A REVIEW OF PROBLEM-BASED LEARNING

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Research on methods of organizing and presenting curriculum reveals a need for change if society's workforce is to be appropriately educated. Historical and theoretical precedence points to the instructional method of problem-based learning (PBL) as an effective alternative. An examination of recent implementation of PBL suggests advantages and disadvantages to this method of instruction and barriers to implementation, which include changes in the teacher's role and adjustments required for assessment.

Parents, politicians, business leaders, and educators are in agreement that change is needed in the American public school system, but what and how to change is not easily resolved (Albion & Gibson, 2000; Elam, Rose, & Gallup, 1994; Sage, 2000; Smith, 1995). Some advocate going "back to basics"; however, what employers are now considering as "basic" has changed. Employers cite the need for workers with excellent communication skills, the ability to work collaboratively to solve problems, an understanding of statistics, and the ability to creatively solve ill-defined problems (Meier, Hovde, & Meier, 1996). Workers should also be able to absorb new ideas, adapt to change, cope with ambiguity, perceive patterns, work cooperatively, and use reasoning skills to solve conventional problems. Few of these skills are evidenced in a classroom which contains rows of students memorizing facts for regurgitation.

The concept of teaching segmented disciplines versus integrated or interdisciplinary curricula is in the center of the debate on what and how to improve instruction. Segmented disciplines divide knowledge into useful, organized hierarchies of facts and theories that direct research and bring order to our understanding (Tchudi & Lafer, 1996). The disciplines are the long established status quo; however, one of their major weaknesses is that they sometimes limit vision such that a scholar becomes an expert in his or her unique corner of the universe, but is unable to speak to others. There is concern that schools are not educating scientists who can recognize how their knowledge and expertise relates to the big picture. Few problems facing our society are aligned within disciplines. Solving environmental pollution, resource depletion, and world hunger requires economical, mathematical, physical, biological, chemical, medical, political, and sociological expertise. According to Meier et al. (1996), students taught within the lecture-based disciplinary system typically have not been able to solve problems that require them to make connections and use relationships between concepts and content.

In contrast, interdisciplinary teaching starts with a topic, theme, problem, or project that requires active student participation and knowledge of multiple disciplines in order to reach a resolution (Dabbagh, Jonassen, & Yueh, 2000; Gordon, Rogers, & Comfort, 2001; Meier et al., 1996; Sage, 2000; Tchudi & Lafer, 1996). Interdisciplinary teaching uses relevant applications that motivate students to search for needed facts. This instructional method encourages students to look for new solutions to relevant problems using available knowledge and resources. The process expands students' critical thinking and problem-solving skills while enhancing their creative capabilities. Interdisciplinary teaching is appropriate for both vocational subjects, including family and consumer sciences, and traditional academic subjects.

Historical and Theoretical Precedence

Interdisciplinary learning is not an untried, new educational technique. It has roots in Socratic inquiry and centuries-old apprenticeship training. Socrates did not lecture as much as he moderated and directed questioning. It can be observed in The Republic by Plato (360 B.C.E./1960) that Socrates guided his students through inquiry to answer their own questions, search out answers to problems, and relate their knowledge to life applications.

Apprenticeships were effective because an expert guided the apprentice through hands-on problem solving in which knowledge and skills were taught and practiced as needed. Boud & Feletti (1991) cite Joseph Payne's description of the teacher's role, from his Lectures on Science and Art of Education published in 1883, as a guide, director, or superintendent of the process through which the pupil teaches himself.

Historically knowledge was acquired by word of mouth from one generation to the next. Eventually the printing press and books made knowledge more accessible. As a result of technological advances in the 20th century, knowledge acquisition and transmission have seen a logarithmic increase. The information available is so plentiful and changing so rapidly that most individuals will encounter only a small portion of it. If students are going to be capable of making informed decisions that result in reasonable actions, they will need more than facts. Students need to recognize what information is needed, have the knowledge and skill necessary to acquire this information, and the ability to use that knowledge appropriately to solve the problems they face (Dabbagh et al., 2000; Tchudi & Lafer, 1996). Disciplinary studies, by themselves, are inadequate to meet these needs. Since it is not possible to learn all the facts from even one discipline, it is critical to learn the processes of acquiring knowledge within the discipline. Once the process is mastered, the facts are accessible when relevant to life's problems and situations.

An examination of students' perceptions of positive and negative learning experiences provides some insight regarding instructional methods that have the potential to develop these process skills. Carlisle (1985) described a pre-training survey that generated a list of what trainees perceived as making past learning experiences either positive or negative overall. Negative learning experiences were characterized by the instructor's lecturing with a monotone delivery, testing on material not covered, teaching incorrect information, failing to provide assistance to trainees, failing to connect concepts to familiar things, and excluding trainees from setting learning goals. The following were related to positive learning experiences: (a) a positive atmosphere, (b) group involvement, (c) goals set by trainees, (d) concepts relevant to familiar ideas, (e) application of what was learned, (f) a motivation to learn, (g) and mutual respect between the instructor and trainees. In this survey, most of the characteristics of positive learning experiences parallel interdisciplinary instruction. Equally evident are the parallels between negative experiences and lecture-oriented instruction.

Interdisciplinary Education through Problem-Based Instruction

Studies of interdisciplinary education repeatedly emphasize the use of themes, projects, or problems (Dabbagh et al., 2000; Gordon et al., 2001; Meier et al., 1996; Sage, 2000; Tchudi & Lafer, 1996). A central stimulus that triggers the need to know and the direction of the learning is key. Some contend that students have experienced hands-on inquiry through math word problems and science experiments. Csikszentimihalyi and Getzel (1971) challenged this notion when they described two categories of problems: presented and discovered. Most of traditional problem solving has involved presented problems. These are problems in which the method and the solution are already known, and the problem solver needs only to adopt the "correct" procedural steps to arrive at the expected solution. However, the development of a problem and how to resolve it are often more critical than its solution, which is frequently a matter of mathematical or experimental skill. To ask new questions, to see new possibilities, and to look at old problems from a new perspective require creativity. Unlike the presented problem, a discovered problem is a situation in which the problem itself has not been formulated but must be identified, and a method for reaching a solution and even the nature of a satisfactory solution are yet unknown.

Problem-based instruction was initially designed for graduate medical school programs when instructors noted that young physicians were graduating with a wealth of information but without the necessary problem solving skills to use that information wisely (Gallagher, Stepien, Sher, & Workman, 1995). In 1969, a medical school was founded in Ontario with a unique educational philosophy, the "McMaster philosophy," which has evolved into the educational strategy known as problem-based learning (PBL) (Bayard, 1994). Gallagher et al. noted three features that set the parameters of the PBL educational strategy: initiating learning with a problem, making exclusive use of ill-structured problems, and using the instructor as a metacognitive coach.

The central concept to PBL is that students will learn content as effectively as through lecture by attempting to solve realistic problems. Problem-based learning has two distinct goals: to learn a required set of competencies or objectives and to develop problem-solving skills that are necessary for lifelong learning (Engel, 1991). Because problems are central to this instruction format, their development is a crucial component of a PBL program. Tchudi and Lafer (1996) describe good problems as having the following characteristics. They (a) confuse just enough to provoke curiosity and provide a reason for learning, (b) provoke thought on new things in new ways, (c) help students discover what they do and do not know, (d) ensure that students reach beyond what they know, (e) create a need and desire for skill and knowledge, (f) lead to understanding the relationship of a procedure to the problem which makes the procedure sensible, (g) naturally lead to interdisciplinary inquiry, (h) build strong communities of learners; and (i) lead to cooperation in the strongest sense that is based on the will and desire to succeed rather than a set of dictated behaviors that are advocated for the sake of politeness. Tchudi & Lafer also note that a quality problem should have a visible product or presentation that is viewed by an outside audience. Most of the production of this product or presentation should be completed during class time and be a class-wide effort or a class collection of smaller projects. This further encourages the development of collaboration and teamwork skills.

An effective means of defining PBL is to outline the steps students take in their learning. Stepien, Gallagher, and Workman (1993) provide the following summary:

> Problem-based learning is apprenticeship for real-life problem solving.…students find a situation with undefined problems, incomplete information, and unasked questions. The scenarios presented to the students demand problem solving the way we find it in life: defining and detailing issues, creating hypotheses, searching for and then scanning data, refining hypotheses with the help of the collected data, conducting empirical experiments or other research, developing solutions that fit the conditions of the problem and evaluating and/or justifying their solutions so there is reason to expect conditions will improve (p. 342).

In theory, PBL appears to answer many concerns regarding educational methods. Recent studies in PBL applications justify further research in this field.

Recent Applications

The most extensive application of PBL in the public education arena has been in science instruction. Gallagher et al. (1995) point out that PBL can and should include experimentation as a tool for solving problems. They used a framework that emphasized that students plan their own experimentation by asking a series of questions. The questions suggested by Gallagher et al. are what do I know, what do I need to know, what do I need to learn, and how do I measure or describe the results. During the design phase of the first problem-based experiment, students develop a protocol that lists every step in the experiment. This protocol, which looks a lot like the standard lab plan, becomes a metacognitive guide for students to use in developing future experiments. This successful application of experimentation adds support to the premise that PBL can promote traditional content knowledge such as using a lab plan through nontraditional methods.

Another study with eighth graders shows the validity of using unsolved, relevant problems with adolescents. At a one-week Illinois Mathematics and Science Academy summer program, students are taken to a nuclear waste burial site to solve the problem of how to safely dispose of thorium waste. In the process of problem solving, students explore a variety of disciplines and expand their knowledge bases through increasingly self-directed study and collaboration with their classmates (Stepien & Gallagher, 1993). This study with gifted eighth graders indicates that PBL, which has been predominantly reserved for adult learners, is applicable to the high school student.

Katz (1996) at St. Louis College of Pharmacy began a longitudinal study to search for reasons behind the high failure rate in organic chemistry and to develop an alternative method of instruction that promoted success. Research of teaching methodologies led Katz to student-directed learning (SDL). Student-directed learning has course content set up around "big ideas" or themes. Lectures are changed to a continuous dialog between teachers and students using a "reverse Socratic" method or student-initiated questioning. Although this research is not true PBL, it contains many of the characteristics and principles of PBL. Four years of cyclical evaluation and revision brought impressive changes in student success as measured by the ACS exam (standardized exit test used by the chemistry department) scores and the ratio of students repeating the course (Katz).

Researchers in a longitudinal study of PBL at Illinois Mathematics and Science Academy have telephoned high school graduates since 1990 to gain information on which classes they perceived as being the most helpful in problem solving, critical thinking, and ethical decision making. The graduates clearly and overwhelmingly favored the American Studies and Science and Society and the Future. These courses were taught using PBL (Stepien et al., 1993). Science and Society and the Future, a one semester elective, senior course, confronts students with social and ethical questions that evolve from making public policy decisions related to controversial scientific issues.

Dods (1997) investigated the effectiveness of PBL in promoting knowledge acquisition and retention. A total of 30 students from a biochemistry course at the Illinois Mathematics and Science Academy participated. Course content was delivered via PBL, traditional lecture, and a combination of PBL and traditional lecture. Data were gathered using a pre- and post-course self-evaluation of student understanding and a measure of depth of understanding. It was found that content coverage was promoted by lecture, but that PBL was more effective than both traditional lecture and a combination of PBL and traditional lecture in promoting comprehensive understanding of important biochemical content.

Published research in PBL in family and consumer sciences has so far been limited to one study in dietetics (Bayard, 1994) and one in food production (Lieux & Duch, 1995). Bayard conducted a short study using two sets of problems each for the study of infant care and elderly care with undergraduate dietetic students (UDS). These units were interspersed with the majority of the semester course work using traditional lecture settings. A second part of the study dealt with case problems for dietetic interns (DI). The DI showed greater gains and more willingness to repeat the experience than the UDS. These results may be partially attributed to the research design that did not provide the UDS with time to adjust to PBL and the resentment to the non-volunteer situation. This research did affirm the effectiveness of PBL for the adult learner.

Lieux and Duch (1995) set up a control (lecture-based instruction) and treatment (PBL) class of quantity food production and service. Each class maintained the same presentation method for an entire semester. Although at the time of the report statistical analysis had not been completed, there appeared to be no significant differences in content acquisition between the lecture-based instruction and the PBL classes. An outcome that supports PBL for the college climate was attendance. The control class had an average attendance of 17.5 sessions out of 26 and never exceeded 80% attendance as a whole. The PBL class attendance rate was never lower than 80%.

Advantages and Disadvantages of Problem-Based Instruction

The use of PBL in various settings has revealed both advantages and disadvantages. Gallagher et al. (1995) view PBL as mimicking real-life situations and being inherently interdisciplinary, which allows the student to perceive how different disciplines interact when problem solving. Through the careful process of coaching and modeling, teachers empower students to become self-directed and independent learners, capable of approaching the kinds of complex problems they will face as professionals.

Problem-based learning students may not perform as well on multiple-choice tests as students taught by lecture-based instruction; however, follow-up studies completed by Norman and Schmidt (1992) reveal better long-term knowledge retention for PBL students. The apparent improvement in retention may be connected to the way learning occurs in PBL. Problem-based learning has the potential to structure knowledge so that acquisition and recall are optimized, students develop self-directed learning skills, and there is an increase in the motivation for learning (Bayard, 1994).

Boud and Feletti (1991) warn that a major problem with evaluating PBL programs is that valid acceptable measures of the outcomes of PBL curricula are hard to find or difficult to interpret. Problem-based learning is also difficult to quickly assess and analyze through testing. Multiple-choice questions, the preferred mode for standardized testing, are not readily adapted to measuring the process skills needed for critical thinking. Structured short-answer questions have the ability to measure problem-solving abilities as well as knowledge recall, but are more time consuming to develop and score (Bayard, 1994).

Time spent in study outside of class is a factor of concern to both instructors and students alike. Whether PBL is an advantage or disadvantage depends on the perspective of the individual. When time spent out of class was analyzed in the college setting, students in PBL spent more time out of class studying and made more use of non-traditional textbook sources for their information (Bayard, 1994). Research into study time for the high school and elementary student has not been examined.

Barriers to Problem-Based Learning

To effectively implement PBL, teachers must adopt new roles that are frequently very different from those of their past. In lecture-based instruction, the teacher is in control and is the "expert" dispensing knowledge. In PBL, the teacher selects the problem, presents it to the students, and then provides direction for student research and inquiry. The teacher functions as a facilitator, and the student controls the problem-solving process. For many teachers, such a change is untenable. One teacher assisting in research reported by Boud and Feletti (1991) wrote on the exit evaluation, "I can't handle this. I want to be in total control and PBL doesn't allow that" (p. 132). These teachers flounder without the control and "power" typical in lecture-based classes.

Another factor inhibiting change was noted by Albion and Gibson (2000) and Novak (1990) in teacher education programs. Most of these programs still rely heavily on rote learning and traditional lecture formats. It is difficult to expect teachers to adopt learning methodologies that they have not experienced personally or through their teacher education programs. With many administrators, curriculum developers, and teachers lacking experience in interdisciplinary education, barriers to broad scale change can become insurmountable.

Another barrier to PBL is the lack of prepared materials for classroom instruction. Few training materials are available. Present curriculum guides and textbooks do not contain the variety of sample problems or assessment tools needed to support this methodology on a broad scale. The philosophies supporting PBL are well established, but the "how tos" are in short supply (Burruss, 1999; Gallagher et al., 1995). Few teachers have the time or the motivation to prepare all new materials for classes.

Not only are ill-structured problems unavailable for much of the public school curricula, but most accountability assessment that is presently in use is product driven and knowledge based. Teachers' and students' performances are examined in light of standardized testing that does not address critical thinking process skills. Meier et al. (1996) report that with many time constraints and administrative pressures to improve test scores, many teachers will not believe they can justify the time necessary for PBL.

The Teacher's New Role

The literature on PBL indicates the importance of the teacher in the success of any PBL program. Problem-based learning requires changes in the way teachers plan instruction, direct learning, transmit knowledge, oversee instruction, and assess learning (Gordon et al., 2001; Maxwell, Bellisimo, & Mergendoller, 2001; Torp & Sage, 1998). Teachers facilitate the development of projects and act as expert consultants. They work to ensure that projects will indeed create a need for disciplinary knowledge and skill. The disciplines are taught as a response to a need created by ill-structured problems. Research indicates that students take advantage of the teachings when those teachings will help solve the problems generated by the project at hand (Boud & Feletti, 1991; Gallagher et al., 1995; Stepien et al., 1993).

A major change that must occur is the teacher's perspective. Teachers' traditional views of problem solving are influenced by their area of content specialization. Because PBL is often interdisciplinary in nature, teachers need to recognize the connections between disciplines and collaborate with other teachers in developing learning experiences that provide relevant applications of content and skills (Maxwell et al., 2001; Meier et al., 1996). Such collaboration is difficult to accomplish in today's high school environments. Boud and Feletti (1991) found that another difficulty in schools was lack of support from lecture-based colleagues. Comments such as "my subject requires an expert to pass on knowledge" and " it may be okay for you, but it wouldn't work for me" may have validity depending on the subject and the constraints under which the faculty have to operate. Problem-based learning will require a paradigm shift in the way teachers think about learning and functioning within their educational systems.

Teachers must not only change the way they think about instruction, but also how they approach instruction. What makes problems good are what the teachers do with them or what they encourage students to do with them (Tchudi & Lafer, 1996). Teachers need to act as models, thinking aloud with the students and practicing behavior they want to instill in their students. They use metacognitive questions like, “What 's going on here?”; “What do we need to know more about?”; and “What did we do during the problem that was effective?” They must coax and prompt students to take on responsibility, to encourage independence and then fade into the background and become another colleague on the problem-solving team (Stepien & Gallagher, 1993). Other tasks identified are (a) keeping the learning process moving, (b) making sure that no phase of the learning process is neglected or misdirected, (c) probing the student's knowledge consistently and intently so that gaps in knowledge and reasoning are glaringly evident, (d) keeping all students involved in the learning process, and (e) guiding the group so that excessive stress is diffused while maintaining the challenge to learn without introducing boredom (Bayard, 1994).

Successful implementation is not easy. Teachers will need self-knowledge, commitment, determination, teamwork skills, and considerable understanding of the learning process to make PBL successful. The lack of training programs, curriculum materials, and rigid scheduling in the high school environment will increase demands on any teacher trying to implement PBL in his/her classroom.

Assessing Learning with Problem-based Learning

Not only is the appearance of PBL different, but assessment must also change. Traditional letter grades and right or wrong answers do not fit, especially when students are presented with problems today's "experts" have not been able to satisfactorily resolve. Most assessment materials that are available are knowledge based. The ill-defined problems of PBL do not have answers that can be written in an answer key. It is difficult to develop multiple-choice questions that will measure creativity, critical thinking, and teamwork skills.

If PBL can meet the demands of the information age, educators will need to replace product-oriented assessment techniques with valid assessments for process-oriented education (Tchudi & Lafer, 1996). Boud and Feletti (1991), in their meta-analysis, point to the difficulties with testing knowledge as isolated facts out of context. Tchudi and Lafer describe traditional assessment as a game that engages the student in guessing what the teacher wants rather than demonstrating the best they can do. If PBL changes the game and learning is to be seen as relevant to life, new methods are needed for the teacher to be able to assess student progress. The emphasis should be on being able to locate the necessary information to solve the problem rather than memorizing facts (Gordon et al., 2001; Maxwell et al., 2001).

One potential assessment has been developed by the Illinois State University's Center for Mathematics, Science, and Technology in its creation of an integrated math, science, and technology curriculum for the seventh grade (Meier et al., 1996). The goal was to develop a single problem-solving model that could be used across the curriculum. Discipline models were studied for their commonalities, and a new model, DAPIC, was developed. The letters stand for define, assess, plan, implement and communicate. DAPIC accentuates the fact that problem solving is not always a linear or circular process; instead one may need to back up or start over when plans run into unforeseen problems. The use of an interdisciplinary problem-solving model provides a framework for student thinking and can assist students in making connections between disciplines. This metacognitive tool meets some of the assessment needs of PBL.

Another appropriate PBL assessment strategy is students' documentation of their intellectual journeys (Gallagher et al., 1995; Stepien et al., 1993; Tchudi & Lafer, 1996). Students can prepare a portfolio assessment that includes notes, in-process commentaries, articles they have read, and discussions or monologues of the evolution of their ideas preparatory to formulating and reporting their conclusions. Teachers can facilitate students' creative problem solving by helping students organize their thoughts under four headings: (a) what do we know?, (b) what do we need to know?, (c) what do you think may be an answer [hypothesis]?, and (d) how do we find out? (Stepien & Gallagher, 1993; Gallagher et al., 1995). Revisiting these questions can help students maintain direction, identify progress, and visualize new avenues of pursuit.

Gallagher et al. (1995) found that a lab notebook, just like scientists use, provided a means to record observations, store data, record proposed hypothesis, and list flashes of genius, i.e., ideas that need to be recalled for later consideration. This lab notebook idea is easily expanded into a problem log whose format can be utilized in problems that are less science based. The problem log is a journal that records ideas, plans, strategies, and progress. It provides a written record of a student's train of thought. Specific log assignments can be given to help teachers track the thinking process and document student participation.

Another potential assessment tool was developed during a longitudinal study of the changes in conceptual understanding of science over a 12-year period at Cornell University. Concept mapping (CM) is a metacognitive tool that was developed for this study to show changes in learning (Novak, 1990). A study completed in Nigeria found that CM as compared to traditional lecture in science classes increased achievement scores and lowered student anxiety toward science (Jegede, Alaiyemola, & Okebukola, 1990). Concept mapping also aided teachers in identifying errors in student learning (Novak). The relevance of this tool is in the need for learning to be "connected" to known concepts.

Another application for CM that is worthy of note is its use in curriculum development. Novak (1990) reports work with fourth- through eighth-grade teachers using CM as a heuristic for curriculum development. As teachers prepared concept maps of curriculum, they were able to improve the hierarchical arrangement of content with increased detail and greater integration of concepts. Concept mapping can not only provide a useful means of assessing knowledge acquisition of the students, but it can also aid teachers in developing meaningful ill-structured problems for PBL.

Both authentic assessment and rubrics were used to assess PBL in a high school family and consumer sciences nutrition class (Ward, 1998). At the beginning of each unit of study, students were presented with "problems." For example, at the beginning of the unit related to fruits, students received the following problem.

Working in groups of three or four, identify fruit-based recipes that are nutritious, easy to prepare, and appealing to teens.

The problem was first discussed by the teacher and students. Resources, timelines, and grading expectations were presented, along with rubrics that informed students of assessment guidelines. For this problem, students were to select one type of fruit and then research its nutritional value, storage requirements, and relevant preparation techniques. They were then to determine three recipes using that particular fruit, prepare the recipes, and conduct taste tests among class members. Research and taste test results were to be compiled into a computer-generated class presentation. Students were also expected to maintain a journal of their progress. Authentic assessment was utilized as students' products were evaluated using appropriate rubrics.

Implications for Family and Consumer Sciences Educators and Researchers

This review of research has revealed numerous examples of analyses of metacognitive assessment tools, PBL for the adult learner, and limited trials of PBL in public education. There is evidence of the validity of PBL in isolated populations. What is lacking is extensive documentation of the effectiveness of PBL in varied age and situational environs, including family and consumer sciences. Continued research and development of ill-structured problems, as well as adequate, valid assessment tools, are needed before PBL can be more readily implemented.

Many of the studies conducted have been for limited periods of time. Those studies that have reaped the most significant results have been long-term or longitudinal studies (Jegede et al., 1990; Katz, 1996; Meier et al., 1996; Novak, 1990). They have involved cyclical analysis and revision of methodologies and assessments. Katz (1996) and Jegede et al. (1990) also refer to the necessity of acclimating students to the new methodologies before significant involvement and improvement is possible. Future PBL research related to family and consumer sciences should consider these insights.

A pure PBL teaching environment is difficult to produce, not only in the family and consumer sciences classroom, but in any classroom. Likewise, some topics and concepts do not lend themselves to this format. However, family and consumer sciences teachers might consider PBL as another effective option for the presentation of subject content. Adding an occasional "problem" to the traditional class will add variety to the classroom learning experiences while maintaining educational integrity. At the same time, the gradual introduction of problems will allow the teacher time to develop new materials and learn new skills without becoming overwhelmed.

Studies found that adolescents enjoyed and valued PBL (Albion & Gibson, 2000; Gordon et al., 2001; Stepien & Gallagher, 1993). Students felt the problem-based approach with its active learning and teamwork made learning relevant and enjoyable. In addition, teachers reported that students' behavior improved when PBL was utilized. With the numerous active learning opportunities in family and consumer sciences, as well as the typically diverse classroom, these findings imply that PBL would offer many benefits to the family and consumer sciences teacher.

As this review of literature indicates, the role of the teacher changes dramatically when using the PBL method of instruction. To be successful, family and consumer sciences teachers will need increased skills in Socratic inquiry, conflict resolution, and classroom management.

They will need to rethink their classroom arrangements, resources, and modes of assessment. They may need to convince reluctant colleagues and administrators to support PBL, to give it a try. But their efforts should be worthwhile as the use of PBL provides students with greater exposure to cooperative learning, teamwork, and critical thinking skills. Family and consumer sciences teachers who use PBL will provide opportunities for students to gain skills deemed critical for the workforce of the future.

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