1/2, 1/2	4, 1/2, 1/2		
6	10			
7	9, 1/2	1/2		
8	8, 1/2	1, 1/2		(1) Choices are unclear
9	8	2		
10	3, 1/2, 1/2	5, 1/2, 1/2		(2) Need a and b clarified
11	1	9		(1) Argues for curriculum over students' interests
12	7	3		
13	9, 1/2	1/2		(1) Wants "work" defined
14	2, 1/2	6, 1/2	1	(1) Needs to complete curriculum
15	7, 1/2, 1/2, 1/2	1/2, 1/2, 1/2		(1) Who is asking questions?
16	3, 1/2	5, 1/2	1	(2) Items address two different issues

APPENDIX G  
DEMOGRAPHIC INFORMATION

**Demographic Information**

1. Sex       Male       Female
2. Age Category  20-35     36-45     46-55     56+
3. Years of teaching experience (Write the number) \_\_\_\_\_
4. Do you teach in a multi-grade classroom (three or more grades)?  Yes  No
5. Years in multi-grade (Write the number) \_\_\_\_\_
6. Grade range of most experience     Pre K - K     Primary (1-5)  
 Middle School (6-8)     High School (9-12)
7. Endorsement area and grade level (write in) \_\_\_\_\_
8. Grade level currently teaching     Pre K-K     Primary (1-5)  
 Middle School (6-8)     High School (9-12)

APPENDIX H  
GENERAL INSTRUCTIONS: PROBLEM-BASED  
LEARNING ADOPTION SURVEY

## GENERAL INSTRUCTIONS

**Problem-Based Learning Adoption Survey**

Teachers' input into curriculum adoption is very important. The North American Division Futures Commission has recommended Problem-Based Learning as a method of instruction that Seventh-day Adventist Schools should adopt to improve Adventist education ( NAD Futures Commission Report, 1997 ). As plans are made to improve the schools' curriculum for the 21st century, we want to hear your ideas. This survey is designed to identify your perceptions of this promising innovation. All responses will be kept in strict confidence. Please do not write your name on the questionnaire. Return of this survey form indicates your implied consent to participate in this voluntary study.

Please include any comments you may have concerning aspects not covered in this survey.

NOTE: Please complete this and the following two pages (pages 2, and 3), before referring to page 4.

1. Sex             Male             Female
2. Age Category  20-35    36-45    46-55    56+
3. Years of teaching experience (Write the number) \_\_\_\_\_
4. Do you teach in a multi-grade classroom (three or more grades)?  Yes  No
5. Years in multi-grade (Write the number) \_\_\_\_\_
6. Grade range of most experience  Pre K - K    Primary (1-5)  
 Middle School (6-8)    High School (9-12)
7. Endorsement area and grade level (write in) \_\_\_\_\_
8. Grade level currently teaching    Pre K-K    Primary (1-5)  
 Middle School (6-8)    High School (9-12)

## APPENDIX I

### COMPARISON OF SDA EDUCATIONAL PHILOSOPHY AND COMPONENTS OF PROBLEM-BASED LEARNING

## **Comparison of SDA Educational Philosophy and Components of Problem-Based Learning**

### Authentic Problems

White (1952) speaks against subjects being taught in a make-believe way. She said subjects should be presented in a way that is true to life. In the study of mathematics, for example, she says children should keep accurate account of their “income and outgoes” (p. 239). They should learn proper use of money by using it.

“In this way every study may become an aid in the solution of that greatest of all problems, the training of men and women for the best discharge of life’s responsibilities” (Ed. p. 239)

*Interdisciplinary:* Teachers should show how studies of history and language for example are linked to other areas of life. Students should not just study grammar, but should learn that the proper use of language can strengthen and build character. History should not only be studied as a “record of the rise and fall of kings, the intrigues of courts, the victories and defeats of armies . . .” (Ed. p.235). Students instead should study “the causes that govern the rise and fall of kingdoms. Let the youth study these records and see how the true prosperity of nations has been bound up with an acceptance of the divine principles. Let him study the history of the great reformatory movements, and see how often these principles, though despised and hated, their advocates brought to the dungeon and the scaffold, have through these very sacrifices triumphed.” (Ed, p. 238).

She is saying that the curriculum should integrate history with Bible, grammar and reading, and allow for discussion.



Practical Application: “Every youth should be taught the necessity and the power of application. Upon this, far more than upon genius or talent, does success depend. Without application, the most brilliant talents avail little, while with rightly directed effort persons of very ordinary natural abilities have accomplished wonders.” (Ed. p. 232).

“The constant contact with the mystery of life and the loveliness of nature, as well as the tenderness called forth in ministering to these beautiful objects of God’s creation, tends to quicken the mind and refine and elevate the character; and the lessons taught prepare the worker to deal more successfully with other minds.” (Ed. p. 112).

### Teaching Not To Depend On Memorization

Knowledge should be gained through experience and not mere memory where student absorbs what adults, parents and teachers present to them, and then the students regurgitate these facts on tests. She says:

For ages education has had to do chiefly with the memory . . . (which) has been taxed to the utmost . . . The mind thus burdened with that which it cannot digest and assimilate is weakened; it becomes incapable of vigorous, self-reliant effort and is content to depend on the judgment and perception of others.

Such a student taught this way, “sacrifice the power to reason and judge for himself, he becomes incapable of discriminating between truth and error, and falls an easy prey to deception. He is easily led to follow tradition and custom.” (Ed. p. 230).

### Students’ Needs to be Individually Met

“In all true teaching, the personal element is essential. Christ in His teaching dealt with men individually. It was by personal contact and association that He trained the Twelve.” (p. 231). “Even the crowd that so often thronged His steps was not to Christ an indiscriminate force and enthusiasm which a knowledge of their reality and importance inspire.” (Ed. p. 233)

### Teachers Should Set Goals, Have Plans to Reach Them

“Every teacher should see that his work tends to definite results. When attempting to teach, he should have a distinct plan in mind and should know just what he desires to accomplish.” (Ed. p. 233-234).

### Teacher Should Teach for Transfer to Take Place

Bruner (1960) says that for transfer of learning to take place, students should learn the principle of what they are learning. Ellen White also agrees. (“The teacher) should not rest satisfied with the presentation of every subject until the student understands the principle involved, perceives its truth, and is able to state clearly what he has learned.” (Ed. p. 234)

### Use Readiness Gauge/Cognitive Development

The youth should be encouraged to advance just as far as their capabilities will permit.

### Parents Resource for Children

“The precious time devoted by many parents to dressing their children for display - - -. would better, far better be spent in cultivating their own minds, in order that they may be competent to properly instruct their children.” (3 T, p. 144-145).

### Time for Change in Educational Method

White (1923) said that the traditional plan of education as it existed in her day caused students to have too many hours of study, without anything to do. The leisure hours with nothing to do give children time to be recklessly involved. These evils could be avoided to a great degree if study and labor could be combined. Some students work

the brain till it is overworked but they allow the physical powers to remain inactive, the muscles become weak because of overwork. Every youth should be educated to labor, that they may be prepared for emergencies and be qualified for practical life. Problem-based learning allows students to practice. As they learn they act the part of a stakeholder in the solution of the problem.

“Moral, intellectual, and physical culture should be combined in order to have well-developed, well-balanced men and women.” (FCE pg. 42)

“Time is too short now to accomplish that which might have been done in the past generations; but we can do much, even in these last days, to correct the existing evils in the education of youth. We are quite aware that time is short, so we should be in earnest and work zealously to give the youth that education which is consistent with our faith. We are reformers.” (FCE p. 44).

Students must be trained to exercise their own judgment and cannot do so by being controlled by parents or teachers. No teacher or parent should seek to “have the individuality of his scholars merged in his own, so that (the child’s) reason, judgment, and conscience shall be subject to this control”. It is “an unwarranted and fearful responsibility.” (FCE p. 58). Students should be taught to feel that they have the power within themselves to become men and women of honor and usefulness.

“Both parents and teachers, are in danger of commanding and dictating too much. . . .” (FCE p. 58).

#### Students to Be Educated for Service

Our capacities and powers are to be enlarged and improved. We must “cultivate our powers and attain the highest possible capacity for usefulness, that we may do noble

work for God, and bless humanity” (FCE p. 82). Christ illustrated this principle in the parable of the talents. Matthew 25:14-30.

God is saying through His servant that the educational system must give students opportunity, to develop morally and intellectually as they prepare for service. There must be a chance to develop a rounded personality. We now stress too much mind work but should give students opportunity to practice at what they may become; incorporate practice in their education.

#### Choose Methods that Create Desire to Learn

Through the use of figures of speech the plainest and most telling rebuke was often given to His accusers and enemies,. . . . In parables and comparisons He found the best method of communicating divine truth. . . .He called forth their interest, aroused inquiry and when He had fully secured their attention He decidedly impressed upon them the testimony of truth. (FCE p. 236).

#### Students to be Stakeholders

“Students should feel their responsibility in the matter of making their school life a success.” (FCE p. 297).

“Allow no one to be brains for you, allow no one to do your thinking, your investigating and your praying.” (FCE p. 307).

“It is proper and right to read the Bible; but your duty does not end there, for you are to search its pages for yourselves. The knowledge of God is not to be gained without mental effort.” (FCE p. 307)

"Their minds should be trained to think, their memories taxed to remember their appointed work; and in the training to habits of usefulness in the home, they are being educated in doing practical duties appropriate to their age." (FCE p. 369)

"In the past, education ... has consisted in laboriously loading the minds of the students with material which cannot be of the least value to them, and which will not be recognized in the higher school. The teachers of the Jewish nation professed to educate the youth to understand the purity and excellence of the laws of that kingdom which is to stand forever and ever, but they perverted truth and purity." (FCE p. 397)

"That Christ, during His childhood, should grow in wisdom and in favor with God and man, was not a matter of astonishment; for it was according to the laws of His divine appointment that His talents should develop, and His faculties strengthen by exercise. He sought neither the school of prophets, nor the learning received from the rabbinical teachers; He needed not the education gained in these schools, for God was His instructor. When in the presence of the teachers and rulers, His questions were instructive lessons and He astonished the great men with His wisdom and deep penetration. (FCE p. 400)

As a student, Christ meditated upon His work. . . .He applied Himself diligently to a study of the Scriptures. He did not waste time in bed and spent early morning hours in a retired place, meditating upon, and searching the Scriptures and in prayer.

#### Change from Traditional Education

"Everything not comprehended in truth is the guesswork of man. Professedly high and learned men may be fools in the sight of God, and so, the high and learned statements of their doctrines, however they may please and humor the senses, and though they may have

been handed down from age to age, and rocked in the cradle of popular faith, are a delusion and a falsehood if not found in the inspired lessons of Christ. (FCE p. 406)

“A mass of tradition, with merely a semblance of truth is being brought into education, which will never fit the learner to live in this life so that he may obtain the higher immortal life.” (FCE p. 407)

“This scheme of restoring the moral image of God in debased humanity, entered into every purpose of the life and character of Christ.” (FCE p. 408)

The Lord believed that when a lesson is taught it is better learned through practical application when everyone becomes involved. The teacher and the learner, so He would bring their imagination and thought into the lesson using question, illustration, story, evoking thought; and then there would be application, or the learner would come up with the response to his/her question.

“In the educational system there was no place for that personal experience in which the soul learns for itself the power of a “thus saith the Lord,” and gains that reliance upon the divine word which alone can bring peace, and power with God.” (FCE pp. 438-439). Under their training the powers of the youth were repressed and their minds were cramped and narrowed. He spent time with word of God for His character development (personal involvement) and to gather the spiritual teaching from the surroundings of His daily life. To Jesus the significance of the word and the works of God unfolded gradually, as He was seeking to understand the reason of things, as any youth may seek to understand.” (FCE p. 442)

“The students are to be taught in such a way that they will develop into useful men and women.... They are to be taught to put their powers to the best use... Physical

and mental powers are to be equally taxed. Habits of order and discipline are to be cultivated". (R and H May 26, 1904, pp. 10 and 11)

We are to prepare workers for service. Every Christian is to have the image of God restored in him, is to be educated for service and to make known to others "the unsearchable riches of Christ." To accomplish these tasks Christ says we must be trained. He also trained His disciples and he left us examples. He says we are to diligently search the Scriptures; become participants in learning. (COL p. 300-301).

#### Making Choices: The Student Needs to Seek for Himself

"The parables by which, during His ministry, He loved to teach His lessons of truth, show how open His spirit was to the influences of nature, and how in His youth, He had delighted mass of human beings. He spoke directly to every mind and appealed to every heart." (Ed. p. 231)

#### Embedded Assessment

"He watched the faces of His hearers, marked the lighting up of the countenance, the quick, responsive glance which told that truth had reached the soul; and there vibrated in His heart the answering chord of sympathetic joy." (Ed. p. 231).

#### Address Learning Styles and Multiple Intelligences

All students from all socioeconomic levels are capable of learning and should be given the opportunity (Wiggins and McTighe, 1998).

"Christ discerned the possibilities in every human being. He was not turned aside by an unpromising exterior or by unfavorable surroundings . . . . Many apparently unpromising youth are richly endowed with talents that are put to no use . . . . The true educator, keeping in view what the pupils may become will recognize the value of the

material upon which he is working. He will take a personal interest in each pupil and will seek to develop all his powers". (Ed. p. 232)

"The youth should be taught to aim at the development of all their faculties, the weaker as well as the stronger . . . . The natural aptitudes indicate the direction of the lifework . . . (but) a well balanced character and efficient work in any line depend, to a great degree, on that symmetrical development which is the result of thorough, all-round training (Ed. p. 233 and 233).

#### Diversity Method

"The teacher should constantly aim at simplicity and effectiveness. He should teach largely by illustration . . . (and) make every explanation plain and clear." (Ed. p. 233).

Peter understood Christ's lesson when Christ placed a little child in the midst of the disciples and bade them become like Him. (Ed. p. 90).

#### The Teacher to Be Enthusiastic

The teacher in his work is dealing with things real, and he should speak of them with all the force and enthusiasm that a knowledge of their reality and importance can inspire (Ed. p. 233).



## REFERENCE LIST

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## VITA

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I received my elementary and high-school education in Jamaica, West Indies. In 1969 I earned a Bachelor of Sciences Degree in Chemistry and Industrial Chemistry from the University of the West Indies, Mona Campus, Jamaica. I accomplished my internship in Industrial Chemistry by working in edible oils at Seprod, Ltd., in Kingston, Jamaica. After graduation, I taught in Jamaica for 2 years.

From 1971 until 1974, I worked as a Research Technician at the Columbia University College of Physicians and Surgeons in New York. From October 1974 until July 1980, I taught at Hanson Place Seventh-day Adventist School.

I obtained a New York State permanent certificate for teaching chemistry and general science in Grades 7-12, and a professional certificate for the Seventh-day Adventist education system. In 1980, I earned a Master of Arts degree for Science Education in the Teacher Education Program from Brooklyn College, New York.

I taught at the Shiloh Seventh-day Adventist School in Florida from 1983 to 1999. By 1990, I completed course work and part of a thesis for an Education Specialist degree in Adult Education. In the summer of 1995, I started as a Ph.D. student in Curriculum & Instruction at Andrews University in Berrien Springs, Michigan. Since the fall of 1999, I have been employed as the coordinator of Adult General Education for the Marion County Public Schools System in Ocala, Florida.