Student Centered Strategies for Engaging Instruction in the Extended Period

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ABSTRACT

Keeping students engaged in the learning process is a challenge faced by most teachers. Instituting a bell schedule that requires them to make changes in their traditional instructional delivery may increase that challenge exponentially. The benefit of an extended period, also known as the block schedule, is that it permits the opportunity for teachers to alter their instruction with learning experiences that require more than 55 minutes by using engaging student-centered instruction. One reality of teaching on a block schedule is that many teachers lack the knowledge of effective strategies and rely on instructional devices they employed on a shorter time period. The purpose behind this work is to create a manual that demonstrates engaging student centered strategies and becomes a resource for teachers who are searching for instructional models to utilize in the block schedule. It does this in part by featuring actual hands-on strategies from three instructional models that can be readily used by classroom teachers. With the generative information about the models and activities that is provided in the manual, teachers are encouraged to create their own activities. Finally, the work provides solicited teacher feedback on the utility of the manual.
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INTRODUCTION

The movement to a block schedule in our secondary schools has heightened the need to use classroom strategies that motivate, engage, and cause students to think and process information. This manual is created to address that need and is meant to be a useful, teacher-friendly resource. It is intended to serve as a manual for educators who may have the need or the interest to look at classroom instructional techniques that permit coverage of content with non-traditional approaches. The strategies detailed are meant to complement and not necessarily supplant the more common direct instructional methods employed by most classroom teachers.

The inclusion of actual strategies that illustrate the featured models of instruction is meant to be a distinguishing feature of this manual. This differs from other works where authors talk about the models in abstract terms. It has been the author’s experience that teachers like ready-made, hands-on practical experiences. The manual’s strategies are at the same time usable by the teacher and serve as models to design subsequent lessons.

Organization of Student Centered Strategies for Engaging Instruction in the Extended Period

Chapter 1, The Challenge of Teaching in the Extended Period, explains the rationale behind this work. The purposes, goals, and thoughts that serve as the impetus of this work are discussed. The block schedule, which produces the “extended period”, is the primary focus. The block schedule is an educational phenomenon that has been utilized by many. As background information about block scheduling is discussed, the
promise it holds for improved classroom instruction comes to the front. A paradox appears; classroom instruction is a major reason for moving to the block schedule and at the same time a major stumbling block toward its effective implementation. Teachers and students have voiced concern about traditional instructional methods not being effective in an extended period. This becomes the problem and the focus that drives this manual.

Chapter 2, Foundational Considerations for the Manual, discusses the theoretical educational principles that the manual subscribes to. The models of instruction in the manual featured follow constructivist educational precepts. A discussion of constructivism in education is included. A discussion of cooperative (collaborative) learning concepts is also included. It is strongly suggested that the featured models of instruction be used collaboratively. Good teaching is the final foundational principle highlighted in Chapter 2. A look at best practices and what takes place in an effective instructional classroom is discussed.

Chapter 3 represents an Introduction to the Manual and included to prepare readers for Chapter 4. It underscores the purpose of the manual and then describes in detail to the content of the manual. It explains how the manual is organized. The chapter also highlights the models of instruction and informs readers how they are demonstrated.

Chapter 4, Student Centered Instructional Strategies, serves as the core of the work, in other words the actual manual. The stated purpose of this work is to provide an instructional manual that can be used by teachers for diversifying their instructional delivery with engaging learning tasks. The chapter features information on three instructional models. The models are explained and demonstrated. This crucial information becomes the actual resource. These particular models were offered because
they are thought to be student centered and engaging.

Chapter 5, feedback on the Utility of the Manual: Teachers Perceptions, reports the results of teacher perceptions on the utility of the manual. Educators were asked to read and comment on the manual by survey. Opinions on the manual’s purpose, its usefulness as a resource, and the manual’s design and readability were among those queries probed in the survey.
CHAPTER 1

THE CHALLENGE of TEACHING in the EXTENDED PERIOD

Many school administrators and school leaders have felt the push to reform and restructure schools. “In restructuring high schools, educators could bring about fundamental changes in the expectations, content and learning experiences provided in the curriculum” (Cawelti, 1994, p.7). One means to restructure and improve the quality of instruction for students is the implementation and utilization of block schedules. Jenkins found in his research on the block schedule that teachers view the block schedule as an opportunity to vary instructional practice (Jenkins, 2000).

Some schools that have turned to the block schedule have failed to prepare adequately for the change in instruction that teaching in the extended period requires. School personnel have become disillusioned and have abandoned the block schedule because of lack of teacher preparation (Queen, 2000). Jenkins also notes that teachers feel that they need staff development for teaching on the block (Jenkins, 2000).

Overview of the Problem

For two decades school improvement and school reform have caused educators to examine and change what it is that they do. Critical commentaries on the condition of our schools have shaken the confidence of educators. The following excerpt from Goodlad’s (1984) book serves to illuminate the rhetoric that caused educators, parents, business leaders, and legislators to ask the question, “What is wrong with our schools?”

The data from our observations in more than 1,000 classrooms support the popular image of a teacher standing or sitting in front of a class imparting
knowledge to a group of students. Explaining and lecturing constituted the most frequently used teaching activities, according to teachers, students, and our observations. In addition, the frequency of these activities increased steadily from the primary to the secondary years. Our data showed not only an increase in these activities but also a decline in teachers interacting with groups of students within their classes from the primary to the secondary (p. 105-106).

Goodlad (1984) observed that at any given time a passerby could walk into a classroom at any of the three levels—primary, intermediate, or secondary—and witness any one of the following three categories of student activity occurring: written work, listening, or preparing for assignments. All three activities were almost exclusively set and monitored by teachers:

We saw a contrastingly low incidence of activities invoking active modes of learning. Except in the arts and vocational education, students were not very often called upon to build, draw, perform, role-play, or make things. In general, there were more different kinds of instructional activities in elementary than in secondary classrooms. Secondary teachers rarely individualized classroom procedures. On the whole, teachers at all levels apparently did not know how to vary their instructional procedures, did not want to, or had some kind of difficulty doing so (pp.105-106).

Observers of public school education reform cite Goodlad’s book and the critical report, *A Nation at Risk*, as catalysts that prompted the school reform and school improvement movements. Educators began to examine practices aimed at school
improvement. One practice that became a viable option for many educators was allocation of time, specifically bell schedules. Adjusting bell schedules suddenly became an option to fix an ailing classroom.

Why Time?

In 1993, Donahoe argued that restructuring of schools should include the formal rearranging of time and bell schedules to promote an active classroom environment that would improve student learning. Goodlad (1984) had warned educators that the traditional school structure does not allow time for individualized instruction, for extended laboratory work, or for remediation and enrichment. In 1994, the National Commission on Time and Learning warned that schools must be reinvented to focus on learning, not time. The Commission recommended the use of block scheduling as a means to give teachers the time to engage students in active instruction.

Many schools experimented and moved to alternative bell schedules as an answer to the school reform issue. The move to extended class periods, or block schedules, was based on sound educational reasons. Implementation of the block schedule permitted teachers to design, develop, and deliver student-centered instruction. The lessons in a block schedule classroom allowed students to become active learners and classes to become alive with critical thinking. The extended period seemed like an easy but viable answer to the question of restructuring schools for improvement.

The movement to block schedules has not come without problems and issues. The utilization of extended bell schedules calls for classroom teachers to rethink and retool the instructional delivery systems employed in their classrooms. In some instances, difficulty with the block schedule has resulted from the failure of teachers to alter
instructional methods. One reality has been that sole reliance on traditional teaching practices does not work as well for instructing students in the extended block period. Students have complained about direct instructional methods and say that lecturing makes the extended period boring and difficult to endure (Queen, 2000).

The rush to incorporate block scheduling as a solution has not always allowed schools and teachers to prepare adequately for necessary changes in instruction. “Essential to the success of a block schedule to fulfill its potential is staff development on issues such as curriculum alignment and pacing as well as on teaching strategies” (Jenkins, 2000, p. 54). Specifically, Jenkins found that staff development and training for instructional variations necessary and conducive to the extended period were lacking.

Statement of the Problem

Many schools have experimented with block scheduling and have returned to traditional bell schedules. There are three underlying problems that demonstrate the need to prepare for implementing block schedules. First, some teachers have encountered problems with altering their instruction methodology. Second, there has been a lack of preparedness on the part of the faculty and administration. Queen (2000) writes:

From my own observations and analyses, I believe that a number of principals and teachers have limited the effectiveness of block schedules…some principals lack specific skills in evaluating effective teaching practices…teachers tend to use lecture and teacher-directed discussion extensively and to limit the 90-minute class to approximately 60 minutes of actual instruction (p. 23).

Third, teachers in some instances have not received adequate training in using
non-traditional student-centered instructional techniques.

Purpose of the Study

The purpose of this study is to create a manual on student-centered strategies for engaging instruction in the extended period. We begin by briefly looking at the underlying instructional problems and challenges presented by the block schedule. The manual addresses some of the instructional issues. The focus of the manual is to address the need for a guide that enables teachers to vary their classroom instruction. Teachers need adequate resources that will help them design and deliver instruction on an alternative bell schedule. Most teachers do not possess a variety of instructional strategies in their repertoire that lend themselves to teaching on an extended period of 75 minutes or more. The manual presents sample lesson plans that can be incorporated into the four major content areas of math, science, social science, and language arts. Activities will come from the three models of problem-based learning, concept attainment, and cooperative problem solving. The activities can serve as templates for the teacher and the manual will contain the information that enables teachers to design their own activities based on the three models. Narratives that give input on how to design and build an activity are included. The sample activities presented are meant to cause teachers to think about where such activities can be used in their planning and teaching of the specific course that they teach. These are important components of the manual, for if it is truly to be a resource then teachers will be enabled to construct their own lessons.

The manual can provide ideas and help for changing instruction in the extended period. The manual provides three student-centered models that teachers can incorporate into their lessons. Use of these models could cause teachers to rethink how they want
learning and instruction to occur in their classrooms. The design and practicality of the manual permit teachers to build their own lessons using the included examples as templates. While this may not initially provide the face-to-face training a teacher may receive in a workshop, it will serve and continue to serve as a resource. A study of the usefulness of this manual as a viable product is included in Chapter 5. The three models presented in the manual are not the only strategies that can be used in an extended period classroom. Perhaps with success from the implementation of these three strategies, teachers will be motivated to seek out other models to incorporate.

To summarize, many view the block schedule as a means of school improvement. The purpose of the block is to give teachers the opportunity to engage and develop their students. On a daily basis, the block schedule gives teachers extended time to instruct their students. Exactly how teachers handle that time is one of the problems of the block schedule. Designing meaningful instruction is paramount for the teacher and the need for staff development and resources is crucial. A manual that demonstrates appropriate instructional strategies and provides the instruction necessary for teachers to design and build their own strategies is a useful resource. The strategies demonstrated in the manual can be utilized in an extended period; they provide challenging complex instructional tasks; and they cause students to operate at higher cognitive processes.

The Essence of Block Scheduling

*What It Is*

Block Scheduling is the lengthening of traditional classroom periods. Educators hope to bring about change and reform in teaching and learning. The rationale behind this reform movement is that, by increasing classroom instructional time from fifty minutes to
ninety minutes or more, instructors are provided with the time necessary to explore topics and content with more in-depth scrutiny. The increased time calls for diversifying and offering authentic activities. “Some teachers in certain subject areas found the block an easier opportunity for varying instructional strategies” (Jenkins, 2000, p.29). These activities designed by the teacher will result in deeper learning and understanding of concepts. A study by Queen, Algozzine, and Eaddy (1997) found an increase in the variety of teaching strategies on the block schedule and an improvement in some end-of-course testing.

Why Schools Moved to Block Scheduling

The traditional high school bell schedule has remained essentially the same for most of the 20th century. Classroom periods on that schedule were between 45 and 55 minutes in length on a normal school day. Bell schedules have been based on tradition rather than on proven educational merit. Leaders in education have criticized the ineffectiveness of some traditions in public education. In 1990, Fullan wrote that the traditional high school schedule has become a powerful myth, ceremonially adopted regardless of its efficiency or effectiveness. Despite awareness of problems, resistance to change caused most educators to remain committed to the traditional bell schedule. Eventually, however, many began to examine and explore alternatives. Convinced that a change in the bell schedule could bring about reform in the classroom, these educators recommended the restructuring of schools in the area of time as a means of improvement.

What Block Scheduling Look Like

In general, block scheduling is similar to the semester course system used at the collegiate and university levels. The school organizes a course around one semester of
90-minute classes instead of two semesters of 50-minute classes. There are variant forms of block scheduling. One variation consists of four 90-minute classes offered per semester. Since a school year has two semesters, it is possible to earn eight credits (hence the name 4 by 4, Semesterized, or Four-Four schedule.) A second variant is a two-day rotating system in which students attend four classes one day and attend another four classes on the succeeding day. As with the Four-Four schedule, students complete eight classes during the year. This model is called the A/B, Alternating Day, or eight block schedule; Modified blocks consist of two to three 90-minute blocks and variable or split 45-minute classes. Classes can be scheduled in various combinations, depending on factors such as subject content and flexibility. Counselors and students must pay attention to issues such as scheduling of sequential courses and an over concentration of credits earned in one specific area, such as band.

Criticism of the Block Schedule

As with any change, observers of block scheduling have divided into positive and negative camps. “On the positive side, improvement in classroom instruction is viewed as the major reform benefit for education” (Queen, 2000, p. 8). The potential exists for students to receive more individual attention from teachers in the block design. Varied instructional strategies such as cooperative learning, inquiry method, group discussion, concept development, simulations, and seminars that actively engaged students in the learning process can be utilized. Queen (2000) reported teachers spending 70% of classroom time engaging students in interactive instruction when teaching on a block schedule.

While many promises for success have been made, the block schedule has not
been without critics. Block scheduling has been criticized for lower content retention from one level of a subject to the next and for the extensive time required for independent study outside of class. Some critics of the block schedule point to the findings of a Canadian study. This study compared the science scores of tenth grade students on a yearlong term, a semester term, and on quarterly schedules. Students whose classes were scheduled for 10 months outscored students who were scheduled in semester or quarter schedules on individual test items. Critics of the block schedule contend that the students on the semester or quarter schedules were at a disadvantage in science.

Teachers also complained that, with the recent attention to curriculum standards, content coverage expectations had been expanded, and the semesterized block was not conducive in this aspect. The semesterized block actually gives teachers fewer total minutes to teach a class when compared with a traditional yearlong course. For example, using a 180-day school calendar gives teachers 9000 minutes for instruction in a 50-minute class period. On a semesterized block schedule, ninety 90-minute-blocks equal 8100 minutes of instructional time. In 1995, Hackmann reported that the first year on block scheduling was the most challenging for teachers and principals. According to Hackman (1995) teachers were uneasy about teaching in longer blocks of time and many veteran teachers complained that the first year of block scheduling was much like being a first-year teacher again.

**Impact on Instructional Delivery**

Much of the research examining block schedules has pointed to the fact that, in extended class periods, teachers are better able to employ a variety of instructional strategies that address the learning needs of students. However, the lecture method
remains the most widely used instructional strategy in high schools today (Jenkins, 2000). Isenhour and Queen found overuse of lectures in 30% of blocked classes, and this problem led to numerous student complaints about longer class periods being boring (Queen, 2000).

Educators complain that there is not enough time to use interactive methods with students because there is too much content to cover in preparation for state-mandated tests. Under increasing pressure to improve test scores, teachers have resorted more and more to the lecture method as the best way to cover the curriculum. Covering their course content by lecturing students may be easier for teachers but it is questionable how much students are able to retain.

*Research on Instruction and Achievement in the Block Schedule*

According to Cawelti (1994), the block schedule qualifies as one element of educational restructuring because it created the opportunity for teachers to make significant changes in instruction. Jenkins (2000) stated that among the advantages of the block schedule is the opportunity for teachers to engage students in active teaching strategies that require more time than the traditional schedule allows. “Educators using a block schedule need to vary their strategies to maximize instructional time and time-on-task if they are to have a positive impact on student performance.” (Queen, 2000, p.13). “The main focus of staff development should be the improvement of instructional strategies for teaching on the block and training on diverse learning styles” (Davidson, 2001, p.7).

Student outcomes such as increased student achievement and better student behavior are considered desirable. In a comparison of schools on traditional schedules
with schools on a block schedule, it was found that measurable outcomes such as grades and student attendance, increased for the schools on the block schedules while disciplinary infractions decreased (Jenkins, 2000). The study also showed teachers implemented a variety of teaching strategies on the block. Negative concerns also showed that teachers felt strongly that adequate staff development for instructional strategies is needed. They also voiced concerns about makeup work due to student absences (Jenkins, 2000).

In a study conducted by King in 1996 the impact of block scheduling on academic achievement and the learning environment was the primary focus and to what extent the teachers changed instructional strategies subsequent to the implementation of block scheduling. The study involved three large urban high schools each at different points in utilizing a block schedule were studied. One school had completed three years on a block schedule, a second school had completed two years on a block schedule, and the third school had completed one year. When looking at suspension rates and dropout rates there were no perceptible patterns revealed about the second question of the utilization of a block schedule …what was the impact on the learning environment.

However, there were mixed results in examining the first question. All three schools showed an increased in A-B grades in the four core curriculum areas of science, math, English, and social science. However, there was an increase in D-F grades as well. Those students defined as academically at-risk students, failing three or more courses, did not decrease. King’s study did find that overall achievement in all classes increased. Using a Likert scale, King’s 1996 study allowed teachers to explain to what degree their instruction incorporated strategies from a list of eleven identified instructional strategies.
The study demonstrated that the block schedule had an impact on the strategies reportedly used by the teachers. Active learning, cooperative learning, and independent study/research were among those methods utilized that showed an increase on the block schedule. The results of the study revealed that: English teachers demonstrated the greatest positive impact; science teachers were next; and teachers in the disciplines of math and the social sciences demonstrated the least impact.

The Southern Regional Education Board’s (SREB) has a school improvement program titled *High Schools That Work* (HSTW). The program suggests to its member schools a recommended design that enhances student achievement. The design consists of four major factors: high standards and expectations; a challenging curriculum and engaging instruction; personalized learning environments; and strong guidance and advisement programs.

In the area of curriculum, HSTW (SREB, 2002) recommends that students complete at least 28 credits for graduation. HSTW prescribes four credits of English, four credits of math, three credits each of science and social studies. They also recommend four credits in an area of concentration and one computer technology-based credit. HSTW recommends the change to a block schedule to those schools performing unsatisfactorily to state standards. The block schedule makes it possible to earn 32 credits in four years that allows ample opportunity to meet their recommended curriculum requirements. SREB provides the following information to support their reasoning:

SREB conducted a study that compared reading, math, and science scores of 320 HSTW member sites between 1998 and 2000. The researchers compared schools with
traditional schedules and those with block schedules. Seventy-four traditional schools required 20 to 23 credits earned. Those schools on block schedules were subdivided into three groups, 72 schools (Group I) had block schedules that required students to earn between 20 and 23 credits. The second block schedule group consisted of 165 schools (Group II) that required its students to earn between 24 and 30 credits. The third group was comprised of 19 schools (Group III) that required 24 to 30 credits but stipulated that four credits were to be earned in math and four credits in science courses.

The results of the study were as follows: For Reading, the traditional schools showed no gains nor did the Group I block schools. Group II block schools showed a two-point gain and Group III schools showed a gain of six points. In mathematics, the traditional schools showed a gain of three points. Group I block schools showed a gain of two points. Group II block schools demonstrated a gain of four points. Group III schools displayed a gain of seven points in math assessment scores. In the area of science, the traditional schools showed a gain of two points, while Group I block schools gained only one point. Group II block schools showed a gain of five points and Group III block schools showed a gain of seven points.

SREB does not necessarily endorse the block schedule as the remedy for a school’s achievement ills; rather, “flexible scheduling that enables students to earn more credits” (SREB, 2002). These data do seem to support block scheduling to allow students to earn maximum credits in meaningful, rigorous courses.

**Opposition to Active Learning Strategies**

Interestingly, a number of strategies identified by Canady and Rettig, Queen and Isenhour, and Marshak as active student learning strategies and labeled as teachers
preferred ‘well-suited’ for a block schedule more often from traditional schedules than from teachers on the block schedule (Jenkins, 2000, p 123). These strategies were discovery learning, simulations, games/role-playing, technology, projects, Socratic teaching, and integrated thematic teaching.

And Jenkins’ findings (2000) also revealed that teachers placed on a block schedule conversely preferred traditional methods. In fact, the differences between the level of appropriateness of projects and Socratic seminars identified by teachers on a traditional schedule and teachers on a block schedule were statistically significant. Teachers from traditional schedules were more likely to believe that projects and Socratic seminars were appropriate strategies for their classrooms than did teachers operating on a block schedule. Jenkins (2000) also reported, “In unexpected findings that a significant number of teachers on the block schedule preferred the lecture/direct instruction methods of teachings” (p. 126). Furthermore, these teachers rejected active learning strategies that are considered appropriate for the block. Conversely, these findings showed that those teaching on a traditional schedule were more apt to use more student-centered strategies. “Educators have been bombarded in recent years with solid research on the potential of active learning strategies to improve the level of student achievement and to help those students gain those problem solving skills which will benefit them in the future” (p. 126).

Summary

“The literature on block scheduling fails to include any systematic empirical studies that substantiate claims that block scheduling raises the academic achievement of students” (Davidson, 2001, p 52). Adjusting the ringing of bells appears to be just part of the puzzle. Adaptation to and incorporation of new instructional strategies by classroom
teachers is an important component. Research studies have shown that instruction that actively engage students can and do raise achievement. The block schedule gives classroom teachers the opportunity to effectively implement the new instructional models by providing them with the required time to introduce, complete, and reflect on the lessons. This process allows teachers to transform their classrooms from teacher-focused to student-focused instruction centers.

While there may be uncertainty of the benefits of block scheduling for student achievement, there are benefits, including: (a) improvement in school climate; (b) reduction of discipline incidents between classes; (c) and fewer students for which teachers have to be accountable at one time on the semesterized block, reducing the ratio of pupil-teacher complaints. The outcome holds true for students, as they have teachers and fewer classes at one time. Students are given the opportunity to earn more credits over a four-year period. Administrators are given more options with long-term suspension cases. Given the space, administrators can also increase staff efficiency. Teachers now teach one more class than on a traditional six- or seven-period day, thus the opportunity exists to provide more elective opportunities with current staff.
CHAPTER 2

FOUNDATIONAL CONSIDERATIONS for the MANUAL

Instructional Implications from the Block Schedule

Administrators have implemented an extended period bell schedule as a means of reforming, and thereby improving, schools. The assumption is that more plentiful and quality interactions, dialogue, and processing of information will occur in the classroom. A reality of the extended period is that longer classes require that teachers alter and vary their instruction. For many teachers who have changed to a block schedule and have relied on direct instructional techniques, this has presented a challenge. Among the challenges that teachers face on the block schedule are motivating students with the daily instructional plan, engaging students for the extended period, and making the daily instructional experience effective and meaningful. The block schedule for some teachers has translated into the need for staff development and for help in the form of instructional resources.

Rationale for the Manual

The manual that is provided in this document is directed at providing one professional development alternative to teachers who want to change their instructional approach. The manual’s most important feature is its presentation of instructional strategies, which are based on the constructivist theory of learning from both a theoretical and applied perspective. A discussion of constructivist learning theory is included because it gives an explanation and a justification of how the manual’s three instructional models are designed and how they work. The manual’s three learning models, problem based learning, cooperative problem solving, and concept attainment aligns with the
concepts from constructivist learning theorists. They also align with one of the purposes of the block schedule that of enriched instruction. The strategies permit interaction beyond that that direct instructional techniques offer.

Collaborative learning is also an important feature integrated into the manual. An assumption of this study is that collaborative methods are the best way to use the three models in the classroom. This chapter includes evidentiary commentary, based on research, on the use of collaborative learning. Cooperative (collaborative) learning is “the most widely used restructuring element under the broad category of curriculum/teaching” (Cawelti, 1994, p 9).

Finally, the models and the methods to incorporate these concepts align with recommended teaching practices. The manual’s strategies match qualities that are found in successful teaching, instruction, and meaningful learning practices. Implementation of the strategies could possibly lend themselves to success in either an extended classroom or a traditional classroom or in any environment in which learning is a desired outcome.

Constructivist Learning Theory

A commonality of the three models featured in the manual is that they all follow the constructivist theory of how students learn. Constructivists believe that students construct knowledge for themselves. Others, such as teachers, may assist students, but ultimately students have to make their own meanings. Learners individually construct meanings or comprehension when they learn something. The challenge for the constructivist teacher is to build a classroom that allows students to discover and construct knowledge within the curriculum supervised by the teacher.

We must allow the learner to: interact with sensory data and construct
their own world. Good instructional planning explores ways to engage students in using knowledge and skills to solve problems and to develop and explore hypotheses. Teachers should create experiences that help students make sense of the knowledge and skills being studied (Tanner, 2002, p 3).

The three instructional models of problem-based learning, cooperative problem solving, and concept attainment can assist teachers in creating an environment conducive for higher-level student learning. Implementation of these models by the teacher can construct desirable learning conditions and create favorable classroom outcomes such as stimulation of student interest. Student interest can, in turn, enhance motivation. Interest and motivation result in student engagement. Constructivists say engagement results in students’ employing cognitive processes that help them construct meaning.

The activities created by the models all call for critical thinking by students. Additional derivative cognitive processes inherent in the activities are problem solving, decision-making, and inquiry. Each model uses reflection, a meta-cognitive process that aids deeper understanding. The activities use a social context for learning in that the three models can be implemented in a collaborative setting. Students have to participate in the activities and generate their own answers and understanding. The teacher is there to offer assistance and clarification but not answers.

Repetitive use of these models can cause growth in subject matter comprehension and in the cognitive processes that are necessary to cope with future situations requiring similar actions by students. Life does not require an instantaneously retrievable
encyclopedia of facts, but, rather cognitive processes that allow the individual to cope, solve, and adjust to life’s situations as they emerge. Reality requires one to be able to analyze information, to solve problems, to make decisions, to work together, and to try, fail, correct, and try again.

**Understanding Constructivist Learning Theory**

Students control their individual learning. Each student constructs a unique understanding through cognitive processes. The process of understanding takes a different route for each student. Several students can listen to the same lecture or speech but when asked to comment on what they heard, invariably they will mention different highlights. Teachers can assist students in acquiring meaning but there is no guarantee that they will acquire the same meaning as teachers.

Constructivism emphasizes the importance of the knowledge, beliefs, and skills an individual brings to the experience of learning. Constructivists believe that individuals construct their own comprehension of knowledge by making connections and meaning for themselves rather than just receiving that knowledge from the transmissions of others. It recognizes the construction of new understanding as a combination of prior learning, new information, and readiness to learn. “Constructing meaning is enhancing understanding, acquiring and using knowledge, monitoring understanding and developing insight (Daniels & Goudvis, 2000, p. 8). Individuals make choices about which new ideas to accept and how to fit them into established views of the world. Others may provide motivation but they cannot acquire knowledge for that individual. Actually, only students can make learning happen for them.

Central to constructivism is its conception of learning. “From the constructivist
perspective, learning is not a stimulus-response phenomenon. It requires self-regulation and the building of conceptual structures through reflection and abstraction” (Von Glasersfeld, 1995, p.14). Fosnot (1996) adds that “Rather than behaviours or skills as the goal of instruction, concept development and deep understanding are the foci (p.10).” “For educators, the challenge is to be able to build a hypothetical model of the conceptual worlds of students since these worlds could be very different from what is intended by the educator (von Glasersfeld, p.16).

Constructivists believe that learning can occur through social interaction. An individual’s learning and comprehension is often enhanced by the insights of others. Often understanding is constructed by engaging in dialogue with others as together they analyze and reflect on the concepts at hand. An awareness of this social construction of knowledge suggests that a pedagogical emphasis be placed on discussion, collaboration, negotiation, and shared meanings.

**Constructivist Principles of Learning**

Constructivists have developed several main beliefs about learning that are central to the theory. To fully understand the meaning of Constructivism, it is important to compare and contrast active learning and passive learning. First, the student is expected to be an active learner. For constructivists, learning is not just the passive acceptance of knowledge that exists out there, but learning involves learners engaging with the world. Constructivists stress that the learner needs to do something with knowledge, in essence handle the information, and in that doing/handling cause one to gain insight, leading to understanding.

People learn to learn as they learn. Learning consists both of constructing
meaning and constructing systems of meaning. If one learns to prepare a particular dish following a recipe, he or she is simultaneously learning the meaning, the essence of a recipe. Each meaning constructed allows one to be better able to give meaning to other stimuli, which can fit a similar pattern.

We learn working with others. Learning is a social activity: Learning is intimately associated with connections with other human beings. “In constructivist theory, learning is facilitated through social interaction, shared-thoughts, and decision-making…” (Eggen & Kauchak, 1997, p. 4). With each of the manual’s three models, students are put in small groups and they work their way through the activity.

Connections that facilitate learning happen with teachers, peers, family members, and with casual acquaintances, including unknown people observing identical events. Constructivists explain that much of traditional education is directed towards isolating the learner from interaction with other classmates and towards seeing education as a one-on-one relationship between the learner and the objective material to be learned. In contrast, constructivist education recognizes the importance of the social aspect of learning and uses conversation, interaction with others, and the application of knowledge as integral aspects of learning.

Vygotsky (1978) adds additional understanding to this principle of social interaction and terms it “zone of proximal development,” stating that there is a limit to what individuals can learn alone. The term refers to a level of understanding that learners can acquire when engaged in a task with the help of a more expert peer. People learn as they are stretched beyond their own knowledge but only within a range that is within their grasp, given the knowledge and skills they bring to a task.
It takes time to learn: Learning is not instantaneous. Learning rarely happens with just one encounter with new data. For significant learning, one need to revisit ideas, ponder them, try them out, play with them, and use them. This usually does not happen in a short time span, especially the short time allotted in traditional classroom activities. Anything learned is the product of repetition. Understanding comes from repeated thought and exposure to the phenomenon.

Motivation is a key component in learning. Not only does motivation help learning, it is essential. Students learn when they are ready to learn. To learn, the mind has to be piqued with interest; it has to be motivated. Motivation can be described as understanding the ways in which the knowledge can be used--its relativity. Unless learners know the reasons why, they may not be involved in using the knowledge that a curriculum tries to instill. Those who are interested become involved, and those who become involved become engaged, enhancing the chance for learning and comprehension.

The final principle involves reflection. As stated previously, it takes time to learn. This includes time to reflect and to revisit an idea. Understanding comes when the learner repeatedly handles the new information. Thinking about, interacting with, and reflecting on the information all help the learner comprehend. The rationale behind the move to a schedule of extended periods of time is it that it will provide the classroom teacher with increased time for learning activities. Activities, when properly designed, permit the students time to reflect on them, revisit them (in the mind if not directly), and internalize the messages.
Proponents of Constructivist Theory

Several individuals, cognitive psychologists and educators, have contributed to the understanding, to the construction of the theory of constructivism. Piaget, Dewey, Vygotsky, Feurstein, Bruner, and Gardner have all added to the constructivist model of learning. A brief discussion follows of their particular contributions to constructivist principles.

Piaget was an expert in child psychological development and believed in the concept of Discovery Learning. Piaget felt that students must be given occasions to work with hands-on learning activities. Piaget believed in giving students the opportunity to make their own interpretations by analyzing, abstracting, and reflecting from learning experiences that interest them. The student discovers the meaning by working with the knowledge in his or her own mind. Instructors can assist, but final understanding comes when the student gains awareness.

John Dewey, an American educator, believed that learning was embedded in action, in experiences (Dewey, 2003). Dewey said that experiences needed to be more than just the dispensation of knowledge by an expert at the front of the room. Dewey felt that learning could be drawn from experiences. “Dewey emphasized not only the content of education but the process as well,” (Daniels, Bizar, 1998, p.171) advocating that learning take place outside the walls of the school building. One of Dewey’s innovative learning concepts was the field trip, taking learning outside the classroom into the context where new information is actually used. Dewey set up a real business, a store run at the school, by students, to help them better understand business and economic notions.
Vygotsky (1978) believed that social interactions were also needed to help students formulate meaning. Students sitting through the very same experience gather different interpretations and meaning. Incorporating the entire class’s focus on the matter at hand and leading the class through reflective dialogue can enhance learning and understanding enhanced through the power of the group (Vygotsky).

Bruner (1967) said that interest in the subject matter to be learned is the best stimulus to learning. Motivation through genuine interest is much more powerful than external goals such as grades or one-on-one competition. Bruner also felt it is the mission of the teacher to help students participate in the process of establishing knowledge. In the ultimate learning setting, the teacher should strive to encourage students to discover principles by themselves.

Feurstein defined the process of students’ thinking about their thinking in a cognitive process called meta-cognition. This process leads students to a deeper connection and understanding of the material. Students are asked to think and discuss how they actually participate in the learning experience. When they discuss where they had difficulties, successes, breakthroughs, and hang-ups, a more complete transfer of knowledge occurs. When students are aware of how they learn, they cognitively process much quicker when faced with a similar or familiar problem or set of circumstances in the future.

Gardner’s contribution to Constructivism is the theory of multiple intelligences. Gardner believes all persons possess eight identifiable intelligences but usually develop a preference for one or more of the intelligences. When experiencing stimuli, people prefer using a particular intelligence to others. Gardner feels there are many ways to make
personal meaning through different experiences.

*Constructivism versus Behaviorism*

Comparing constructivist principles to the behaviorist model of learning can help one to understand constructivist theory. The constructivist model of how people learn contradicts the behaviorist model. The behaviorist model of learning is usually credited as the foundation behind most direct or didactic instructional methods used in the traditional classroom.

Constructivists explain behaviorist theory in the following way. There exists in the world a pool of standing knowledge and that knowledge is just waiting to be understood. The child’s brain is like an empty tank waiting to be filled from that pool. Each person or learner learns about the world by tapping into this reservoir of knowledge and pouring knowledge into his or her brain. Teachers are relied upon to do most of the *pouring*.

The goal of educationalists, then, according to the behaviorist, is to explain and help students come to know their world--to explain and interpret events. Students are told about their world and are expected to give back or replicate that same explanation to demonstrate understanding and knowledge. All students should hopefully have virtually the same understanding of each event. The teacher delivers and explains the learning and clarifies for the student who may be having trouble understanding the content.

Behavioral psychologists are interested in the study of changes in behavior as opposed to changes in mental states. Learning is conceived as a process of shaping the behavior of an individual, and shaping the individual's response to events (stimuli) that occur in the environment. The student has to be prepared and shaped for his world yet to come.

Behaviorism centers on students' efforts to accumulate knowledge of the natural
world and on teachers' efforts to transmit it. It therefore relies on an instructional approach that is largely passive, teacher-directed, and controlled. Students are expected to be mirrors reflecting the realities that the school says they should.

In some contexts, the term behaviorism is used synonymously with objectivism because of its reliance on objectivist epistemology. Jonassen (1991) describes the assumptions of an objectivist approach to learning. Objectivists believe in the existence of reliable knowledge about the world. As learners, the goal is to gain this knowledge. As educators, it is to transmit it. Objectivism further assumes that learners gain the same understanding from what is transmitted. Learning therefore consists of assimilating that objective reality. The role of education is to help students learn about the real world. The goal of teachers is to assist students interpret events. Learners are told about the world and are expected to replicate its content and structure in their thinking.

Behaviorism emphasizes observable, external behaviors and is silent on meaning, representation, and thought, whereas constructivism takes a more cognitive approach. This difference has profound implications for all aspects of a theory of learning. The way in which knowledge is conceived and acquired, the types of knowledge, skills, and activities emphasized, and the role of the learner and the teacher are all factors articulated differently in the constructivist perspective.

The Constructivist Classroom

In the classroom, the teacher must present problems. The problems should promote new ways or patterns of thinking. Students should be permitted to engage in learning experiences. The learning experiences should engage them in dialogue with the teacher and their classmates. Discourse helps to reinforce thought or change original
perceptions. The reflective process of thinking is accelerated when students hear the input of others. Ideas, questions, perceptions, and insights that they had not yet considered now enter their world of sensory information. All trials and efforts go toward the student constructing their own meaning toward the end of acquiring knowledge. Learning experiences are incorporated within the strategies of the manual presented.

“Constructivism is an approach to teaching based on research about how people learn” (McBrien & Brand, 1997, p 24). Brooks and Brooks (1993) define constructivism as “a theory of learning that describes the central role that learners’ mental schemes play in their cognitive growth” (p.18). Scherer (1999) states, “The constructivist is prepared to share with the teacher how the student learns but not what the student is to learn” (p 54).

The challenge for the teacher is to blend the what students need to learn with the how. Teachers may need assistance with that blending. “Creating an environment in which students build their own knowledge is a much harder task than just asking questions and fielding answers” (McKeown, 1999. p 18). The manual’s three models, cooperative problem solving, problem-based learning, and concept attainment, closely follow the tenets of constructivism. All three models design activities that permit students to construct knowledge and understanding.

*Constructivist Classroom Activities*

The constructivist teacher sets up problems and guides the direction of student inquiry and exploration. Activities are designed to promote and cause new patterns of thinking. Teachers design their instruction so that it probes the insights and perceptions of their students. The crucial action of constructing meaning is mental: It happens in the mind. Physical actions and hands-on experience assist learning, especially for children.
Teachers need to provide engaging hands-on activities and observations of the natural world that provide experience for those constructions.

In a constructivist classroom, the teacher asks open-ended questions and allows wait time for responses. Students who frame questions and issues and then go about analyzing and answering them take responsibility for their own learning and become problem solvers. Higher-level, critical thinking is encouraged. Instruction in the constructivist classroom questions the students’ point of views and their suppositions. The lessons are designed around big ideas and real-world relevance. Students use “…prior knowledge and experience to interpret the new material in personally meaningful ways. They make inferences, elaborate on the new information by adding details, and generate relationships between the new material and information already in memory” (Wood & Willoughby, 1995, p. 19).

Constructivists call these learning experiences. The teacher monitors students by observing them handling classroom investigations and problem solving presented in the activities. Students must be permitted the opportunity to talk about the concepts that are presented to them for learning. A constructivist classroom provides a neutral zone where students exchange their personal views and test them against the ideas of others. It is in this talk that the teacher can gauge how well or what it is that the student is constructing for meaning.

The constructivist teacher challenges students to reach beyond the simple factual response. She encourages students to connect and summarize concepts by analyzing, predicting, justifying, and defending their ideas. Students are engaged in experiences that challenge hypotheses and encourage discussion. When allowed to make predictions,
students often generate varying hypotheses about natural phenomena. The constructivist teacher provides ample opportunities for students to test their hypotheses, especially through group discussion of concrete experiences.

Effective Classroom Practices

Small groups discuss the various observations and speculate about their meanings. Students engage in dialogue with the teacher and with each other. Social discourse helps students change or reinforce their ideas. If they have the chance to present what they think and hear about others' ideas, students can build a personal knowledge base that they understand. Only when they feel comfortable enough to express their ideas will meaningful classroom dialogue occur. How teachers pose questions to their students and the manner that students respond and talk with one another is crucial to the success of the learning experience. Classroom climate, including the teacher’s willingness to step away from the central role of controlling all thought, is critical for the constructivist classroom. For the teacher, listening to students as they discuss ideas together is essential if the balance of responsibility is to be shifted to the learner.

Reflection

Reflective thought takes time and is often built on others' ideas and comments. Deeper comprehension and learning can come from reflection. “Reflection permits one to take stock of one’s current understanding and then reach new insight” (Daniels & Goudvis, 2000, p.144). To develop new insight about an old topic, new information is needed. New information comes from dialogue, authentic activities, and simulations. Researchers have noted that people talk to themselves as they learn, even though they might not do it aloud. Activities allow learners to think and to talk, not only to themselves, but also aloud, to others,
as well. Equally as important, they are allowed the opportunity to hear others. Learning, then, is a social activity as much as it is individual activity. People need to speak and hear others as much as they need to reflect individually in order to construct, grasp, and store knowledge. Therefore, the classroom teacher must give attention to learners’ thinking, and not just pay attention to the subject or lesson that is to be taught. The teacher must give learners situations in which they are allowed to think, to construct meaning.

The Traditional Classroom

Comparing the constructivist classroom with the behaviorist classroom serves to further differentiate the two theories. In the behaviorist classroom, classes are usually driven by teacher-talk and depend heavily on textbooks for structure of courses. The idea is that there is a fixed world of knowledge that the student must come to know. Information is divided into parts and built into a whole concept. Teachers serve as pipelines that attempt to transfer their thoughts and meanings to passive students. There is little room for student-initiated questions, independent thought, or interaction among students. The goal of the learner is to reproduce the accepted explanation or methodology expostulated by teachers.

Research

In a study of 140 classrooms in 15 elementary schools, grades 1-6, Knapp (1992), over a three-year period, compared the differences between traditionalist instruction and constructivist instruction to see if the latter made an impact on student achievement. Findings suggested that, regardless of subject area, constructivist instruction leads to greater gains in advanced skills such as problem solving ability, reading comprehension, and written expression. Cooper (2000) concluded the constructivist teaching resulted in
similar gains for both low-achieving and high-achieving students. The results did not vary much with longer versus shorter amounts of instructional time as long as strategies that emphasized meaning and understanding (constructivist) were employed in both situations (Cooper, 2000).

In a study of elementary schools, Slyva (2000) compared the results of teachers who used blended instruction (some traditional and some constructivist teaching) with explicit (wholly constructivist or wholly behaviorist) teaching and found no significant differences over time in achievement scores. Although some evidence did favor blended instruction, findings were inconclusive. Another study comparing blended instruction with explicit constructivist strategies proved that blended teaching might not be as effective as explicit teaching. It must be pointed out that both of these studies were conducted in elementary settings and therefore not necessarily applicable to secondary schools. The results of these studies and three other studies (Brown, 1996; Wolf, 1998; and Simmons, et al, 1995) showed that a moderate favorable gain was had when employing constructivist-teaching techniques. It is apparent that future research is still needed to address the issue of how constructivist teaching affects student achievement.

**Conclusion**

Constructivism refers to the idea that learners construct knowledge for themselves. Each learner individually (and socially) constructs meaning, as he or she learns. Constructivists believe that there is no such thing as knowledge out there, independent of the knower, but only knowledge that learners construct for themselves as they learn. They feel that learning does not have to be timely, that is that new knowledge has to be understood immediately. Mistakes and adjustments in learning over time are
permitted. Mistakes and misunderstandings are considered a healthy part of the process. Neither is it confined to remembering preconceived perfect ideas; but, rather, it is a personal and social construction of meaning derived from a multitudinous range of sensations, which have no order or structure besides the explanations that learners invent for them.

In the constructivist model, learning emphasizes the process, not the product. How one arrives at a particular answer, not the retrieval of a right answer, is what is important. Learning is a process of constructing meaningful representations, of making sense of one's experiential world.

In this process, students' errors are seen in a positive light and as a means of gaining insight into how they are organizing their experiential world. The notion of doing something 'right' or 'correctly' is to do something that fits with 'an order one has established oneself' (von Glasersfeld, 1987, p. 15).

In the Constructivist classroom, teachers are asked to step away from the traditional role where they provide all knowledge to be learned by students. Mayer (1996) describes teachers as guides, and learners as sense makers. In Gergen's (1995) view, teachers are coordinators, facilitators, resource advisors, tutors, or coaches. Their role is not to dispense knowledge, but to provide students with opportunities and incentives to build it up. Indeed, the teacher still manages the curriculum and what is studied in the classroom. Providing activities that are constructivist in nature takes effort but it is not an insurmountable task for the teacher. But like most professions, training and professional development are certainly in order. The manual can play a useful role as a complement to such development and in the absence of such training; become a tool a teacher can rely
Collaborative Learning in the Classroom

Many of the activities contained in the manual can be accomplished as individual seat assignments, a traditional method of instruction, and maintain their power if approached that way. However, all of the strategies are better suited to collaboration, which is a powerful learning force if utilized correctly. Collaboration makes it easier for teachers to have the entire class focus on the topic at hand. With traditional instruction, the focus by the entire class on one topic is something that is difficult to achieve for the typical teacher and is usually relegated to the status of fantasy for most teachers.

Collaborative learning, and its subset of cooperative learning, is structured, systematic instructional strategies in which students are directed by the teacher to work together on a common topic. Collaborative learning tends to encompass a variety of group learning experiences, such as peer tutoring, group discussions, student-faculty research projects, short-term buzz groups, problem-based learning, project-based learning, learning communities, and other techniques. Cooperative learning divides the students into smaller groups whose missions become to work together toward a common goal such as solving a problem or completing a project. Research has shown that cooperative learning is a tool utilized by teachers placed in a block-scheduling situation. Cawelti found that cooperative learning was “the most widely used restructuring element under the broad category of curriculum/teaching” (Cawelti, 1994, p. 9).

*The Value of Collaborative Learning*

In a collaborative classroom everyone talks and shares their perceptions and understandings. In the traditional classroom, teachers are charged with explaining their
meanings and understandings so that those meanings and perceptions become those of their students. This is how it has been done for years and this is what is under attack by the critics of the United States education system. Teachers’ explanations do not guarantee learning and understanding. The different perceptions in the collaborative classroom expose students to more views than just that of the teacher. Students have come to realize that when they are stymied about the comprehension of a topic, they may hear an explanation that makes sense to them in the different stages of a cooperative learning lesson. They may hear clarification in the *sharing phase*, more perspectives in the *debriefing phase*, and even in the *reflection phase* words and thoughts that reveal an insight that they may not have conjured if not for the chance to repeatedly work with the same information. No matter the intellect and no matter how brilliant one may be, there will always be topics that stymie an individual. What is complex for one student might be simple for another. The meaning becomes understandable for the stymied student with different words and examples, provided by a classmate. In addition, students teaching students reinforces their own learning.

*Problems and Pitfalls*

Teachers have to have the expertise and resources to make small-group instruction viable. Criticisms and problems areas have been identified with collaborative learning. The most vociferous complaint against collaborative and cooperative learning is the difficulty of maintaining an equitable workload among the group’s members. The following scenarios could create work ethic problems in a collaborative classroom. Some students will see small group instruction as the opportunity to take time off. Some students will do all the work and resent doing it because others share in the group’s
success without making significant contribution to the group’s effort. Some students cannot get involved because the group will not let them or they are ignored. Some students will want to do all the work without worrying about sharing. Student accountability and monitoring by the teacher must be in place to ensure consistent effects on achievement.

Cooperative Learning Research

A meta-analysis of 164 previous studies on cooperative learning methods and their effect on student achievement by Johnson, Johnson, and Stanne (2000) was conducted to examine the empirical support validating the effectiveness of the different methods of cooperative learning. (Johnson & Johnson, and Stanne, 2000) They investigated the effectiveness of eight cooperative learning methods. Those methods were Learning Together (LT), Academic Controversy (AC), Teams-Games-Tournaments (TGT), Student-Team-Achievement-Divisions (STAD), Group Investigation (GI), Jigsaw, Teams-Assisted-Individualization (TAI), and Cooperative Integrated Reading and Composition (CIRC.) The researchers examined the studies with four guiding questions. The first question addressed the amount of research that had been done to validate specific cooperative learning methods. The second question addressed how many different cooperative learning methods have been evaluated. The third question was, “how effective are the different cooperative learning methods in maximizing achievement?” Finally, the researchers tried to determine the characteristics of the more effective cooperative learning methods. The results of student achievement under cooperative learning were compared to results of achievement under more traditional instruction identified in the study as competitive or individualistic learning. For the
purpose of the current study, the focus is on the third theme, the effect of cooperative learning as an instructional strategy on student achievement.

The meta-analysis was of more than 900 studies using computer searches in Educational Research Information Center (ERIC), Psychological Abstracts (PA), Dissertation Abstracts International (DAI), and the Social Science Citation Index (SSCI) (Johnson, 2000). The studies located using these services and the subsequent bibliographies contained in the studies and in previous meta-analyses provided the researchers an abundance of sources to examine. The number of studies was reduced by using only those that investigated the impact of a specific method of cooperative learning on student achievement.

The studies were conducted in K-12 and post-secondary settings. All of the studies were conducted after 1970. Twenty-eight percent of the studies were conducted between 1990 and 2000. Subjects and studies were global and not limited to North America.

The researchers identified two independent variables one dependent variable for meta-analysis. The independent variables were the cooperative method identified and the classification of how the cooperative learning method was applied in the classroom on a continuum from direct to conceptual. Direct application was defined as employing the method in a strict, prescribed fashion. Conceptual employment of the cooperative learning method allowed the teacher to be flexible and utilize, construct, and fit the strategy as teachers determined the needs of students. The dependent variable was student achievement. Achievement was defined as a measure of some type of student performance on assessment administered by the teacher and the school.
The results of the meta-analysis showed that cooperative learning methods can significantly increase student achievement when compared to competitive and individualistic learning (Johnson, 2000.) The study revealed that all eight methods of cooperative learning proved effective in increasing student achievement. They all had substantial effect sizes and produced significant higher achievement when compared with competitive or individualistic learning. The research shows that when the cooperative learning methods are implemented effectively, the likelihood of positive results is quite high (Johnson, 2000.) The study produced a ranking of the cooperative learning methods. Learning Together produced the greatest effect followed by Academic Controversy. The remaining methods, as determined by their positive effect on student achievement, were STAD, TGT, Group Investigation, Jigsaw, TAI, and CIRC.

Limitations of the study should also be discussed. The studies used in this meta-analysis could have flaws and shortcomings in their methodologies—flaws that could influence the findings. Errors could result in different findings. A second limitation is that many of the validating studies have been conducted by the researcher-developer who originated the method. With a stake in the outcome by the researcher there is the potential for bias. The authors state that more research needs to be done on the individual methods. The studies utilized in this meta-analysis could be those studies that showed a significant difference. Studies that produced no significant differences could possibly have been omitted. The conclusions drawn from the results of only a few studies conducted could be misleading.

The researchers reported that all of the studies measuring the impact of cooperative learning showed positive results not only for achievement but also for other
worthy school-based outcomes. Improvements in time-on-task, retention, social
development, higher-level reasoning, and transfer of learning are the results of using
cooperative learning methods. These beneficial outcomes along with increased
achievement occur simultaneously when using cooperative learning as an instructional
strategy.

Summary

Student achievement may be enhanced by the use of cooperative learning
techniques. It can result in a gain as much as 27 percentile points in student achievement
(Marazano, 2002). The strategies lend themselves well with the extended period. The
strategies featured in the manual are most effective when done cooperatively. This
method allows a teacher to involve an entire class and keep it on task and on content
focus. Properly implemented an entire class may be engaged in higher-order thinking
activities and the extended period becomes may be efficiently utilized.

Good Teaching

For the classroom teacher it is essential to know what constitutes good teaching
and classroom management. It is essential to have an understanding of how students learn
in the classroom. The master teacher can blend sound instruction with learning theory to
optimize results. Fundamentally, teachers should expose students to knowledge. Learning
entails trying things out, formulating hypotheses, and testing them. The teacher has the
duty to be there as a guide, offering students the proper experiences. The teacher must
also be there to answer students' questions, or at least, to listen to their questions and
perhaps suggest ways they could discover the answer themselves. Curiosity comes from
trying things out, from failing on occasion, from explaining why, and from trying again.
Good teachers should expose their students to enough situations so that they will become curious enough to take learning into their own hands. In other words, the role of the teacher in a learning-by-doing scenario is to open up interesting problems and to provide tools for solving them when asked by the student to do so. The curriculum must be oriented toward the idea that students will learn what they need in order to accomplish goals.

Teachers generally want three things from their students concerning the content that they teach to the students: (a) to cause them to think about the content, to remember what is taught and (c) to understand the content of the curriculum. There exists a relationship among the concept of memory, thinking, and understanding. Students are more apt to remember those things they fully understand. Students are more likely to understand those things about which they are thoughtful. This cycle will not happen with assignments and strategies that primarily emphasize memory. “Students must not only be taught what it is they are to think about but must also be taught how to think” (Gunter, 1990, p. 8).

The teacher must be able to match the students’ learning preferences to the content to be taught and the strategy be used (Schwartz, 1992). To do so, the teacher must understand the three basic constructs, which are: (a) a thorough understanding of the teaching/learning act; (b) an understanding of the matching process and the choices available to teachers and students; and (c) the skills to carry out the available options. So that effective teaching might take place, the teacher must be willing to make decisions based on addressing the constructs.
An Effective Classroom

The pursuit and acquisition of knowledge has long been the focus of education in the American classroom. Students must knowledgeable about math, history, science, geography, literature, music, and writing, and be sufficiently skilled to apply and use this knowledge. However, knowledge and skill do not necessarily guarantee understanding. It is possible to acquire knowledge and demonstrate routine skills without understanding the knowledge base or when to employ the skills. Knowledge and skills that are not understood do students little good. The dissemination of information should not be the sole and primary goal of instructors; at least equal time should be given to how students think and process such information. Teachers must teach understanding in order to realize the long-term payoffs of education.

Engaging Instruction for the Extended Period

The hope for the manual is to assist teachers to involve students in activities that engage them more deeply and thoughtfully in subject-matter learning. Through carefully designed tasks, students are encouraged to think through concepts and situations, rather than memorize and regurgitate for a quiz or test. Contained within the strategies are processes that cause them to think, and the products produced are the result of manipulation of acquired knowledge. The student is given the immediate opportunity to use the knowledge. “If transfer of learning from students is desired then we must engage them in thinking centered activities immediately” (Perkins, 1993). “In student centered instruction, the student, not the teacher; becomes the ‘maker’ of knowledge. Students discover on their own what teachers under most circumstances are accustomed to ‘revealing’ to students” (Boyer, 1996, p.25).
Research indicates that teachers who are familiar with different models of teaching are more likely to create teaching environments where students are active learners: They are more willing recipients of knowledge and engaged in the learning process (Rettig & Canady, 1996). Using a variety of teaching methodologies has improved classroom results. “Schools in which active learning methods were widespread had significantly resulted in higher achievement as measured by the National Assessment of Educational Progress” (Queen, 2000, p 7). The block schedule’s extended period can work as anticipated by its proponents. Gunter, Estes, and Schwab reported in 1990 that teachers found that the added time of the block schedule allowed them to design differentiated lessons in order to maintain greater student interest. Teachers are the “designers of meaningful student work” (Schlechty, 1990.)

When teachers expand their repertoire of teaching tools by understanding a multitude of teaching strategies they become more effective, professional, and adept at imparting knowledge to students and the students become more adept at understanding and retaining what is being taught. (Joyce, Weil, & Showers, 1996) Effective teachers work at improving student achievement and learning. One way to do this is by examining the usefulness of instructional materials provided for the class. Sizemore, Brossard, and Harrigan (1983) found that teachers in the school that they studied were active in adapting to better meet the needs of their students. They also found that teachers in less effective schools seemed to be controlled by the mechanics in the management aspects of their instructional systems.

*Teaching for Understanding*

When students are knowledgeable, they can bring the knowledge forth upon
demand. The student can express the knowledge or demonstrate the skill. However, to understand something requires explaining the essence of the knowledge or the concept in terms of another completely different concept. A student might be able to regurgitate reams of facts and demonstrate routine skills with very little understanding. The student just might be able to provide a definition but not necessarily relate it to an unrelated concept. Comprehension goes beyond just knowing.

Proponents of teaching for understanding suggest that understanding a topic of study is a matter of being able to perform successfully in a variety of thought-demanding alternatives with the topic. The more thought-demanding the performances in which the student can participate and the more opportunities to nurture and display understanding, the more certain it is that the student understands. Understanding something is a matter of being able to carry out a variety of performances concerning the topic. The strategies provide the stage for performances and the growth in those performances.

While understanding performances can be immensely varied, by definition they must be thought demanding; they must take students beyond what they already know. Traditional classroom activities are too lower-order oriented to be comprehension performances: spelling drills, true-and-false quizzes, arithmetic exercises, conventional essay questions, and so on. Such performance activities have their importance, but they are not performances of understanding; hence, they do little to build understanding (Perkins, 1993).

The High School That Works (HSTW) initiative of the Southern Regional Education Board (SREB) has identified eight factors that help students learn and raise student achievement. One of those eight is that “Teachers should engage students in
completing challenging assignments” (Bottoms, 2000). HSTW’s data showed that at 45 of their most improved sites, teachers indicated that they were lecturing less and their students spent more time being active learners. Teachers had students writing and discussing explanations of concepts, using knowledge and skills to solve problems, and telling others what they had learned. This was accomplished in part by using more student-centered learning strategies (Bottoms, 2000).

Summary

Good teaching is less about what the teacher does and more about what the teacher gets students to do. The teacher must arrange for students to think about the ideas they wish for their students to learn. Unless students have time to think about the ideas they are learning, they are not likely to build a command of understanding. Learning for understanding requires not just taking in what one is hearing; it requires thinking in a number of ways about what was heard. It requires practicing and debugging one’s thinking until the right connections are made. It requires the learner to generate new knowledge. Perkins (1993) writes:

Knowledge tends to be glued to the narrow circumstances of initial acquisition. It is all too easy to conceive of learning with understanding as a matter of taking in information with clarity. If only one listens carefully enough, then one understands. If the transfer of learning from students is desired then we must engage them in thinking centered activities immediately. We must seize the moment to cause the student to think and to understand (p. 23).

Most traditional direct instruction classroom activities are not comprehension
performances. They are usually knowledge building or routine skill building. Knowledge building and routine skill building are important; however, if knowledge and skills are not understood, the student cannot make good use of them.

When classroom activities or performances which require understanding, such as interpreting a poem, designing an experiment, or tracking a theme through an historical period are offered in class, they are usually inadequately designed by teachers, as they typically lack sufficient guidance as to criteria. They lack sufficient feedback before the final product is produced, which may have made the product even better, and few opportunities to truly to stand back and reflect on their progress. To learn effectively, students need criteria, feedback, and opportunities for reflection from the beginning of any sequence of instruction (Marzano, 2000)

“The success or failure of any block schedule will be determined largely by the ability of the teachers to harness the potential of the block and improve instruction. ‘THIS IS OUR CHALLENGE!’” (Canady, Rettig, 1996, p.27). The extended period presents teachers a special challenge beyond that already present in teaching in a traditional schedule.
CHAPTER 3

INTRODUCTION

This chapter presents the manual of instruction that is proposed as the centerpiece of this work. The extended period of time provided by a block schedule presents classroom teachers the opportunity to offer challenging and enriching instructional activities. These activities when designed and presented properly permit deeper connections and understanding of curriculum. As stated previously in this work, a problem cited by teachers who have moved to the block schedule is that they lack a variety of effective strategies to utilize with their students. In some instances they also lack professional development and resources that help them plan and design such desired instruction. The efforts of this work and study are meant to address in some small measure these areas of need.

A key goal for this dissertation was to structure and write a manual in a manner that makes it useful and practical for teachers who are trying to instruct in an alternative instructional period. The primary audience is educators that may be moving or have moved to block scheduling. While the manual and its targeted audience are those involved in some form or some type of extended instructional period, the content of the book, especially the strategies and the activities that are included, are student-centered and lend themselves to teaching in any schedule.

Introduction to the Manual

Chapter 4 is designed to be the crux of the efforts of this writer. The manual is meant to be a guide to design more effective and challenging instruction by accentuating three instructional models, Problem Based Learning, Concept Attainment, and
Cooperative Problem Solving. Each of the three models are featured and explained; sample activities that illustrate the models are also included. The samples are modeled in the four major curriculum content areas, of Math, Science, English (Language Arts), and Social Science. The purposes for including these content areas is to show that the models are generic; and in the instance where teachers may just need to see how an activity is designed, the teachers have a concrete model displayed to help them design their own activities.

The manual also contains the necessary instructions that enable teachers to design their own activities in other units of study. The sample activities are immediately usable by the teacher and the strategies may serve as ideas to replicate activities in other units of studies and other content areas.

The three strategies of Concept Attainment, Cooperative Problem Solving, and Problem-Based Learning are important and desirable because of the cognitive operations they require of the students. Incorporated in these three strategies are thinking and learning processes such as analysis, creative thinking, problem solving, and decision-making. The activities also provide complex and authentic tasking. Complex tasks permit students to work at challenging learning activities and apply recently acquired knowledge. Authentic tasks provide students with real-world applications of new knowledge. Teachers charge students to work in these learning situations, enabling them to stretch to find ways other than memorization to retain that knowledge. Such procedures may permit students to increase their understanding of subject material. Additionally, the tasks and cognitive processes in which students engage allow for a variety of learning styles. Students can work collaboratively on various activities. Finally,
these strategies permit students to interact with the content in a manner, which can create new understanding and connections to the material, and places the knowledge in long-term memory.

How to Use This Manual

Descriptions, explanations, and examples of lessons are exhibited for each of the three models. The manual is organized into three sections. Section 1 features the model of Problem Based learning. Section 2 features the model of Concept Attainment. Section 3 features the model of Cooperative Problem Solving.

Due to the nature of the models no sections are exactly parallel in how they were written. However, it is possible to summarize the commonality among the features of each section. Each section begins with background information about the particular model. This information may contain a definition and description of the model. It may also contain historical information, a rationale for its use, and the role of the teacher with this activity. Information about how to construct an activity is also given. Finally, each section contains pertinent research when available about the model attesting to its effectiveness.

Following the presentation of this background knowledge, the sample activities are presented. The four major content areas are all represented with at least two sample activities each for the content areas of Math, Science, Social Science, and English. The activities are designed to be different enough to demonstrate various ways that the model might be employed. A description of the activities also appears in this section. Brief explanations and the purposes of the actual activities are included. Finally, each model contains a summary section. Final words and thoughts about the model appear and
additional strategies for using the model are also given. Application in the classroom is also discussed. The manual contains a total of 28 activities. There are activities presented for the PBL model, eleven activities for the CA model, and nine activities for the CPS model. These activities are written for use by Math, Science, English (Language Arts), and the Social Science teachers.

The first eight activities in the manual are written to demonstrate the Problem Based Learning model. A brief narrative appears with each activity that explains the nature of the activity, including information about the learning task that is presented in the activity, and also gives instruction as to how the activity is to be carried out. Some PBL activities include a worksheet that accompanies the particular activity, for other activities this is not a necessary component.

Eleven Concept Attainment activities are featured. Again these are meant to be usable lessons in the four academic curriculum content areas. It is suggested that the activities be re-typed or reproduced in a word processing program. Using a font that permits the students to clearly view the material, a teacher could make transparencies to use on an overhead projector. If the technology of “Smart Boards” is available, this would be an ideal method of presenting the strategies included in this section. Suggestions of exactly which format to use to present the lesson are given and the classroom teacher will make an individual choice. Unlike the PBL model, information that is vital to understanding each CA activity is included for the teacher’s use; this permits teachers to correctly utilize the specific activity and to also follow the rationale of the author in designing a CA lesson. This information delineates the positive attributes from the negative attributes of the concept.
The manual’s third section features nine Cooperative Problem Solving activities. This section differs in that solutions to the problems are provided for the teacher. Some solutions appear in the narrative that accompanies the activities and other solutions appear in the appendix. Several activities in this section have accompanying worksheets, but for others this is not a necessary component. To utilize the activities in Cooperative Problem Solving, it is recommended that the teacher reproduce the clues to the activities. Each clue should appear and be presented to the students in a separate or isolated format, e.g., on an individual sheet of paper or card. This is important for the very nature of a CPS activity.

Summary

Proposals appear in this chapter that permits the classroom teacher to design engaging instruction. The models presented and the sample activities that are included help a teacher transform a classroom into an active one where students are busy and involved in higher cognitive level tasks. Ideas and suggestions for designing an activity appear. Ideas and suggestions for using the activities also appear. This manual is meant to serve as a guide for teachers looking for the means to alter their instructional delivery, especially on a block schedule where more time is available in the classroom. When paired with a teacher’s own abilities of ingenuity and creativity the manual then becomes a useful resource. Teachers who may not think they have the creativity to construct their own lessons need to consider the following. Teachers at the secondary level are usually experts or near experts with their subject matter. These teachers design lesson plans, put together lectures, make worksheets, develop projects, coordinate visual displays about the subject matter. They create test (essay, short answer, true-false, and multiple choice)
questions; in other words teachers create varied tasks for their students routinely as part of their responsibilities. It is realized that sometimes teachers rely on textbooks and accompanying materials but it is also common practice for teachers to modify these materials. Teachers are fully capable of using this manual in much the same manner. Once teachers tinker with the designs they can create their own. And it is not necessary to teach in isolation; teachers should collaborate with colleagues thereby subscribing to the old adage “two head…” Also after facilitating this type instructional experience for their students, teachers will want to permanently incorporate these types of learning tasks in their methodology of instruction.
CHAPTER 4
MANUAL of STUDENT CENTERED INSTRUCTIONAL STRATEGIES
for TEACHING in the EXTENDED PERIOD

Problem-Based Learning

Problem-based learning (PBL) permits students to work with the information they are expected to learn. The teacher does this by creating problem scenarios. Inside these scenarios are tasks that require students to use the knowledge that they are expected to learn in the world from which that very knowledge comes. Although it can be done as an individual student assignment, PBL is very effective when done in small groups or teams. Students, when given an assignment, will learn to break up the work that the assignment requires and share that workload. This teaching model transforms the traditional classroom where students are usually told about the information and are expected to be able to tell it back to a classroom where students are active learners. They actually are able to manipulate the information and thereby come to a better understanding of the information.

Problem-based learning is an instructional method that challenges students to analyze the situations in which they are placed and offer solutions to problems. Students do this by thinking critically, by finding and using appropriate learning resources, and by working collaboratively with classmates. Through PBL, students learn to problem solve and to develop their critical thinking skills. The teacher designs curriculum and learning for a specific problem, a question, or a puzzle that learners are asked to solve. Problem based learning is … “the means by which new knowledge is introduced and learned”
History of PBL

PBL instruction was first developed and used in medical colleges for medical students by medical educators. In the 1950s, Canada’s McMaster University Faculty of Health Sciences and later Harvard University School of Medicine became the first two schools respectively to use problem-based learning to help medical students become doctors. In the 1980s other medical schools of universities in this country as well as abroad begin to use PBL instruction as a means to help deliver desired learning to their students. In education, PBL instruction was first used to train prospective school administrators. Teachers may choose to utilize it in their classrooms.

The PBL Problems

The problems are used as stimuli for student learning. In the process of struggling with the actual problems the students learn content. The problem may be so structured that it is representative of how, when, and where the knowledge is expected to be used. A problem is so structured and so posed that the answer is not immediately reached. However, a solution, or solutions are obtainable. The problem should be complex enough to cause students to create, test, and settle on options for reaching a solution and to require significant effort on their part.

The problems place students inside simulations in which they use the content that they are expected to learn and use. They are asked to operate as professionals would, the way the real world brings problems. They confront problems as they appear and occur--sometimes with unclear options, insufficient information, and always with the challenge to determine the best solution possible. This is the manner in which professionals are
expected to operate. Lawyers, doctors, and engineers are expected to perform their work when confronted with real world problems. In their work, they use their knowledge and expertise and are expected to find paths to take, develop favorable responses, and work out favorable solutions.

As an instructional strategy, PBL has the following characteristics: The problem is similar to what the real world might bring within the discipline that is being studied. This is a key to creating or finding the problems. The instructor has to think about where the knowledge to be acquired by the students is ultimately to be used. In one of the sample math activities, a fictitious band trip is featured, providing the perfect real world setting to do a lot of math. The problem presents students with the opportunity to develop and display their own knowledge and understanding of the content. Most of the learning takes place within the group’s research efforts and the exchanges that occur in small collaborative teams (Bridges, 1992).

Role of the Teacher

The teacher’s role in PBL is to find, develop, and present problems to the class. They must learn to construct problems that assist students to learn appropriate skills and knowledge. Preliminary work must be done when designing the problem, ensuring that there are enough resources available. A fundamental adjustment that must be made by teachers is that they must learn to facilitate, rather than direct, student learning. Teachers attempt to motivate student initiative, empower students, and develop PBL activities that will allow them to transfer knowledge.

The teacher can use either of two formats. The first format is called problem-stimulated learning. The teacher provides the problem. Along with the problem the
teacher can present direction for the students, such as tasks to be done, questions to be answered, and resources to be used. This approach is more directed. The second approach is student-centered learning. It is similar to problem-stimulated learning but differs in that the teacher does not specify resources, steps to be taken, and, at least initially, does not require students to arrive at answers for certain inquiries. The degree to which a PBL course is student-directed versus teacher-directed is a decision that the faculty member must make. Factoring in such a decision may be variables such as class size, the intellectual maturity level of students, and the instructional goals of the course.

The instructor must guide, probe and support students' initiatives, not lecture, direct, or provide easy solutions. When instructors incorporate PBL into their courses, they empower their students to take a responsible role in their learning and, as a result, they must be ready to yield some of their own authority in the classroom to their students.

*PBL in Action*

If involved in a well-designed PBL activity, students will first become engaged with the problem. Interest will cause students to immediately think about how to solve the problem. They will devise *modus operandi* in which to take on the problem. Students will divide and take on assignments necessary to work through the problem. The process usually forces consideration of different perspectives. The students will monitor and assess their own progress. The group will revisit the problem and decide on new courses of action. Construction of a solution comes from the information gathered. Once a solution is reached or a new product completed the group will assess its accuracy.

Students solve the problems; teachers are to be coaches and facilitators. Usually students are given only guidelines for how to approach problems, as there is no one
formula for student approaches to the problem. In working through the problem, students must re-organize their thoughts and data in new ways.

Problems in Implementation

Cultural change is required to implement PBL. Students trained in the more traditional model of teaching, which features the teacher as the disseminator of knowledge, will usually need to make some adjustments. Students must learn to be part of the group. As with real life tasks, one person cannot conduct all research and make the entire presentation of the problem solution. Complaints about riders, those in the group who do not make sufficient contributions, might occur and teachers must have strategies to cope with these types of problems. One solution might be group evaluation and assessment sheets where group members rate each other’s efforts. The entire assignment could be valued at a specific point total. Points could be earned for different phases of the PBL assignment.

Problem-Based Learning Research

As a recommended instructional model to be used in the manual, the author conducted a search to see how well PBL performs. The purpose was to uncover research findings on the merits of PBL as a worthwhile instructional strategy affecting student achievement. Student achievement is the major outcome focus for the research on all three models presented in the manual. Student achievement, while not the only desirable educational outcome, is the one outcome that is regarded by the public as indicative of successful instruction. Results of the search revealed that there are not a lot of studies that measure how PBL instruction affects student achievement. However, two sources are reported that enable the users of this manual to decide if PBL has merit for their
particular classroom. The sources are not pure indicators for secondary classrooms but users can decide if transfer would be feasible and effective.

*Research findings from medical schools.*

Bridges (1992) compared PBL classrooms with traditional instruction classrooms along the following variables: student attitudes toward the instructional environment; student approaches to studying; career preferences; completion times and rates; knowledge of basic disciplines; clinical competence; and study loads. PBL classrooms were rated more positively in terms of how students felt about their learning and classroom instructional climate than traditional instruction classrooms. Students in PBL classrooms took the knowledge they were expected to learn and adopted a “meaning orientation as opposed to a reproducing orientation adopted by the traditional instruction students” (Bridges, 1992, p. 15). In other words, PBL students were more likely to care and try to understand the subject material they were being taught. Traditional students were more likely to become specialists while PBL students were more likely to become primary care givers. These are viewed as more desirable career preference outcomes for medical universities. PBL students took less time to complete their studies and did so at a higher rate than did their study counterparts. There were no detectable differences in study loads and a small difference in clinical competence with the scales slightly tipping in the favor of the PBL programs.

Finally, on tests of medical knowledge, the results favored the traditional programs slightly over the PBL programs.

In light of the cognitive rationale advanced for PBL, I had expected results that clearly favored students in PBL programs. On tests of medical knowledge,
students in the traditional programs scored higher than students in the PBL programs but the differences were small (Bridges, 1992, p. 16).

*Research findings from a middle school study.*

One hundred and thirty five eighth grade science students were part of a study to investigate the extent to which problem-based instruction affects student performance when compared with students receiving standard instruction on the same topic. Also of interest was whether as much curriculum could be covered successfully, as measured by student achievement, using a problem-based learning (PBL) format as opposed to standard based instruction.

The area of the curriculum used for the study was a 15-day unit on genetics. The 135 students came from one gifted class, two standard instruction classes, and two PBL classes. The unit was closed, with students taking an end-of-unit group test. Three impartial teachers graded each of the participants’ tests. Each student was graded three times and the three results were then averaged to get a student average. Students’ averages were totaled and then divided to get a class average.

The PBL classes were experienced in working with PBL units. They had both worked in two other PBL units earlier in the school term. The standard instruction classes consisted of lectures and lab experiments. The gifted class studied the genetics unit with considerable more attention to details and specifics.

Standardized test scores, both verbal and quantitative, were obtained to establish a base for comparison as to the skills and potential ability for these students. The standardized scores for all students in each class were first totaled and then divided by the number of students in that class to get a standardized average score for each class.
Averaged scores for the group tests were also totaled and divided to get an average and were also used for comparison.

The gifted class outscored both the PBL classes and the standard instruction classes when comparing the standardized test score average and the genetics test score average. However, the two PBL classes outscored the two standard classes on the unit test performance. The standard instruction class’s standardized averages were 17 and 21 points higher on verbal intelligence than the averages on the same test for both PBL classes. However, that class’s performance on the genetic tests was lower by 6 and 17 points, respectively, when compared to the genetics test scores of the two PBL classes.

When the standardized scores for the standard instruction class were examined it was learned that the averages of both PBL classes were higher than the second standard class by 9 and 13 points. After comparing the unit test scores of the second standard instruction class with the two PBL classes, the two PBL classes outscored that class by 4 and 17 points, respectively.

As for the benefits of PBL, we believe this study as well as the responses we have received from students indicates that PBL does increase higher-level thinking skills by asking students to think about a given problem more critically and to analyze data to derive a solution (Kynock, K. & Robb, L. 2002, p. 24).

Further studies need to be conducted to more accurately determine if PBL does positively affect student achievement, particularly of high school students, as this particular study focused on middle school students. The strategy certainly does not impede student success. The favorable results of this small study and the outcomes that typically result from PBL instruction would seem to give an affirmative thumbs-up to the
use of problem-based learning activities. The desirable characteristics of PBL lessons, specifically collaboration of students, problem solving, the authentic nature of the problems, and the complexity of the tasks usually result in increased engagement by students are in themselves attractive enough to make implementation of PBL activities feasible.

**Problem-Based Learning Sample Activities**

The activities that follow serve as examples of problem-based learning. Teachers can choose to follow the format strictly or they can modify the techniques as they choose. Not every conceivable way the model can be used is depicted here.

All of the activities follow the design of sound instructional planning for the classroom. All activities will have a topical subject area focus and educational objectives. With the specificity of the topic, teachers will be able to identify specific instructional objectives related to the content. In addition, all of the lessons possess some common educational objectives, causing students to work at higher cognitive processes such as problem solving and critical thinking. Students will see the use of their learning in real-world applications. Students are also advised to work collaboratively at the tasks.

An important instructional step of every activity is that each activity be debriefed and reflected upon meta-cognitively. Have students explain how they worked through the activity. Have students talk about when the concept became clear for them. Have students talk about the process as individuals and as a group. Allow students to comment on any revelations or understanding that they picked up during the activity. Have students share ideas as to how they might work differently the next time in a similar situation.
The Activities

As a feature of this manual, the author has written sample activities that perhaps can be utilized by a teacher and also guide the teacher in constructing similar activities. In this chapter, eight activities appear, two that are math oriented; two that are science oriented; two activities that might be utilized in the English (Language Arts) curriculum; and two activities in the Social Science curriculum. The samples permit teachers to see how PBL activities are crafted …their conception and construction.

The first two activities, “Elements of Literature” and the “America’s Top Ten Literary Figures” are designed for use in the English curriculum. The next two activities “Survival in the Amazon” and the “Cloning Controversy” are designed for use within the Science curriculum. “Profiling your Community and White House Planning” are linked to Social Studies curriculum. The final two PBL activities are Math oriented. They are titled “Air Patrol” and “Spring Band Trip.”

“Elements of Literature” is designed to familiarize the students with the properties and characteristics of effective literature. The scenario requires the students to role-play using curriculum content. They are asked to define and synthesize their understanding of the different elements of literature. Specifically they are comparing television shows to written works of literature; using characteristics and principles found in written literature. The students working in groups will decide how to proceed and work through the task.

“America’s Top Ten Literary Figures” is another activity whereby students work with the properties and characteristics of literature. The lesson scenario also requires the students to role-play using curriculum content. Specifically, they are to create a survey
instrument that demonstrates their understanding of literature, literary devices, and good writing.

“Survival in the Amazon” is a Science Problem Based Learning activity. This activity is designed to familiarize the students with the environment in the Amazon rain forest region. The students will broaden their knowledge base of the indigenous life, climate, and terrain of the Amazon rain forest region. The scenario requires the students to role-play. The activity requires that students plan, research, and problem solve as they work through the activity. Specifically they are researching a region of the world; looking at its biological and geographical data.

“Counseling the Cloning Controversy” is also a Science Problem Based-Learning activity. This activity is designed to familiarize the students with the concept of cloning and stem cell reproduction and specifically they are researching the concept of Cloning (stem cell research.) The scenario requires the students to role-play. The students are members of a law firm hired to defend the controversial practices of cloning and stem cell research. The activity demands that the students plan, research, and problem solve as they work through the activity.

“Profiling Your Community: ‘A Study in Local Government’” is a Social Studies Problem Based Learning activity. The students will develop a better understanding of their community, its complexity and the role of government. The students will broaden their knowledge base of their community. The scenario requires the students to role-play. The activity demands that the students plan, research, and problem solve as they work through the activity. Specifically students will research their community and become more aware of their surroundings. The students working in
groups will decide how to proceed, to channel assignments, and to work through the task.

“White House Planning.” is another Social Studies Problem Based Learning activity. This is an activity that permits students to look at one perspective of the President of the United States. The students will broaden their knowledge base of the expectations and demands placed on the President. The students will have a better understanding of the varied range of activities and actions required of a leader. The scenario requires the students to role-play. The activity demands that the students plan, research, and problem solve as they work through the activity. Specifically they will analyze and examine possible tasks and events the president might encounter. They will also learn about the concepts of planning and prioritizing.

“The Air Patrol” is a Math Problem Based Learning activity. This is an activity designed for using and applying math skills. The students are required to operate at high thinking levels such as problem solving, analysis, and synthesis. The student will see the use of their skills in real world applications. The students will work through the task collaboratively. The scenario requires the students to role-play as a firm hired to create a reference chart that aids the highway patrol. The stimulated learning activity demands that the students apply problem solving skills and mathematical skills as they work through the activity. Specifically the groups will decide how to calculate the values that the problem demands. They will also decide on the design of a chart for the final product. The students will work in groups and will decide how to proceed and work through the task. Groups may choose different routes and strategies. The teacher could require or the students could opt to use a spreadsheet program.
“The Spring Band Trip” is a Math Problem Based Learning activity. This is an activity designed for using and applying math skills in real world situations. The scenario requires the students to role-play in a problem stimulated learning activity as a “band booster group.” The activity demands that the students apply problem solving skills and mathematical skills as they work through the activity. Specifically the students will decide how to calculate the values that the problem demands as they plan for the economic and financial realities of a high school band trip.
Sample PBL Activities

**Elements of Literature**

The students are divided into teams. The teams are hired by the MESS (“Meeting and Educating Students in their own Settings”) organization. The aim of MESS is to defend television as a viable form of media. The members of MESS feel that television programming, its writing and scripts are not fully appreciated and valued; and traditionalists in the study of the language unnecessarily ridicule them. Each group’s mission is first to develop a rubric based on the elements that are traditionally present in literature. Then the team is assigned to watch seven television dramas, one for each night of the week. Using their rubric, the team will comment on the presence and incorporation of the following literary elements: character, setting, theme, plot, climax, rising action, falling action (anti-climax), local color, atmosphere, characterization, conflict, mood, suspense, point of view, foreshadowing, symbolism, and complexity. The group will list the seven shows watched. Each group has to design a rating sheet that can be used by the public. The rating sheet must list and define the literary elements. They are to analyze and comment on the presence of the literary elements that they were able to observe in the programming.
America’s Top Ten Literary Figures

The students have been brought together as outstanding literary specialists and hired to perform a task for the American Library Association (ALA). The students are placed into teams. Each team is hired to conduct a “nationwide campaign to create a list of America’s top ten literary figures for ALA. The teams will be required to report and publish their findings. The nominees can come from any genre of writing, novels, poetry, prose, short stories, etc. The students are to come up with strategies to make this happen.

In this simulation they are told that the included audience surveyed must be national in scope. The students are to develop criteria and then a rating sheet (or some type of instrument(s)) that they use to develop the top ten list. The teacher can give lists of American literary personalities in the different types of writing and the students can narrow from those selections. The group is told that have a window of three months to accomplish this fictional task. The teacher decides the length of time allowed for this student centered learning problem.
**Survival in the Amazon**

You and three of your friends comprise a team selected for a reality television series. There are two other competing teams. The winning team will receive one million dollars. To win the contest, you and your team must survive 60 days in the Amazon jungle. You can have a party of up to 15 people but no fewer than 12, which includes your team members. The rules of the contest allow your group to take 10 items and only 10 items on this trip. No one item can be larger than a refrigerator. A box of matches counts as only one item. Two guns would count as two items. Additional foodstuff is not an option; however, there is enough food for 10 people to eat three meals a day for 15 days. However, you could choose to take seeds. There is only enough fresh water for five days. You must justify the items that you select with your rationale. You may submit three options as to where you would like your group to be dropped off. The producers of the series will select from one of the three choices that you provide. You must use the Internet for your group’s research. The members of the team outside your original group can possess one special skill and you may select them for that skill. No more than two members may have the same skill. Be able to justify your selections. One person is a mole for the producers and has the mission of sabotaging the group’s efforts. Develop a plan for survival!
Counseling the Cloning Controversy

A group that advocates the legalization of cloning has retained your firm. The group has to appear before a congressional committee. The committee is considering legislation that will affect the future of cloning in this country. Generally, your task is to defend the concept and practice of cloning against its opposition. Specifically, your firm’s responsibilities include preparing a brief that justifies cloning; promote its merits, and its potential benefits for mankind. You must prepare an electronic presentation for the committee that defines cloning and stem cell reproduction. Your group also needs to research legal issues. The group also expects your firm to anticipate the arguments against cloning and to prepare defense and rebuttals. Be certain to anticipate objections from the religious community.
Profiling Your Community

Your group’s task is to research your community. You are to locate and identify entities that exist in your community other than private individual residences. However, apartment complexes are to be charted. The groups are to chart businesses, industry, government, and civic organizations. In addition to creating a chart that maps all of the entries from their research, the students are to develop an individual data form for each site that they depict. The students are also to create a master chart categorizing and subcategorizing the different types of organizations that they discover.
White House Planning

You work on the White House team with the White House Chief of Staff and the President’s Press Secretary. You have a basket of index cards in front of you. The cards contain “in the very near future” appointments, engagements, requests, and responsibilities. Using these in-basket activities, your group’s mission is to prioritize, respond, and schedule for the President. In addition, you are to prepare strategies and position statements for the following items, 1, 2, 3, 4, 5, 7, 9, 10, 12, 13, and 14.

“In Basket Scenarios”

1. The President must fly to Europe to address NATO. He is trying to recruit Allies and support against Iraq.
2. The President must meet with party leaders.
3. First speech before the UN to solicit support for “War on Terrorism.”
4. Meet with business leaders in the oil industry.
5. American Hispanic leaders ask for meeting with President on relaxation of border scrutiny.
6. A National Security Council briefing on potential terrorist targets in America.
7. Invitation for the Kennedy Center to attend special awards ceremony for Tom Hanks, Demi Moore, Meg Ryan, and Denzel Washington.
8. Invitation to speak at University of Michigan commencement.
9. Invitation to speak at the Wichita Falls Elementary School PTA.
10. Arab-American community leaders want to talk about profiling and bigotry.
11. Daughter’s dance recital on Thursday night.
12. President has news conference to brief the nation on strategies to boost ailing economy.
13. David Bigbigot, head of the notorious ultra right wing Keep America Pure Movement has asked for an audience to meet with the President.
The Air Patrol

Your team works for the Highway Patrol. The patrol has decided to experiment with using aircraft to enforce speed limits. White bands are painted on the highway, spaced two-tenths of a mile apart. The particular stretch of highway you are calculating has a 65 M.P.H. speed limit. Your team is to calculate acceptable and unacceptable times to travel these bands. If a car is going too fast, it will be radioed from the plane ahead to patrol cars for action. To avoid confusion and the potential for human error, a five-mile grace buffer exists for each speed zone. To further explain, a car traveling in a 55 M.P.H. zone will not be cited unless the car is deemed to be traveling at a rate of 61 M.P.H. or higher.

**Task 1.** (In a 65 mph zone) Car A travels through the zone in 11 seconds; Car B travels through the zone in 9.5 seconds; Car C travels through the zone in 13 seconds; Car D travels through the zone in 12 seconds; and Car E travels through the zone in 10 seconds. Which cars are exceeding the permitted speed limit?

**Task 2.** Reckless driving is deemed to be traveling in excess of 75 m.p.h. What is the minimum time to be driving at a reckless rate through the zone? Reckless driving is deemed to be traveling in excess of 15 M.P.H. over any speed limit. What are the times for the 45 M.P.H. zones and the 55 M.P.H. zones to for which one would be charged with reckless driving?

**Task 3.** Your team has been asked to create a usable chart for a 45 M.P.H. zone, a 55 M.P.H. zone, and a 65 M.P.H. zone. It should depict speeds and acceptable times to travel through the “bands.”
The Spring Band Trip

You are a member of the ACME High School Band Boosters. You have been asked to serve on a planning committee for a spring field trip for the band. Your committee must give a report to the large group in one week. The report must be comprehensive with specific breakdown of financial activity. Please include a breakdown of transportation, lodging, and meals. Also prepare a report on the fund raising activity that the boosters must do.

The school band was raising money for a spring field trip in April. The actual dates for the trip were April 16-20. The band consists of 110 members. The band will need 3 charter buses to accommodate an entourage of 134. The additional numbers are for the 2 instructors and 22 chaperones. The individual cost for the trip is estimated at $295 per person. This includes the cost of transportation, lodging, meals, and entertainment.

The band started with a $0 budget for this activity. They start on January 2. The trip is to last five days. The total cost of the trip can be calculated by multiplying the individual estimate per person by the 134 persons who will make the trip. The goal is to raise 100% of the money for the trip and not one person have to pay out of pocket.

The band is using several fund-raisers. The first fundraiser is expected to raise 53% of the money. That comes to a total of $___. The fund raising company gets two dollars for every unit of candy sold. The boosters have calculated that they need to sell an individual unit at three dollars and seventy-five cents. How many units will the band have to sell and gross a total of at what price to raise the necessary money? All members are expected to sell a minimum quota. How many units will each member have to sell?
Fundraiser number two is to sell hotdogs at the 10 home basketball games. Three of the games were played in the month of December before the fundraising activity began. Twenty per cent of the money needed is to be raised by this function. Hot dogs will be sold at 50 cents each. The overhead to produce the hotdogs comes to $1.35 per dozen hotdogs. How many hotdogs will they have to sell to earn the necessary money?

Fundraiser number three is the sale of stadium cushions. The boosters have ordered 1500 cushions. The remaining money for the trip is to be raised through this activity. The boosters had to pay a flat fee of $975 to the distributor of the cushions. What was the cost of a single unit? What price will the boosters have to sell the cushions to recoup the money they paid for the cushions and to earn the remaining money for the trip?

The hotel will give the band a room rate of $45.00 per day plus an additional rate of $2.50 for each additional person staying in a room. The rate includes all taxes. The maximum number that can stay in the room is four persons. Chaperones will stay no more than 3 persons per room. The trip will require four nights of lodging. A down payment of 25% must be sent to the hotel by March 16, it is non-refundable after April 1.

The bus company wants a 10% down payment at the time of booking. Fifty percent of the contracted fee must be paid one week prior to the actual trip. The remainder must be paid on the morning of departure. The initial charter fee for one bus is $1200.00 per bus. There is an additional rate of $150.00 a day (after the first day) for each bus. The drivers are usually tipped 10% above the cost of the bus that they are operating.

The band consists of 62 females and 48 males. The drivers must get individual
rooms. The instructors will room together. There are six married couples with each
couple having their own room. Among the remaining chaperones, there are two more
female chaperones than male chaperones. Chaperones will not room with students with
only one exception; a mother will room with her twin daughters.

The meal allotment is $25.00 a day per person. There are outings planned for
three of the four days with a shopping spree planned on the first day of arrival. The band
has to perform and compete in festival events the second day of the trip. A movie on that
second night is planned at $7 per person. A spring training baseball game is planned for
the third day, again at a cost of $7 per person and a $14 boat ride around the bay is
scheduled for later that evening. The fourth day’s entertainment is a day at an amusement
theme park. All day passes will be supplied at $45.00 per pass. Use graphs to break down
the percentage of money going to the different phases; and display the expenditures.
PBL and Constructivist Principles

Problem Based Learning activities are grounded in Constructivist principles. First there is no one correct answer and students are told this from the outset. Therefore students must create their own understanding of the knowledge that they work with as they arrive at a solution. The problems engage the students with the content. They are required to make their own connections. The problems are simulations from real life and as students take the problem on the students step by step work with the knowledge and content. They blend the new knowledge in front of them with prior knowledge to work through the problem. In the process of working with the current content and the already acquired knowledge they create new knowledge and understanding for themselves.

Fine-tuning the PBL Experience

A common problem that classroom teachers face with implementation of Problem Based Learning is the inexperience students have with working with such a methodology. Initially, the teacher may have to give more guidance to the students. They may have to be helped with how to “take on” the problem. A nudge by the teacher to get them moving is helpful. First, check to see if the students understand the problem. Have them talk about what it is they have before them and what they think they may need to do. The teacher may want to do this with the entire class on the first PBL experience or two. Teachers may want to establish that this is how they should take on future problems. Help the students understand they need to develop a plan of action.

Students may not always approach a problem as thoroughly or professionally as a teacher may desire. They may not predict or see issues that may affect their suggested
plan or the eventual solution. Their approach may be too simplistic or they not provide sufficient attention in the means of strategies and tactics. Their work at the problem may be inappropriate. The teacher has to monitor each group working in the activities and be prepared to put the students in timeout to discuss their progress. The teacher could do this either by walking around and observing or by having the teams report to the teacher at periodic points in the instructional process. This is not unlike real life as well.

Guidance and suggestions to resources needed and that are available may be presented by the teacher. Initially, a lot of assistance could be built in the directions given out by the teacher. As mentioned before this is the “problem stimulated approach. Ultimately, the students will become familiar with the process and these steps are the teacher need not provide this type of direction and assistance.

Creating the Problems

The examples demonstrated in this chapter are meant to show teachers just what PBL activities look like. This manual is certainly not meant to restrict the creativity of teachers to design their own problem-based activities. It is suggested that teachers think about situations in real life where the content they are teaching comes into play. With the content in one hand and the authenticity of real world application in the other hand, the teacher simply comes up with a simulation in which the students work with the two. Standard techniques such as making the students as an expert or professional group can be infinitely used.

Theory into Practice

Problem-based learning is an alternative instructional strategy that uses real-world problems as learning activities. The problems cause students to critically apply their
knowledge to the content. The problem drives the learning. PBL is a complex learning task in that students work with and manipulate the meaning of new knowledge. Problem-based learning is designed to extend comprehension of the curriculum. Students increase their understanding of a topic because they are required to stretch and adapt knowledge, thereby constructing new in-depth meaning to work through problems. Students are placed into groups and are presented a problem and asked to develop a solution to that problem. Students use a collaborative effort to work through problems. They develop options for the task and apply them to develop a solution, response, or product.

Problem-based learning is a more student-centered approach to learning. It is a move away from traditional didactic instruction. Students can use knowledge previously acquired and blend it with new knowledge gained from pertinent research. This approach brings the knowledge into play more rapidly than waiting and depending on real-life situations and circumstances to occur that call for application of the new knowledge.

Teachers can stretch their students with scenarios that cause them to apply knowledge beyond the manner in which it was presented. Teachers can take real-professionals who might have call to use the particular knowledge and use that group as the basis for a PBL activity (i.e. The PBL Cloning Controversy activity.) Teachers can also take real life situations that applies the knowledge just recently taught and use them as the basis (i.e. The Band Trip or The Air Patrol PBL activities.) The problem justifies the need for the knowledge and PBL allows students to practice with the knowledge immediately.

Problem-based learning scenarios do not necessarily contain one perfect answer. The problems are truly ill structured in that there is not always meant to be one solution.
As students attempt to solve the problem, new information is gathered in a reiterative process, previous perceptions of the problem change, and thus the solution may change. It is within teachers to create these scenarios; if teachers can write test questions then the same teachers can design PBL problems. Try it!

Concept Attainment

All teachers have to teach concepts in their work with students. This particular model can aid students in their understanding of a concept by requiring them to go through an inductive process. Students compare and contrast examples that contain characteristics or attributes of the concepts with characteristics of examples that do not contain those attributes.

Concepts are present in all disciplines and content areas that teachers teach. A concept is a collection of connected ideas that explain a phenomenon. In mathematics, one could be talking about the concept of counting numbers, or of ratios. In science, one could be talking about osmosis or forensics. In an English class, students could be expected to learn about modifiers or irony. In a social science classroom an explanation of propaganda might be given or a discussion of justice might occur.

If one examines the sequence contained in the preceding paragraph, it will illustrate how the traditional classroom teacher teaches concepts. The teacher announces the concept: “In today’s class we will study oxidation.” The teacher has just named or identified the concept to be learned. Next the teacher gives a definition or an explanation of the concept. Finally, the teacher will spend time giving examples of the concept. The reason the teacher uses examples are to make the meaning of the concept come alive. It
takes the concept out of abstractness so that students can make real-world connections. Students connect the new knowledge with previous understanding so that comprehension of the new concept becomes real.

A concept is thought to be generalized from making meaning and establishing relationships of examples of phenomena. Definitions of concepts appear in textbooks, in which authors take the content and explain the information concisely for their audience. Authors and editors carefully choose words that best explain the concept’s meaning. The definitions are exact and cover all aspects of the topic or concept. They are able to offer definitions because they have thought about the concept, analyzed and considered its attributes, understood its meaning, and finally put into words a meaning that captures the essence of the concept. The expert’s definitions offer explanation, meaning, and understanding.

The authors have worked with the material and shaped meaning. During this process of working with the thought surrounding the concept they gained comprehension. In the beginning the author has not necessarily been given a definition of the concept to gain understanding. Instead, the author has worked with and reflected upon the concept enough to gain insight and to translate that insight into words. However, this definition is the author’s understanding of the concept and this same understanding may or may not be gained by students. The connections and meaning that went into that definition belong to the author. It is shared with the readers of the book to assist and expedite their comprehension of the same material. Maybe the reader can make connections and gain comprehension by reading and working with the offered explanation. The teacher is hoping so.
The authors were able to formulate a definition because they are required to work with the ideas of the content area about which they have written. There is an expectation for them to explain various concepts to their readers. If students were given the same opportunity to work with the information that authors were given they would have to put the puzzle together as did the expert. This would give them the opportunity to formulate their understanding rather than just memorize someone else’s understanding.

Memorization of a definition does not guarantee comprehension. When students generate their own definitions as meaning they truly have understanding.

How Concept Attainment Works

Concept attainment takes the traditional approach outlined earlier and reverses the procedures. The examples one might use to illustrate the concept are presented first. They are revealed to students one at a time, a couple at a time, or all at once. It is left to the instructor as to how the lesson is to proceed. Information that does not illustrate the concept is presented as well. This gives students a base for comparing and contrasting the data before them.

From these examples and non-examples students make meaning of the positive examples. They are able to ascertain, or better yet, induce, what the examples have in common. They form a hypothesis that explains what they have induced. They test their hypothesis and to see that it holds true. When they verbalize their hypothesis, they in essence have created their own self-constructed definition of the concept. Finally, the teacher tells students what it is they have learned about by naming the concept they just studied.
Background for Concept Attainment

The design of the instructional model of concept attainment is based on the works of Bruner (Gunter, 1995). Bruner believed that students learn best by discovery and that the learner is a problem solver who interacts with the environment, testing hypotheses and developing generalizations. The goal of education should be intellectual development, and the teacher should strive and scheme to develop problem-solving skills through inquiry and discovery (Bruner, 1967).

As a constructivist, Bruner (1967) believed in discovery learning activities and espoused that knowing is a process, rather than the memorization of wisdom, as presented in textbooks. To learn concepts and to solve problems, students should be presented with perplexing situations. Energized by intrinsic motivation the learner in this situation will want to figure out the solution (Bruner).

Bruner (1967) felt that lessons should be designed to pique curiosity and cause uncertainty in order to help students be willing and able to learn. Concept attainment includes an element of uncertainty and ambiguity targeted for student curiosity. This curiosity provides a *predisposition toward learning* leading to intrinsic motivation. Bruner believed that the desire to learn and to undertake problem solving could be activated by devising problem activities in which students would explore alternative solutions.

Bruner (1967) indicates that learning happens sequentially and that instruction should lead the learner through the content in order to increase students’ ability to “grasp, transform and transfer” (p.18) what they learned. In general, sequencing should move from enactive (hands-on, concrete), to iconic (visual), to symbolic (descriptions in
words). The concept attainment model follows this logic. Students are presented with examples and non-examples, manipulate the examples to find an explanation, and then verbalize an explanation.

The Steps of Concept Attainment

First, the teacher describes the purpose of the lesson. The teacher may then explain how the activity works. This becomes less necessary if students are familiar with the model. If there are rules for how an activity is to precede the teacher would present them in the form of words, pictures, objects, equations, or symbols. There are different ways to handle this portion of the activity to add to its variety and mystique.

Teacher then ask students to focus on what is listed, displayed, underlined, circled, or highlighted. Then the teacher gives a positive example and a negative non-example and has students think about the information before them in terms of how they are alike and how they are different. The teacher should be careful not to ask students to focus on an attribute of the concept. This will short circuit the discovery process. For example, do not ask students to focus on the shape when teaching polygons.

Teachers should: (a) Tell students that they should be forming theories (hypotheses) about the positive examples and then be ready to add more positive examples and negative examples; (b) allow time for students to assimilate the new information or test students’ thinking by asking them to decide if the next example is positive or negative; (c) have students indicate thumbs up for positive and thumbs down for negative examples; and (d) test them against their hypotheses.

After allowing sufficient time for the activity, the teacher then asks for students to share their thinking and explain their theories. The teacher may help them refine their
words but it is best to coach and probe their own statements, which become the definition of the concept. The teacher then gives a name or label to the concept.

The teacher allows for true understanding by asking students to generate their own examples of the concept. Finally, the teacher has students reflect and talk about the process they just experienced and to indicate where they had difficulty as well as where they had breakthroughs. Constructivists feel that it is essential to have students think about their thinking. It prepares them for the next time that data come their way and they have to interact with that data.

**Designing a Concept Attainment Lesson**

The teacher selects a concept that is conducive to the concept attainment lesson format. The teacher then needs a clear understanding as to the definition of the concept chosen. With this definition, the teacher decides upon the attributes of the concept. In essence, the teacher is trying to capture those aspects, traits, and examples that help illustrate and explain the concept. Next the teacher constructs the examples to be used in the activity embedded with the attributes of the concept.

An example would be addressing the concept of *Democracy*. The definition of the concept might be that democracy is: *A system of government where there is political and social equality among the people. There is classlessness, at least in the way with which the government interacts and protects its citizens. There are rights, freedoms, and protections guaranteed by the government. The people have a voice in their government, its leaders, and its laws. They have some control over their destiny and they are the final authority.*

Using that definition, democracy has the following attributes that the teacher
could work with: political equality; social equality; an absence of class-ism; protection of its citizens; guaranteed rights; guaranteed freedoms; and participation in the government by its citizens. Working within that definition, the teacher could create statements that illustrate each of those traits. The following statements could serve as examples of things that happen inside a democracy. Each statement speaks to an aspect of life within a democracy:

1. Those with political aspirations must appeal and appease the voting public.

2. The American Voter Association is dedicated to registering and encouraging every able-bodied citizen to vote.

3. The Court ruled that the evidence could not be used due to an illegal search conducted by the police.

4. The Texas State Police must protect a person from Ohio traveling in or through Texas as well as they would a native Texan.

5. The parents were angry at the position taken by their school board member and vowed to work to unseat the member come the next election.

6. Dr. Martin Luther King, Jr. led a civil rights demonstration, in protest that some Americans were denied the same opportunities as other Americans.

7. The police protected the followers in Dr. King’s demonstration from an angry crowd gathered along the parade route.

8. Members have the right to protest or visibly dissent against the political system.

These statements could be balanced with the following statements that do not
correspond to attributes of democracy. The statements provide contrasts that emphasize the positive examples.

1. The Secret Police show up in the middle of the night and arrest critics of the current government.

2. The mayor of a city heads up the executive branch.

3. People weighing over 300 pounds have been decreed as unfit members of society and have six months to lose 50 pounds or face banishment.

4. Under Hammurabi’s Code of Law, if the arm of a slave was accidentally amputated then the following might happen: If the guilty party was a Plebian then the Plebeian’s arm was amputated as well. If the guilty party was a Plebiscite then he owed the owner five minas of gold.

5. Anyone voicing support for a candidate other than the current leader faces ostracism and could expect some type of retribution.

When using the concept attainment format teachers must select a method of delivery. A concept attainment lesson might mean presenting all of the examples at once, using a graphic organizer. A second option uses an opposite approach to the previous approach whereby the teacher produces a graphic organizer showing all examples, both positive and negative. The teacher labels only a couple of positive examples and a couple of negative examples. Students are to try to identify the remaining examples as positive or negative. A third option has the teacher writing down the examples on cards and distributing them to students, one card per student. At the teacher’s direction, students read their cards aloud. The cards are already labeled yes or no. The teacher can prepare an area on the chalkboard labeled positive and negative. As items are identified they are
recorded appropriately on the board. One final option that is uniquely different from the aforementioned methods is to give the definition of the concept to the students at the outset. The students then label the examples (positive and negative, or A and B) presented in the activity by working from that definition.

Using small learning groups, the teacher can deliver a concept attainment lesson using yet another technique. Students are given cards with an example of the concept or a non-example of the concept written on each card. However, the cards are not labeled yes or no, or positive or negative. The groups are given a complete set of cards. The groups work to sort the cards into positive and negative. The teacher needs to prompt students with an initial positive or two, as well as a couple of negatives. The teacher moves around to check student understanding and listen to their hypotheses.

Conducting a Concept Attainment Lesson

The teacher presents the examples and non-examples, a matched pair at a time. Or all at once! Students look at the positive examples and determine what they have in common with one another. The negative non-examples do not possess this same relationship and serve as a contrast to the positives. Students categorize each entry as either positive or negative. Students form impressions and have to create hypotheses to explain the concept. As the activity continues, students identify more and more samples as either positive or negative. When they are able to label correctly the statements or the samples, they have an understanding of the concept. The teacher then asks students to verbalize their thoughts about the positive examples. When students can explain their thoughts they have attained the definition of the concept. As students polish their words, the teacher leads them to a more formal definition. The next step in the concept
attainment lesson is to test student understanding by having them generate their own examples of the concept.

Research on the Concept Attainment Model

Martindale conducted a 1998 study to compare the effectiveness of three distinct models in teaching an online self-paced lesson (non-classroom-based instruction (NCBI.) The three models were (a) direct instruction from the behavioral model, (b) group discussion from the social interaction model, and (c) concept attainment from the information-processing model. Students were placed into three groups, were taught the same lesson, and were classified as either experienced or non-experienced in using the world-wide web (WWW.) After receiving instruction, students from all three groups were given identical assessments. The object of the study was to look directly at the effects on student achievement attributed to each model and compares those effects. A second component to the study was to see how many attempts it took students in all three groups to pass a test on the online lesson. If a student failed to pass a test then that student received a different test the next time. A student was allowed three attempts to pass a test. Finally, the third query was, “What effect does a teaching model have on the number of test attempts needed by undergraduate students to pass a multiple choice test in an online self-paced lesson?” (Martindale, 1998, p.12). Refer to Table 2, which displays the supporting data.

For the purpose of the manual, the author has special interest in the concept attainment lesson from the information-processing model and it is a featured model in the manual. The targeted group for the manual’s instructional strategies is primarily
secondary students. Martindale’s (1998) study included undergraduate college students. While these are two distinct groups, it is reasonable to conclude that the results of the study could have the same general implications for high school students.

Tables 1 and 2 chart the statistical information from the study. Table 1 shows the mean scores for the number of correct items scored on a 15-item instrument. The second table depicts the number of attempts each group needed to pass the test. Results of the study were as follows:

(There were) no significant differences in number of test attempts to pass the course instrument. There were also no significant differences in mean test scores or first attempts needed test scores for participants, regardless of teaching model or prior WWW experience. There was significant interaction effect between teaching model and WWW experience. This may indicate that certain models are more effective for NCBI environments (Martindale, 1998, pp. 7-8).

Specifically, the concept attainment students had an overall higher mean score than did students instructed with the other two models. Table 1 shows that more students who had experience with using the WWW and had received direct instructional methods recorded the highest marks. Students with no previous WWW experience were able to score higher after using the concept attainment model.

The study was limited in that the experiment could have been extended over several curriculum units. This would have allowed the investigators to determine if their initial findings held up over a longer period of time while concentrating on several units of study. A study to look at instruction using the same models but with instruction other than NCBI might have been conducted.
Table 1

*Mean Test Scores for Sample Population Using Three Models of Instruction*

<table>
<thead>
<tr>
<th>World Wide Web Experience</th>
<th>Behavioral Model</th>
<th>Information Processing Model</th>
<th>Social Interaction Model</th>
<th>Overall Mean for Entire Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>13.75</td>
<td>13.1</td>
<td>12.96</td>
<td>13.24</td>
</tr>
<tr>
<td>No</td>
<td>12.43</td>
<td>13.26</td>
<td>12.64</td>
<td>12.81</td>
</tr>
<tr>
<td>Mean</td>
<td>13.09</td>
<td>13.19</td>
<td>12.81</td>
<td>13.02</td>
</tr>
</tbody>
</table>

Participants: 38, 44, 46, 128
Table 2

*Number of Attempts Needed to Pass the Test (by each group)*

<table>
<thead>
<tr>
<th>Test Group by Attempts</th>
<th>First</th>
<th>Second</th>
<th>Third</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Instruction</td>
<td>31</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Percentage</td>
<td>81.6</td>
<td>10.5</td>
<td>7.9</td>
</tr>
<tr>
<td>Concept Attainment</td>
<td>37</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Percentage</td>
<td>84.1</td>
<td>6.8</td>
<td>9.1</td>
</tr>
<tr>
<td>Group Discussion</td>
<td>34</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>Percentage</td>
<td>73.9</td>
<td>23.9</td>
<td>2.2</td>
</tr>
<tr>
<td>Total</td>
<td>102</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>Percentage</td>
<td>79.9</td>
<td>14.1</td>
<td>6.3</td>
</tr>
</tbody>
</table>

Martindale (1998) conducted a study of college students to determine the impact of various instructional models on achievement on a non-classroom based instructional unit, using an online self-paced lesson. Three models used were (a) a direct instruction design from the behavioral family of learning theory; (b) concept attainment instruction from the information processing family theory of learning; and (c) group discussion from the social interaction family of learning theory.

The researchers measured how well the students handled the test and how many attempts it took them to pass the test (Martindale, 1998). The preparatory lesson and test were both administered online. The study also addressed whether the participants had
previous experience on using the world-wide-web (WWW). If a student had to retake a test due to first time failure, a completely different test was administered for the second and third attempts.

Summary of Research

The study found that there were no significant differences in the number of attempts needed to pass the course assessment or in the mean tests scores of participants. There were no significant differences in the first attempt pass scores of participants. However, the study did show that there was a significant interactive effect between the teaching model utilized and the experience of participants in navigating the WWW. Participants who used the concept attainment lesson and who had no prior experience with using the WWW performed significantly better than other non-WWW users who used the other two models.

Concept Attainment Activities

As with problem based learning activities, sample activities written by the author are included with the dual purpose of being ready made activities that can be utilized; and serve as guides for teachers to make their own concept attainment activities. The teacher can understand the design and components of concept attainment lessons. The information in each activity is designed for duplication. Teachers can put the information on transparencies or flipcharts or a chalkboard. There are a total of 11-concept attainment lessons included in the manual. The content areas of Math, Science, English, and Social Sciences are all included. This is done to demonstrate that this model can be utilized in any subject area.

“Simple Machines” and “Energy” are examples of how activities might look in
the Science curriculum. The Concept Attainment activities, “Rule of Law,” “Dictatorship,” and “Time, Place, and Manner!” are all designed for use within the Social Studies Curriculum. “Quadrilaterals” and “Prime Numbers” are all examples of Concept Attainment activities in the Math curriculum. “Homographs”, “Metaphor and Simile”, “Oxymoron and Redundancy”, and “Unclear Pronoun Referent” are four English curriculum Concept Attainment activities.

“Simple Machines” is a Science Concept Attainment lesson. Machines decrease the amount of work one has to do. Machines require less energy and force to complete a task. A simple machine is a device that helps you to do work more efficiently but it has no moving parts. Simple machines are present in everyday life. More complex machines consist of two or more simple machines. The positive examples in the activity are examples of simple machines. In the activity the positive examples of the concept of Simple Machine are C, E, G, J, K and M. Choices A, B, D, F, H, I, L, and N are the negative or non-examples of the concept.

“Energy” is also a Science Concept Attainment lesson. Energy is defined as the ability to do work. There are several types of energy: solar, electrical, thermal, and chemical to name a few. This activity is designed to cause the students to think about these types of energy and where they can exist and can be found. The positive examples in this activity are vessels in which a type of energy is stored or is used. In the activity the positive examples of the concept B, D, E, F, G, I, J, N, R, and S. Choices A, C, H, K, L, M, O, P, Q, and T are negative and are not examples of the concept.

“Rule of Law” is a Social Studies Concept Attainment activity. Rule of Law is a
government concept that serves as a basis for establishing legal order and stability for a society. The concept explains to whom the law applies and how it will be administered. The following statements help explain the concept. We are a government of laws not of men. We are all equal before the law. The law treats all the same. The law affords us all equal protection. No man is above the law. The positive statements in the activity are designed around these statements. In the activity some statements are positive examples of the concept of Rule of Law. Statements 1, 4, 6, 8, 9, 10, and 11 are positive examples. Statements 2, 3, 5, 7, 12, 13, and 14 are negative or not examples of the concept of Rule of Law and in some cases are opposite actions that are found under the concept.

“Dictatorship” is a Social Studies Concept Attainment activity. In general terms, a dictatorship a form of government in which the political power resides in the hands of a single individual. The individual can rule and exercise authority as they fit; usually they do not have to answer to anyone for their decisions. In dictatorships whereby the government tries to control all aspects of life within the state are said to be totalitarian. The activity includes statements that are descriptive of things that are typical of a democratic society. The positive examples of the concept are B, C, D, E, G, H, I, L, M, N, and P. The remaining examples are all negative and are not examples of the concept of dictatorship. In some instances they are actually opposite actions of the concept.

“Time, Place, and Manner” is a Social Studies Concept Attainment activity. Time, place, and manner is used a guide to govern a person’s individual’s rights when weighed against the rights of others. Basically, it means that when a person chooses to exercise an individual right and it conflicts with the rights of others there may be controversy. As to actually who has the right or sanctioning to do a particular act may
depend on the circumstances of when it is happening, where it is happening, and how it happened, or “time, place, and manner.” The time when it is exercised could be appropriate or not appropriate. The site or venue when one chooses to do something may make it appropriate. Finally, the way a person chooses to execute a right may make it legal or illegal. This is a “positive – negative” labeled activity. In the activity, statements 5, 7, 9, 10, 13, 15 are positive examples of the concept of time, place, and manner. They accentuate when the concept is being positively applied. Statements 1, 2, 3, 4, 6, 8, 11, 12, 14, and 16 are negative examples of the concept of time, place, and manner.

“Quadrilaterals” is a Math Concept Attainment lesson. Quadrilaterals are polygons. A quadrilateral is a four-sided polygon with four angles. Quadrilaterals are the second most used shape (they cover everything from squares to trapezoids) in geometry except for the triangle. In the activity examples 3, 4, 7, 9, 10, and 11 are positive examples of the concept. Examples 1, 2, 5, 6, 8, 12, 13, 14, and 15 are negative and not examples of quadrilaterals.

“Prime Numbers” is a Math Concept Attainment. The activity looks at the nature and properties of numbers. A prime number is number that is divisible by only that number and the number 1. In the activity examples A, D, E, M, N, P, and I are positive examples of the concept. Examples B, C, F, G, H, L, and O are negative and not examples of quadrilaterals.

“Homographs.” is an English Concept Attainment activity. Homographs are words that have two distinct pronunciations from the same spelling and could possibly have two distinct meanings. This activity on homographs presents the teacher with the opportunity to teach about the origin of words. The activity is a good activity for
introducing the technique of concept attainment. In the activity some statements are positive examples of the problem of homograph. Statements 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 16, 17, 19, 20, 22, 25, and 28 are positive, while statements 1, 4, 10, 14, 15, 18, 21, 23, 24, 26, 27, 29, and 30 are negative and are not examples of the concept of homographs.

“Metaphor and Simile” is an English Concept Attainment lesson. Metaphor and simile are categorized as figures of speech. Both terms are used to help explain or describe one concept in terms of another concept. Figures of speech are used commonly in both verbal and written communication. Simile likens one thing to another by using the words “like” or “as”. In a metaphor a pairing is also made but the use of the words “like” and “as” are not employed. This is an A and B activity where two concepts are featured. In the activity some statements are positive examples of simile. Those statements are 1, 3, 5, 8, 10, 11, 12, 15, and 18. Statements 2, 4, 6, 7, 9, 13, 14, 16, 17, 19 and 20 are examples of the concept of metaphor.

“Oxymoron and Redundancy” is an English Concept Attainment activity. Both concepts appear in written and verbal communication. An oxymoron is regarded as a colorful example of speech (and writing) and gives accent to a communication; it is a word pair seemingly opposite or contradictory in meaning but used together in speech and writing. Redundancy can also appear in written and verbal speech is usually regarded as a communication problem in which the writer overstates rather than modifies a word by pairing words that are similar in meaning making one of the words repetitive and unnecessary. In this A and B activity some word pairs are examples of oxymoron while other statements are examples of redundancy. Statements 1, 4, 7, 8, 9, 11, 12, 16, 17, and 20 are examples of oxymoron. Word pairs 2, 3, 5, 6, 7, 10, 13, 14, 15, 18, and 19 are
examples of redundancy.

“Unclear Pronoun Referent” is an English Concept Attainment activity. An antecedent is the word to which a pronoun refers (also called the referent.) A rule of correct grammar for writing and speaking is that when using personal pronouns there must be agreement with the person and its antecedent. This concept addresses the situation when the writer or speaker makes the referent or antecedent ambiguous or unclear. The problem takes place when the communicator is talking about multiple persons and the reader or listener is unsure of which person the pronoun is intended. In the activity some statements are positive examples of the problem of unclear pronoun referent. Statements 1, 4, 5, 7, 8, 9, 10, 12, and 13 are positive, while statements 2, 3, 11, and 14 are negative and not examples of the concept of unclear pronoun referent.
Simple Machines

Examine the following terms closely. Some of the terms are illustrative of a concept and possess a sameness and while other terms do not have those characteristics. Try to determine the attributes that the positive terms have in common.

A concept is identified in this activity. Identify words that demonstrate the concept with a (+ sign) and those words that are not examples of the concept with a (-sign).

A. Vacuum Cleaner     H. Microwave
B. Piston              I. Freezer
C. Lever               J. Wheel and Axle
D. Radio               K. Pulley
E. Screw               L. Button
F. Diesel Locomotive   M. Incline
G. Wedge               N. Zipper

Definition: __________________________________________________

Concept Name __________
Examine the following terms closely. Some of the terms are illustrative of a concept and possess a sameness and while other terms do not have those characteristics. Try to determine the attributes that the positive terms have in common.

A concept is identified in this activity. Identify words that demonstrate the concept with a (+) sign and those words that are not examples of the concept with a (-) sign.

A. Helium  H. Zinc  O. Oxygen
B. Battery  I. Sail  P. Salt
C. Mass  J. Gasoline  Q. Compass
D. Ice  K. Steel  R. Atomic Bomb
E. Catapult  L. Weight  S. Density
F. Furnace  M. Bomb  T. Anchor
G. Dam  N. Chlorine  U. Funnel

Definition: __________________________________________________

Concept Name __________
Rule of Law

Examine the following statements closely. Some of the statements are illustrative of a concept and possess a sameness and while other statements do not have those characteristics. Try to determine the attributes that the positive statements have in common.

A concept is identified in this activity. Identify words that demonstrate the concept with a (+) sign and those words that are not examples of the concept with a (-) sign.

___1. Even though the country was in the midst of a civil war, Abraham Lincoln had to rerun for the presidency in 1864.
___2. George Allen is currently the “junior senator” from Virginia.
___3. Abraham Lincoln was the sixteenth president of the United States.
___4. Celebrity star OJ Simpson was charged with the murder of his ex-wife.
___5. Ike Eisenhower was a general before he became the President.
___6. Although he was not convicted, Bill Clinton became the second President of the United States to be impeached.
___7. Ignoring the 24th amendment, President Reagan’s supporters wanted him to run for a third term.
___8. Although the judge wanted to give him a suspended sentence the prescribed remedy called for a mandatory three-year sentence.
___9. David Bigshot, the mayor’s son, was among those charged with vandalism and disorderly conduct.

(Continues on to next page)
____10. “It does not matter who you are if there is no emergency and you speed you should be fined.”

____11. Franklin Delano Roosevelt had to rerun for the presidency in 1944 while the country was still in the midst of World War II.

____12. Under the European divine right system, laws often changed when the monarch changed.

____13. All but two of the fifty states of the United States use counties.

____14. In Hammurabi’s time, the punishments for some offenses were different for the commoner as opposed to someone who came from the upper class.

Definition: __________________________________________________

Concept Name ____________
Dictatorship

Examine the following terms closely. Some of the terms are illustrative of a concept and possess a sameness and while other terms do not have those characteristics. Try to determine the attributes that the positive terms have in common.

A concept is identified in this activity. Identify words that demonstrate the concept with a (+) and those words that are not examples of the concept with a (-).

A. Rights  K. Equality
B. One Party  L. Oppression
C. Authoritative  M. Regime
D. Coercion  N. Force
E. Class-ism  O. Liberty
F. Elected  P. Ruler
G. Control  Q. Limited Government
H. Intimidation  R. Accountability
I. Tyranny  S. Fixed terms
J. Justice  T. Rights

Definition: __________________________________________________

Concept Name ____________
**Time, Place, and Manner**

Compare the positive statements once they are identified to determine the characteristics they have in common. The negative examples do not directly support the legal concept.

A concept is identified in this activity. Identify statements that directly identify the concept with a (+) and those statements that are not positive examples of the concept with a (-).

1. The principal announced that school was dismissing early today.
2. The adults drank a six-pack of beer at the public park.
3. Even though McDonalds’ closed at midnight, the teenagers frequently hung out in restaurant’s parking lot sometimes as late as 3:00 a.m. on Friday and Saturday nights.
4. The small child was insistent that he wanted a toy and sat down in the department store floor and cried when his mother refused to buy him one.
5. The father wanted to take his sons on a fishing trip on Saturday morning.
6. A kid yells fire in a crowded theater when there is no fire.
7. The concerned parents requested a conference with the teacher to discuss their son’s grades.
8. The new shows on TV air this week.
9. Someone yells fire as smoke appears and the alarm sounds in a bank building.

(Continues on to next page)
___ 10. The members of the meat cutters’ union carry signs of protests about a new contract outside the Food Dragon grocery store.

___ 11. Mr. Cox saw Jamie attempt to slip a note to Lynn in Math class today and gave her detention.

___ 12. The dissident workers move their protest to the factory manager’s front yard in Whispering Hills.

___ 13. Betty handed Wilma a note in the parking lot after school.

___ 14. The upset parents wanted to talk to the coach at half time about why their child was taken out of the game.

___ 15. The small child twice asked his mother to buy a toy as they moved through the department store.

___ 16. The father checked his daughter out school at midday for her tanning appointment.

Definition: __________________________________________________

Concept Name ___________
Quadrilaterals

A concept is identified in this activity. Identify examples that demonstrate the concept with a (+) and those examples that are not exemplary of the concept with a (-).

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Prime Numbers

Examine the following statements closely. Some of the statements are illustrative of a concept and possess a sameness and while other statements do not have those characteristics. Try to determine the attributes that the positive statements have in common.

A concept is identified in this activity. Identify examples that demonstrate the concept with a (+) sign and those examples that are not exemplary of the concept with a (-) sign.

____A. 5   ____I. 547
____B. 4   ____J. 548
____C. 36  ____K. 14
____D. 7   ____L. 12
____E. 31  ____M. 17
____F. 8   ____N. 1453
____G. 9   ____O. 2000
____H. 10  ____P. 29

Definition: __________________________________________________

Concept Name ____________
Homographs

Examine the following examples closely. Some of the words are illustrative of a concept and possess a sameness and while other statements do not have those characteristics. Try to determine the attributes that the positive words have in common when positive statements are identified and labeled as such.
A concept is identified in this activity. Identify words that demonstrate the concept with a (+) sign and those words that are not examples of the concept with a (-) sign.

_____1 refute    _____16 wind
_____2 duplicate   _____17 read
_____3 present    _____18 police
_____4 condition    _____19 abuse
_____5 recreation    _____20 minute
_____6 mobile    _____21 rely
_____7 perfect    _____22 tear
_____8 rebel    _____23 sell
_____9 project    _____24 weight
_____10 delve    _____25 refuse
_____11 live    _____26 corroborate
_____12 record    _____27 incident
_____13 attribute    _____28 graduate
_____14 mix    _____29 define
_____15 interrogate    _____30 try

Definition: _________________________________________________

Concept Name   ____________
Metaphor and Simile

Examine the following statements closely. Some of the statements are illustrative of a concept and possess a sameness and while other statements do not have those characteristics. Try to determine the attributes that the positive statements have in common when positive statements are identified and labeled as such.

Two concepts are identified in this activity. Identify statements that one concept with a (A) and those statements that are examples of the second concept with a (B).

___1. David smokes likes my old oil-burning Pinto.

___2. Joan is a rock in the most trying of times.

___3. Paul’s face was as red as a beet.

___4. Michael’s car is a junkyard on wheels.

___5. The smog covered the valley like a huge gray blanket.

___6. …until justice rolls down like waters…

___7. Juan has that peacock strut when he is feeling good.

___8. Betsy attracts the boys like ants to a picnic spread.

___9. Lynn’s approach to solving the problem resembles a bumblebee’s flight path.

___10. Matt was spreading his money around the mall like hot butter on a roll.

___11. Their relationship was like two ships passing in the night neither realizing what the other had to offer.

___12. …took to the table like buzzards to a fresh carcass

___13. …has all of the pep of the walking dead

___14. … just keep jabbing maybe we will hit a nerve in their defense.

(Continues on to next page)
15. She turned as white as a ghost

16. Her feelings sank lower than a snake’s belly in a wagon rut

17. ... has the speed of an old turtle

18. He was as quick as lightning

19. In this meeting, Keith needs to step up to the plate for us when the time comes

20. The Bill of Rights is a blank check for all...

Definition: Concept A

Definition: Concept B

Concept A  Concept B
Oxymoron and Redundancy

In this A and B concept attainment activity there are two concepts featured.

Examine the word pairs closely. Some of the statements are illustrative of a concept and possess sameness. The other statements do not have those characteristics but have characteristics of a second concept.

Word Pairs (Two concepts are identified in this activity. Please identify the word pairs as belonging to concept A or concept B.)

__1 Numb feeling  __11 Constant change
__2 Free gift  __12 Good grief
__3 Small minority  __13 Added bonus
__4 Tight slacks  __14 Advance warning
__5 Past experience  __15 Security guard
__6 Honest truth  __16 Resident alien
__7 Original copy  __17 New tradition
__8 Old news  __18 Revert back
__9 Partial commitment  __19 True fact
__10 Personal friend  __20 Unbiased opinion

Definition: Concept A  

Definition: Concept B  

Concept A ____________  Concept B ______________
Unclear Pronoun Referent

Examine the following statements closely. Some of the statements are illustrative of a concept and possess a sameness and while other statements do not have those characteristics. Try to determine the attributes that the positive statements have in common. Statements that demonstrate the concept are identified with a (+) and those statements that are not examples of the concept with a (-).

1. The judge informed the lawyer of his mistake.
2. Linda called Keith; she was upset with Leila.
3. I called Ruth earlier this morning, she was clearly confused.
4. Linda walked with Leila every day when she was recovering from her surgery.
5. Tristan called your mom about Ania; expect her to come over.
6. Erin was stopped for speeding, she was late again for her class.
7. Marva, Linda called LaVerne this morning because she was very angry.
8. David needs to e-mail Frank since he can easily go down the wrong path.
9. Saddened by the death of his father; Richard attempted to contact Leon.
10. Ed challenged Joel about the test because he needs to pass to retain his eligibility.
11. Individuals are protected from abuse by their government.
12. Rose cautioned against trusting Kate, she could be so overly dramatic at times.
13. Lucy thinks you should talk to Louise; expect her to call at nine.
14. If you get a chance to purchase Keith a ticket, please bring it with you tomorrow.

Definition: __________________________________________________

Concept Name ___________
Troubleshooting the Concept Attainment Lesson

Some students could initially have difficulty with handling the type of task that a CA activity requires. The teacher must be aware of this and at this point work on developing a classroom climate where risk taking on the part of the students is desired and protected. Students could be way off target as they brainstorm about what they think is occurring during the activity. They cannot be ridiculed for their offerings; the teacher explains that all contributions add in some way to the knowledge of the group and to the task at hand. The teacher could begin with an initial CA activity or two that are easier (perhaps using some samples presented in this work) to introduce this model. As with most practices, the more times students participate in these types of activities the more adept they become at working with this type of learning task. The CA lesson will develop in students the potential to look at something, a phenomenon, and glean meaning from the occurrences.

Concept Attainment and Constructivist Theory

Concept Attainment activities are active, the student does not merely have information handed to them; they must work with that information. The design built into the activity calls for dialogue among team members, social interaction that permits the insights of others to help form meaning. The activity requires students to operate with several higher-level cognitive processes including, analysis, synthesis, evaluation, decision –making, and problem-solving.

Perhaps more than Problem Based Learning that was described in the preceding section and Cooperative Problem Solving that follow this section, Concept Attainment more completely adheres to the tenets of pure Constructivist learning theory. The
students take the information in front of them and for all practical purposes handle that
information and eventually shape meaning. The object of a Concept Attainment activity
is that the student generates a definition out of the examples and non-examples presented
to them. They then are connecting to the information and forming new understanding.

Concept Attainment: Theory into Practice

Concept Attainment is a strategy that causes students to think about what is in
front of them. They create meaning out of the examples (and non-examples) of
information. They are able to analyze; recognize a pattern that gives connections to and
comprehension of a concept. It is an important cognitive life skill to be able to look at a
jumbled situation and glean meaning and understanding.

Teachers can design a CA activity with a little forethought about the content that
they teach. Teachers should look for suitable concepts to utilize the Concept Attainment
model. The concept should have several examples that identify or are associated with the
concept. The same concept should also have several non-examples for contrast. For
instance lets say we were building a CA activity about the concept of “Conservation;”
items such as recycling, rationing, and re-planting could be among those positive
phenomenon while decay, extinction, waste, and erosion could serve as negative
attributes. Teachers could have students look up definitions; or the teacher could present
physical or visual examples of each of the attributes or non-attributes. Again with a little
thought into the subject materials teachers could create their own lessons.

It is not necessary to teach every concept in a discipline this way. What is
important however is that students have to use their cognitive processes in such a fashion
occasionally. This model of instruction requires a conscious effort on the part of the
students every time it is utilized. Requiring students to use various highly level thinking processes such as analysis, synthesis, problem-solving and critical thinking help students to fully understand and connect to the new information that they are being taught. They are engaged in a manner most teachers would find desirable.

Summary of Concept Attainment Model

A concept has three elements: (1) a name; (2) examples; and (3) attributes (essential and nonessential.) The name is the term given to the category. Examples are instances of the concept. Attributes are features and characteristics of the concept; they consist of distinguishing variables that help define or set apart the concept from other concepts. The games of baseball and football are games played with a ball and players. There are similarities but there are variables that set the two games apart.

The concept attainment model leads students to the understanding of a concept by requiring them to go through an inductive process. The students compare and contrast given examples that contain the characteristics or attributes of the concept with the characteristics of examples that do not contain those attributes. The teacher prepares the examples and non-examples. Some positive examples are identified and some negative examples are identified. The negative examples help identify the parameters of the concepts. Students compare the examples to determine what the positives have in common. They form hypotheses as to the nature of the positives. There is usually one idea that all of the positive examples have in common. After they formularize their theories, students test, modify, and refine them.
Cooperative Problem Solving

Problem solving is the process used to solve a problem. Cooperative learning is a learning environment where students work together to learn, as opposed to competing as individuals with one another for marks. Cooperative problem solving (CPS) is an instructional strategy whereby students are placed into small groups and given a task to perform or a problem to solve. Students must learn to work together to maneuver through the tasks. The tasks and problems are designed to be challenging but they are solvable. The challenge of the tasks motivates students.

What It Is

Cooperative problem solving is a learning strategy that ties learning to doing. CPS presents the group with a challenge. Using analytical and organizational skills and the knowledge already gained through content, students apply that knowledge inside a real world process, that of problem solving. They investigate and they reason. Students work to find a plan of action, reach preliminary hypotheses, test them, and eventually reach a solution. It is the same type of doing, as if they were outside of school. For instance, a teenage group’s members are financially destitute but they devise a plan to come up with the necessary money to go to a movie. They may also come up with plans for transportation or the means to get to that movie; and the means of justifying going to the movie to their parents. They have worked through a problem as a group. The modern workplace is looking for employees who can work and thrive in this environment.

What CPS Looks Like

A strong problem successfully engages and piques student interest. Students work on a common problem; bringing different bits of information to the problem solving
table. It will require a concentrated effort on the part of the group. Students must organize and devise plans of action to work through the problem.

A strong problem will generate a learning situation. Problem solving necessitates application of knowledge and requires an understanding of content beyond memorization. A good problem necessitates higher-order critical thinking. Students working in a CPS environment become skilled in handling problems.

Erickson (1996), who has authored two books using this model, comments on the importance of a strong problem and distinguishes between a problem and an exercise in content material. “A genuine problem is an encounter with a new and unexpected situation. If you know what to do already—for example, if you’ve seen the teacher solve one problem just like the one that you have now but with different numbers—it’s an exercise” (p. 16).

CPS in Action

Cooperative problem solving starts with a problem to be solved. Each member receives information about the problem via an information card. Some information is pertinent to solving the problem while some of it is not. Some information is duplicated on other group members’ cards while some information appears on one card only. The problem is deliberately structured so that the information is presented in such a fashion that it takes the information on all four cards to arrive at a correct solution. The members can share their information verbally but they are not to physically share the cards. Each member is responsible for the knowledge on his or her individual card. The model charges that member to communicate that information to the other group members.
Steps to Solve Problems

Faced with a problem or a perplexing issue, the group will do a lot of work to arrive at a solution. They will separate the issues, examine the facts, and reach a decision. Deciding on a plan of action can happen by the group’s directed thinking and naturally moves them to some type of problem-solving procedure. The instructor can aid students by introducing them to a planned problem-solving process. To make the best decisions and to become valuable knowledge workers, students can follow a problem-solving formula such as the following five-step plan.

1. Initially, students identify and clarify the problem. The first step in reaching a solution is pinpointing the problem area. The task is to recognize where a problem exists and what a possible solution might entail.

2. The group must then decide on a course of action, a direction to take. They begin implementing the plan. At some point they must stop and evaluate the plan and ask themselves the following questions: Is the plan working for you? Do you feel it is on the right path? Will it lead you to a solution?

3. Initially the group will draw conclusions from the gathered evidence, pose solutions, and act. After evaluating their actions, the group may need to consider new implications and alternatives. The group will consider the merits and disadvantages of each alternative.

4. Using consensus, the group chooses and implements the best option. They put an alternative into action and execute the plan. As the group follows through on their decisions they must monitor the results of the plan and
their efforts.

5. Finally, they must answer one final question. Does their work solve the problem?

Research on Cooperative Problem Solving Model

Investigation failed to find any pertinent individual research on this specific instructional strategy. However, because it is a cooperative learning technique by design, readers could refer to the research on cooperative learning mentioned in Chapter 2. Cooperative problem solving bears most similarity in its design to the cooperative learning technique called *Jigsaw*. It also bears some similarity to some aspects of problem-based learning, covered in Chapter 3, and the research on this model would be relevant as well.

The two strategies would appear to have similarities, but there are distinguishing characteristics as well. Both activities can be done in small groups and both require students to work with a problem. PBL differs in that it usually places students inside a simulation, or a role-play. That is usually not a feature of the cooperative problem-solving model. In PBL, the problem is usually a more in-depth, time-consuming experience with curricular content. As in PBL, CPS usually involves subject area content but the scope of the problem does not possess the breadth of a PBL problem. In PBL activities the problem is usually an ill-structured one, meaning there is usually not one perfect answer.

In CPS activities there usually is a correct answer although some CPS activities can be ill structured as well. In PBL students are placed in real-world applications, and often put in simulation scenarios where the actual subject area content is pertinent. This
may or may not happen in CPS. In CPS the subject area content is present but students are not involved in a role-play of sorts. Both models require students to go through the steps of a problem solving process to solve problems.

The Cooperative Problem Solving Activities

Teachers can incorporate the following sample activities into their instructional planning. The author wrote all the activities. The samples are meant to allow the teacher to understand the design and components of cooperative problem solving lessons. The teacher should pay heed to the different types of tasks the students are required to do. In cooperative problem format the information is presented so that it can be put on several cards or sheets of paper. Each student is delivered some of the information about the problem. There are a total of nine Cooperative Problem Solving lessons included in the manual. Once again they cover the curricular areas of Math, Science, English, and Social Science.

“Poetry Rhyming” is an English Cooperative Problem Solving lesson. One of the features or elements of poetry is that the verses may carry rhyme. Rhyme is where the final vowel and consonant of each line is the same. There are however different rhyming schemes. There are four different rhyming patterns. The rhyming patterns are \textit{ABAB}; \textit{ABCB}; \textit{AABB}; and \textit{AAAA}. The students are placed in four person teams. The student will understand the element of poetry identified as exact rhyming. Each person receives information about the problem or task confronting the group. The four reconstructed poems are as follows:

(Continues on to next page)
1. The rain was like a little mouse, 
   Quiet, small and gray 
   It pattered all around the house 
   And then it went away.

2. Mary had a little lamb 
   Its fleece was white as snow 
   And everywhere that Mary went 
   The Lamb was sure to go.

3. Twinkle, twinkle little star 
   How I wonder what you are 
   Up above the world so high 
   Like a diamond in the sky.

4. Rain, rain, go away 
   Come again another day 
   Little children want to play 
   So rain, rain, go away.

“APA Numbers: ‘Two Be or Not 2 Be’” is an English Cooperative Problem Solving activity. This activity looks at the instances as when to write the numeral and when to write the word for a number in a composition. The object of the lesson is to help the students know when to use written numerals as opposed to the actual words. The students are to correct or re-write the newspaper article correctly using numbers according to the rules (APA) and words for numbers specified in the activity. The students are placed in four person teams. Each person receives information about a problem or task confronting the group. They work together and share information and
ideas about how to solve the problem and eventually arrive at the solution.

“Calculating Temperatures Scales” and “Mineral Hardness” are the next two activities they are Science Cooperative Problem Solving lessons. “Calculating Temperatures Scales” features three temperature scales, Fahrenheit, Centigrade, and the Kelvin scales. The students become familiar with the scales as they develop scale conversion capabilities inside a spreadsheet program. The students are asked to compare the scales and convert temperatures back and forth among the scales. The students are placed in four person teams. Each person receives information about a problem or task confronting the group. Four persons working together and sharing information and ideas about how to solve the problem can arrive at the solution.

“Mineral Hardness” is a Science Cooperative Problem Solving lesson. The students are to recreate the rank of minerals found in the earth’s crust. There are several ways to tell minerals apart from each other. Characteristics or properties such as color and shape of crystal help distinguish minerals. Hardness is a property that helps to identify and distinguish minerals. The harder a mineral is the higher the number assigned to it is on a scale of one to ten. The Mohs Scale is used to rate hardness of minerals. Mohs arranged ten minerals in order of hardness, so each will scratch those lower in the scale.

The students are placed in four person teams. Each person receives information about a problem or task confronting the group. Four persons working together and sharing information and ideas about how to solve the problem can arrive at the solution. The Solution: 1 Talc, 2 Gypsum, 3 Calcite, 4 Fluorite, 5 Apatite, 6 Feldspar, 7 Quartz, 8 Topaz, 9 Corundum, 10 Diamond.
“Combination Lock” and “Two Friends” are Math lessons in the Cooperative Problem Solving format. Word problems in math are an age-old staple in math curriculum. They are exercises in reasoning and math problem solving skills. The students are placed in four person teams. Each person receives information about the problem confronting the group. The answer for the first problem (Combination Lock) is 43, 13, 10, and 15.

“Two Friends” is a Math Cooperative Problem Solving activity. Word problems in math are an age-old staple in math curriculum. They are exercises in reasoning and math problem solving skills. The students are placed in four person teams. Each person receives information about the problem confronting the group. The solution of the problem: after 4.5 hours of driving the friends meet at mile marker 292.5; at 9:30 pm Central Standard Time. “A” covers 315 miles and “B” covers 292.5 miles.

There are three Social Studies lessons. One is a Geography-oriented lesson titled “World Rankings: Top Ten Lists.” There are two history-oriented lessons titled “Tobacco Economy” and “The Headright System.” “World Rankings ‘Geography Top Ten Lists’” focuses on general information about the world’s nations. It looks at two characteristics: population and land area. The activity requires collaboration and problem solving skills. For the solutions to the “World Rankings” activity look in the appendices. (See Appendix L)

“A Tobacco Economy” is a Social Studies Cooperative Problem Solving activity. The activity focuses on general information about the economy of historical Virginia and Colonial Jamestown. Specifically, the activity permits a look at the agrarian tobacco economy of Colonial Jamestown. The students are placed in four person teams.
Each person receives information about the problem confronting the group. The data found in Appendix K will help the instructor check the students’ solutions. The questions embedded in the clues can be answered once the students develop their crop plan.

“The Head Right System” is a Social Studies Cooperative Problem Solving activity. The activity focuses on general information about the economy of historical Virginia and life in Colonial Jamestown. The activity permits a look at the agrarian tobacco economy of Colonial Jamestown. The students are placed in four person teams. Each person receives information about the problem confronting the group. The students will answer the questions; the answers are embedded in the information. The questions and answers are as follows: (1.) What was Throughgood’s quitrent bill in 1628? 1635? (1628) £2, 1s; (1635) £5, 7s. (2) How many people did Throughgood (excluding himself) bring over between 1621 to 1627? 106 (3) What was the acreage value of a headright? 50 acres.
“Poetry Rhyming”

Clue Group I. There are multiple schemes or patterns to make a poetry rhyme exactly. “So rain, rain, go away.” The following is half of one type of rhyming scheme: “Mary had a little lamb It’s fleece was white as snow” The end of a poem is marked by a “.” An example of “Exact or Perfect Rhyming” is: "fear – near." Each rhyme display here demonstrates a different rhyming pattern.

Clue Group II. The following statement is a verse of a poem illustrated in these clues. “Up above the world so high… Like a diamond in the sky.” An “End Rhyme” - occurs at the end of lines. “And everywhere that Mary went” Define the four “exact” rhyming patterns. “Rain, rain, go away” “And then it went away.”

Clue Group III. Find the four rhyming patterns. “Come again another day” The following is half of an “A, A, B, B” rhyming scheme (which by the way is a good way to define a rhyme scheme!) “Twinkle, twinkle little star …How I wonder what you are”

There are four “END” rhyming patterns.

Clue Group IV. Identify and put together the four rhymes found in the clues! “The rain was like a little mouse … quiet, small and gray… It pattered all around the house” There are four different poems present in this exercise. “Little children want to play” … “The lamb was sure to go.” A “Rhyme” matches final vowel and consonant sounds.
APA Numbers: “Two Be Or Not 2 Be”

Clue Group I. For all numbers 10 and above, use numerical figures. (Rule 2) If a number below 10 is grouped with a number above 10, then use figures. The 5th name and the 14th name on the class roll have identical scores. However, if items are not being compared abide by Rules 1 and 2.

Clue Group II. Use figures if fractional quantities, ratios, decimals, percentages, percentiles, and quartiles are being expressed. Use figures if statistical or mathematical functions are represented (“divided by 6”). Use figures instead of words if time, dates, points on a scale, ages, and exact sums of money are indicated. Place a zero with a decimal that is less than 1 (unless the entry can never reach 1 or greater.)

Clue Group III. Use numbers that denote a specific place in a numbered series 5th grade, (row 5, seat 14.) Use words to express numbers one to nine. Use a word rather than a figure when any number begins a sentence, title or heading. Use words to express common fractions one half, three-fifths.

Clue Group IV. For numbers one to nine, use words instead of figures. (Rule 1) Use a combination of words and numbers to express rounded large number beginning in the millions (6 million users.) Use a combination of words and numbers to express back-to-back modifiers. (3 one thousand dollar bills, or first 12 questions, a group of twenty 18 year-olds.)
Two Be Or Not 2 Be Worksheet

Game Highlights (October twenty, two thousand and seven, seven thirty p.m.)

The Forty-niners won their seventh game out of eight contests by a thirty-six to twenty-four count. The victory clinches at least a tie for the district title and will advance them in Region three play in the State’s Class two classification set to begin three weeks from now on November six. The Forty-niners now have won eight straight District Six titles, nine out of the last twelve, and a total of sixteen championships in Coach Jones’ twenty-one years at Ridgemont High School. The first two championships were co-championships. This is the fourth straight contest where the offense has scored thirty points or more. The twelve-point margin of victory is the fifth straight contest the team has won by a double figure margin. The game will be delayed broadcast on channel forty five at eleven p.m. tonight and again Monday evening, October twenty third at ten thirty p.m. Radio stations FM “P ninety two” and its sister am station “fifteen ten” broadcasted the game live. The thirty-one year old series against the Rams now stands nineteen wins for Ridgemont HS and twelve wins for Monte Vista.

Coach Jones celebrated his two hundred and fiftieth career win (against seventy two losses). Jones has one hundred and eighty nine of his victories at Ridgemont HS.

A crowd of about seventy two hundred attended the game. With the normal admittance rate of five dollars per game, the revenue generated by the game can only help the dire financial situation of sports at Ridgemont. Gate revenue should roughly be in the thirty-five thousand to thirty six thousand dollars range. It helped that the seventy-four degree temperature at the eight p.m. kickoff time was ideal. Early in the day forecast had been upgraded from fifty per cent chance of rain to a prediction of only scattered showers.
Both teams put on an aerial display, as there were a combined sixty-three pass attempts. Quarter back Dave Boone completed seventeen out of twenty nine passes for the Niners for two hundred and twelve yards. His counterpart Dan Crockett attempted thirty-four passes in the losing effort. His twenty completions garnered two hundred and thirty three yards. The Rams could only rush for sixty-nine yards on seventeen rushing attempts. The Forty – Niners rushed for one hundred and fifty three yards on twenty-one running plays. Walters, Ridgemont’s number thirty-three had eighty-six yards rushing on thirteen attempts. Walters is closing in on three straight one thousand yards seasons. The three hundred and sixty five yards of total offense was the team’s fourth best offensive output for the season. The team had three major penalties of the ten and fifteen-yard variety and four five yard minor penalties. Coach Jones was not pleased with the seven miscues but all in all praised his team’s efforts. The team’s final two contests are on the road. The first two rounds of the playoffs could be played at home. It will mark the twenty times the team has been in the state playoffs in the school’s thirty-one years of existence.
“Calculating Temperature Scales”

Clue Group I. In theory, the lowest possible temperature is called absolute zero that is −273.15 degrees C. A one-Celsius degree is equivalent to 1.8-Fahrenheit degrees. The Kelvin temperature scale is a temperature scale having an absolute zero below which temperatures do not exist. Absolute zero, or “0” K, is the temperature at which molecular energy is a minimum, and it corresponds to a temperature of -273.15° on the Celsius temperature scale. Gabriel Fahrenheit made the temperature scale more accurate when he used mercury in the thermometer rather than alcohol.

Clue Group II. The Kelvin degree is the same size as the Celsius degree; hence the two reference temperatures, the freezing point of water (0°C), and the boiling point of water (100°C), correspond to 273.15K and 373.15K, respectively. Hint: Find the corresponding decimal for the fraction 100/180. When writing temperatures in the Kelvin scale, it is the convention to omit the degree symbol and merely use the letter K. The temperature scale is named after the British mathematician and physicist William Thomson Kelvin, who proposed it in 1848. Build a spreadsheet program that converts Fahrenheit temperatures into Centigrade and Kelvin temperatures.

Clue Group III. Temperature may be defined as the condition of a body that determines the transfer of heat to or from other bodies. The Centigrade degree is a customary unit of temperature; it is 1/100 of the difference between the temperature of melting ice and that of water boiling under standard atmospheric pressure. In other words, water freezes at 0 degrees and boils at 100 degrees. Thirty-two degrees Fahrenheit equals zero degrees Celsius. Temperature scales use when water freezes and when water boils as fixed points of reference. The Celsius temperature scale named after Anders Celsius is a designation of the scale also known as the centigrade scale.
**Clue Group IV.** Twenty degrees Celsius is equivalent to sixty-eight degrees Fahrenheit. Twenty degrees Celsius equals 293.15 K. The Fahrenheit degree is a unit of temperature. It is 1/180 of the difference between the temperature of melting ice and that of water boiling under standard atmospheric pressure. Water freezes at 32 degrees F and boils at 212 degrees F. The Fahrenheit degree has 180 equal points or intervals on its scale between the fixed points of freezing and boiling. The zero of the Kelvin scale is -273.15 degrees C. The magnitude of the degree in both these scales is defined as 1/100 the difference between the temperature of melting ice and that of boiling water at 760 mm pressure. Frequently, the Kelvin scale is defined as degrees C + 273.15
“Mineral Hardness”

**Clue Group I.** The softest mineral in the series is assigned a hardness of 1. A knife blade has a hardness of around 6 so it will not scratch Quartz. There are a total of 10 minerals used in the Mohs series for testing for mineral hardness. Fluorite can scratch Calcite but cannot scratch Feldspar. Quartz can scratch all but three minerals.

**Clue Group II.** Substances such as diamonds are minerals and possess several distinguishing physical properties among them is hardness. The hardness of a mineral is determined by what materials it will scratch and what materials will scratch it. A knife blade can scratch Apatite, but Fluorite cannot scratch Apatite. Rank the ten minerals used in the Mohs scale for hardness from 1 to 10.

**Clue Group III.** Talc cannot scratch it can only be scratched. Mohs assigned each of the test minerals a reference number for hardness. A mineral with a higher rating will scratch all minerals rated lower than it’s rating. Mohs’ scale is said to be one of increasing hardness. A diamond can scratch anything that feldspar can.

**Clue Group IV.** Rank the ten minerals used in the Mohs scale for hardness from 1 to 10. Topaz can only be scratched by two minerals, one of them being corundum. Gypsum is one of the minerals used in the Mohs test series and it can be scratched by all but one of the minerals. Certain minerals are harder than other minerals. A diamond can scratch anything that topaz can.
The Combination Lock

Clue Group I. In this problem, the combination lock on your high school locker has been changed. The lock is unlike the usual lock you have seen. Your buddies think you have moved on to solving problems “solo”; they have devised a challenge for you.

Clue Group II. The lock has four numbers to the combination. The total of the four numbers is one more than eight times the third number. Open your locker.

Clue Group III. Find the four numbers. The first number is seven less than five times the third number. The fourth number is fifteen less than the difference of the second number from the first number.

Clue Group IV. The lock works right, left, right, and left. Your homework buddies have been tutoring you on solving math word problems. The total of the four numbers is one more than twice the first number minus three. The total of the four numbers is 81.
Two Friends

*Clue Group I.* Two friends depart from two different but neighboring states. The Interstate Highway system has mile markers placed at every mile of interstate. They travel I-12. It’s a straight shot! City B’s person drives at a rate of 65 miles per hour.

*Clue Group II.* The two friends depart the cities at exactly the same moment. City B is in the Eastern Time zone. The cities are exactly 607.5 miles apart. The Interstate Highway system has tenth of a mile markers placed between every mile marker.

*Clue Group III.* City A’s person drives at a rate of 70 miles per hour. City A is in the Central Time zone. From City A the Central time zones extends eastward 225 miles at the state line. At what point does A cross over into B’s state.

*Clue Group IV.* The friends depart at 6:00 pm EST. They make no stops. Each driver drives at a consistent rate and pace. At what point along I-12 will the two friends meet and at what time of day?
Top Ten Lists

*Clue Group I.* There are two “Top Ten Lists” presented. One “Top Ten List” represents the ten most populous countries. In land area size Australia makes an appearance at the middle of the top ten lists ahead of Argentina. China is two places below Canada but two places above Argentina. The Top Ten countries include Argentina, Australia, Bangladesh, Brazil, Canada, China, and India. Recreate the two top ten lists.

*Clue Group II.* Japan and Sudan occupy similar positions but on opposite lists. Five of the nations appear on both lists. In population, Nigeria ranks ahead of Bangladesh but appears below Pakistan. Brazil and the United States appear on both lists and curiously enough in the same order on each list.

*Clue Group III.* The Top Ten countries also include Indonesia, Japan, Kazakhstan, Nigeria, Pakistan, Russia, Sudan, and the United States. Brazil ranks below the U.S. India has more people than anyone else except China. China separates Brazil and the United states on the land area list. India drops six places in the rankings on the land area size list.

*Clue Group IV.* Kazakhstan the ninth largest country in land area was once a part of the number one ranked land area nation. One “Top Ten List” represents the largest countries in land area. Sudan is on the land area list but does not make the list in population; Japan occupies the final spot on that list. Russia changes six places as it moves from one list to the other.
Understanding the Early Tobacco Economy

Clue Group I
A planter has five men working for him, what is the size of the acreage of his plantation and **how many acres of tobacco does he have planted?** An indenture contract usually lasted for seven years. Tobacco was very ruinous to the soil’s fertility. You will work your land alongside your helping workers. The planting season for tobacco usually began in January.

Clue Group II
An individual worker could usually work as a rule of thumb a total of three acres of tobacco annually. **What is the first year that will you be able to replant an area that has previously cultivated a tobacco crop?** You are a planter that owns a total of contiguous fifty acres of land. It usually took at least 20 (sometimes 30) years for an acre of land depleted from planting tobacco crops to replenish it with enough nutrients to sustain another planting cycle.

Clue Group III
You have one other man helping you. Develop a plan detailing how you will plant your land so that you might perpetually be able to plant tobacco on your plantation. Devote 48 acres of your 50 acres to growing the cash crop tobacco. **If two men work your plantation how much land must sit dormant annually?** Two acres of land would be utilized for growing food crops to sustain the plantation.

Clue Group IV
You begin planting your tobacco crop in the Cycle Years 1620. **How many men would you need to keep a 2500-acre plantation profitable?** Before turning to slavery the indentured servant system served as the primary source for plantation labor. Use the low-end estimates for your calculations. The tobacco plant/crop drained a soil of all of its nutrients in a 3 to 4 Cycle Years span.
Table 3

_Tobacco Economy Worksheet:_ Tobacco Plantation. *Develop your planting plan using the following grid.* (Each block represents one acre of land.)

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The Head Right System.

Clue Group I. Over the course of seven years beginning in 1628, Throughgood brought enough persons over to build an estate of 5,350 acres. The Headright System provided labor for the colonies. What was Throughgood’s quitrent bill in 1628? 1635? The population of the Virginia colony grew from 600 in 1619 to 3000 in 1621. A warrant for a claim for land had to be secured from the colonial secretary. A warrant entitled the planter to wild, un-granted land for his own use. Robert Taliaferro transported a grand total of 126 persons to the colony. The Headright System worked to the advantage of the Master and not the servant.

Clue Group II. If a planter wished to start a plantation right away he had to lay it out with an official surveyor. In 1621, Thoroughgood came to the New World without his family. A planter was also entitled to equal acreage of un-granted land for each person, relative or not, for whom the planter paid passage. Planters sometimes entered into partnerships to bring persons over and they then divided the land, or headrights. How many people did Throughgood bring over between 1621 and 1627? Freedom dues were given to a servant once his contract time was up.

Clue Group III. Adam Throughgood brought over a wife, son and 38 servants in 1628. Robert Taliaferro at his estate’s height paid an annual quitrent (tax) of £6,7s. A planter did not have to convert all his headrights into land right away; they could be saved for future use. What was the acreage value of a headright? Originally, the company would grant a parcel of land to a worker when his time (contract) was up with the company. The Headright System was started in 1618 and awarded land to planters. The planter was also granted a headright for himself.
Clue Group IV. Freedom dues usually consisted of several barrels of corn, a suit of clothes, and a small parcel of land. How large was Taliaferro’s estate? The planter must also seat the land; that is build a structure on the land or start to cultivate the land. There was a tax or quitrent on the land at an annual rate of two shillings per 100 acres. Headrights could be transferred by sale or willed to heirs. £1 = 20 shillings. How many people did Throughgood (excluding himself) bring over between 1621 and 1627?
Troubleshooting the CPS Classroom Experience

As with the PBL experience, initially some students may experience difficulty with the startup of the learning task. The teacher may have to prime the students with tips and insights. Again it is recommended that before the instructor move to this point that dialogue is encouraged the team members. Each team member must give insight to the problem and speak to how the group might precede working on the task.

Make certain that the group is aware of all the information before them. All of the information does not have to be presented in the clue cards. Some vital information might be found in the setup of the problem or in some of the worksheets included in the activity.

Creating a Cooperative Problem Solving Activity

This is an interesting and challenging way to present new material or cover content. Teachers should look for the opportunities to cover material with this model. It is a great way to reference data presented in a chart or table and the students to become familiar with that data. The data found on the map of a country or a continent is examined within the throes of working on the problem. It gives the students an experience to connect with the content and that helps with recall of the knowledge. To create a CPS activity, the teacher must decide where the content presents an opportunity to design a problem. The following describes one way to design a problem.

The following activity is called Marva’s Vegetable Garden. Follow along as a CPS activity is built. To build a CPS problem it is recommended to start with the end, the finished information...a completed chart or table, or an already known answer and build
backward. In this instance, the end result is found in Table 4, Marva’s Backyard

Vegetable Garden Plot. This could be an initial fun lesson used to teach students how to
work through a CPS activity.

<table>
<thead>
<tr>
<th>Row 1</th>
<th>Broccoli</th>
<th>Carrots</th>
<th>Peppers</th>
<th>Cauliflower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Row 2</td>
<td>Peas</td>
<td>Onions</td>
<td>Cucumbers</td>
<td>Lettuce</td>
</tr>
<tr>
<td>Row 3</td>
<td>Celery</td>
<td>Tomatoes</td>
<td>Beans</td>
<td>Potatoes</td>
</tr>
</tbody>
</table>

The work task becomes to fill in the empty garden plot (Table 5.)
Using the table as the foundation for building the clues, clue statements are developed. The following statements serve as examples. They are not the only clues that can be developed. Clues give partial but pertinent information to filling in the chart. The teacher would then distribute the information over three to five cards depending on the size of the team. Additional information, not necessarily vital to the solution could be included. The clue statements might be written as follows.

*Marva planted a dozen vegetables in her garden plot.*

*There are four vegetables planted in each of the three rows.*

*The beans are planted between the tomatoes and potatoes.*

*Marva planted cucumbers between the lettuce and onions.*

*Broccoli is planted in the front row with which also features cauliflower.*
Marva planted the celery behind the peas.

Marva planted cucumbers between the beans and peppers.

Tomatoes are planted to the right of the celery.

The tomatoes are planted behind the onions.

The onions are planted behind the carrots.

The carrots are planted between the broccoli and the peppers.

The front row of the garden is located north of Marva’s back deck.

These clues were created by simply looking at the finished garden plot and making true statements about the location of information. At least one clue serves as an anchor clue; this serves as a launching place for the group to start to build the table. From this clue the other clues fall into place.

CPS and Constructivist Learning Principles

Cooperative Problem Solving subscribes easily to Constructivist learning principles. Constructivists believe that students need to do more than just hear knowledge; they in some way should get to work with that knowledge. From this work they gain insights, come to understand as they make connections with the knowledge. In CPS, students unravel and make sense of the information before them; they make their own meaning which follows the tenets of Constructivist philosophy. By working the problem within a group they can learn from others. Where an individual may have come to an impasse with the material, teammates may be able to handle this particular stumbling block, the student benefits from shared thinking…this social interaction with others. Finally, CPS activities require trial and error. Every hypothesis generated by the group is not necessarily correct, arriving at a correct solution may take time; the students
have to re-visit the information before them and this repeated reflection helps them make understanding.

CPS: Theory into Practice

Cooperative problem solving is a cooperative learning activity. Students are given the opportunity to solve a problem in a collaborative setting. To build accountability for each group member, the activity borrows from the cooperative learning technique called Jigsaw, which divides work assignments and tasks among the group’s members. Each team member is given information about the problem. Every member has vital information--so vital that if one member withholds the information in his or her possession then the group cannot solve the problem. Each member’s information contains facts that are crucial as well as other information. Students must eventually recognize what information is needed to solve the problem. The teacher can also design the problem and include hints to help work through the problem; or require students to figure out all angles that the problem entails. The optimum group size for CPS is four.

The sample activities included in this chapter demonstrate how to use this technique with subject area content. As students work through the problem they handle the content they are working with at higher cognitive processes such as problem solving and thinking critically. Socially, they are required to work in a group setting and tackle simultaneously the issues and dynamics of working with others and the actual problem itself. CPS is an example of what educators refer to as a challenging complex learning task.

As with the Problem Based Learning activities and the Concept Attainment activity it is hoped the teacher can create their own CPS activities. Any subject material
presented in a chart, table, map, or sequence lends itself well for CPS. The CPS Headright activity is an example where teachers manufacture a CPS experience by simply cloaking several fundamental and basic questions about the content inside the clues. This is a very clever to enhance bland content. The content in most CPS activities can be covered in other more traditional ways…but the problem solving process is an excellent cognitive exercise. Again students are caused to think in a different but a higher-level manner. This helps to assure mastery of the content.
CHAPTER 5

FEEDBACK on the UTILITY of the MANUAL: TEACHER PERCEPTIONS

Purpose of the Manual

The purpose of the manual is to present, explain, and demonstrate three instructional models that might be utilized by teachers teaching in an extended period of time (block schedule.) The manual will name the particular model, define it, give the model’s background and history, provides explanations of how the models work and how they might be utilized in the classroom. It will also explain how the model might affect student achievement. Sample instructional activities are included to help demonstrate the usefulness of the models and how teachers might craft their own activities. The intent of the manual is that it serves as an instructional resource for teachers.

Purpose of the Feedback Activity

The writer’s goal is that the manual has practicality and utility. Thus it was decided to solicit the thoughts and perceptions from some members of its intended audience. Educators from the secondary school level were selected to provide feedback on a number of queries about the manual. So that feedback might be gained, the educators were asked to preview the work and then answer questions about the manual and the models of instruction presented in the manual on a questionnaire.

The following queries were built into the questions on the survey instrument used to ascertain their responses. Is the manual clear and readable? Is the manual functional in that it has utility (usefulness and value)? Do teachers view the manual as a resource? Does it adequately explain the instructional models? Does it adequately demonstrate the
models? Do the included activities have value in the following ways; one, do they serve as a valid example of the model; two, do they convince a teacher of the model’s merit and effectiveness; and three, do they support a teacher’s efforts to construct a similar activity for the classroom?

Who Reviewed the Manual

Educators attending several conferences and staff development workshops conducted by the writer were targeted for participation in the feedback activity. Those persons who attend these conferences and workshops are made up of educators from across the nation. The writer explained the concept, purpose, and intent of the manual and asked for volunteers to participate in the survey. Some teachers decided to participate in the activity sometimes after the initial request made at a conference. They made their interest known by contact through electronic mail.

The writer also solicited the opinions of teachers at a high school in Virginia. The opinions of these teachers were sought because it is a school that uses a block schedule format. Their experience while teaching on a block schedule was thought to provide them with a valuable perspective and insight for providing feedback.

How was Feedback Gained

Participants volunteered and agreed to read and consider the manual and respond to a questionnaire. Respondents came from several states. These teachers were then sent the first nine pages of the manual, which contained the dissertation title, the dissertation abstract, introduction, purpose, and context. They were also given a copy of an entire chapter on an instructional model. All teachers were given these items plus a copy of a survey via e-mail. (See Appendices A, C, & E) Those that chose to participate and
respond did so by returning the survey using electronic mail. A cover letter explaining the purpose of the manual and the purpose of the field test (including an explanation as to the survey) was given to all of the participants. (See Appendix I)

Getting the materials to the teachers who participated in the process from the high school was slightly different. The teachers were gathered and the purposes of the manual and the feedback activity were explained. They were also asked to read, consider and give feedback on the manual. They responded using the same survey instruments, as did the national group however.

A “Likert-type instrument” response format was used for the survey. The responses used with the survey questions were strongly agree, agree, undecided, disagree, and strongly disagree. Using this same order, values of five to one were assigned sequentially to the responses, with “strongly agree” receiving a value of five and “strongly disagree” receiving a value of one. The finding and results that come later in this chapter are based on the responses from thirty-two participants in the feedback activity.

The survey was divided into two parts. The first part contains seven questions about the manual and its purpose. (See Appendix G) The second section consisted of the remaining 13 questions. These questions focused on one of the particular instructional models. (See Appendices A, C, & E) Three questions were posed in a negative context. Questions 1, 4, of the first section of the instrument and question number 13 of the second section were purposely worded this way to help establish internal reliability for the instrument. Copies of the surveys can be found in the appendix of this work (see Appendices A, C, E, and G.)
What Was the Feedback on Problem Based Learning

Eleven participants gave input on all 13 questions that were included in this section of the instrument (see Appendix B.) The very first probe in this section asked the readers to rate Problem Based Learning as exemplified in the manual; and as explained in the manual as an instructional model. It was done using the following query: “Problem Based Learning is a useful instructional model.” Eleven respondents gave feedback to this question. Nine responses were “strongly agree” and the remaining two responses were “agree.” The thirteenth and final question posed a similar query but within a negative context. The statement read “The activities presented were not useful.” Five respondents stated that they “strongly disagreed” with the statement and five “disagreed” with the statement. One respondent rated this as a “strongly agree.” However, because the respondent answered the first query with “strongly agree” it probably means this reader did not recognize the negative spin on the question. The results from these two queries would seem to support the premise that problem based learning is a valuable instructional strategy.

The second, third, and fifth statements examine the potential that PBL can have in the classroom. Using their teaching experience as the basis for their opinions, the participants commented on the promise of PBL as an active instructional strategy. The second statement reads; “Problem Based Learning will engage my students.” The third statement reads; “PBL will provide students with a challenging learning task.” The fifth statement read; “I plan to use PBL in my instruction.”

For the second query the response was overwhelming positive, 10 participants “strongly agreed” while the final person “agreed.” The third query saw eight participants
“strongly agree” and three participants “agreed.” The fifth query had four participants “strongly agreeing” and seven educators “agreeing.” No other response was marked. Again the participants in their opinions indicate in conclusive fashion that PBL has instructional merit for the classroom teacher.

The value and usefulness of the activities that were presented in the manual were measured. This was done with the survey statements 6, 7, 8, and 12. Statement 6 said, “The activities demonstrated in the manual served as plausible examples of the model.” Four participants marked this with a “five” response and the remaining seven participants scored this with a “four” response.

Statement 7 read, “Seeing an example of the activity helped me understand the model.” On this query, five respondents marked a “strongly agree or a score of five. Six respondents marked a “four” or an “agree” response. Statement 8 read, “Seeing an example of the activity helped me see how the model could be utilized.” Four respondents scored “fives” and seven respondents scored “fours.” Statement 11 asked, “The activities presented were easy to emulate.” Only two participants marked “strongly agree” but most participants felt the activities were somewhat useful in this manner; so nine participants scored “fours.” The results from these four queries indicate that the participants consider the problem based learning activities a useful inclusion in the manual.

The remaining four queries investigated the activities’ objectives of enabling teachers to design and construct their own PBL instructional activities. Statements 4, 9, 10, and 11 were included to provide feedback on these queries. Statement 4 was worded as follows, “I now feel as if I can create my own PBL activities.” One respondent
“strongly agreed,” eight participants “agreed,” and two teachers were “undecided.”

Statement 9 read, “Seeing an example of the activity was useful in helping me write an activity.” Four teachers “strongly agreed”, six respondents “agreed”, and one respondent was “undecided.” Statement 10 said, “I could have written an activity from the narration included in the text.” The responses would produce mixed results. One person “strongly agreed”; five persons would “agree”; two were “undecided”; and three persons “disagreed”. Statement 11 probed, “The activities presented aided me in designing my own lesson activity.” The data results were as follows, three educators “strongly agreed”; five recorded an “agree” response; one person was “undecided”; one person “disagreed”; and one person “strongly disagreed.”

The feedback gives credence to the fact that Problem Based Learning is a worthwhile instructional model in the opinion of the teachers. They also supported the contention that the activities were useful and representative of the model. The ability of the teacher to design and construct his or her own activities did not receive as strong an endorsement. The feedback demonstrated some hesitancy on the part of the teachers to agree in this area.

What Was the Feedback on Concept Attainment

Ten educators participated in the feedback on Concept Attainment (see Appendix D.) They gave input on the section’s 13 questions. One educator failed to respond to question 10 but did respond to the remaining 12 queries. The queries followed the same agenda and format as described in the previous section on Problem Based Learning. The words Concept Attainment were substituted for Problem Based Learning and the abbreviation CA appears where PBL is used.
As before the very first probe in this section asked the readers to rate Concept Attainment as exemplified and as explained in the manual as an instructional model. It was done using the following query: “Concept Attainment is a useful instructional model.” All ten responses were “strongly agree.” The thirteenth and final question to the instrument posed a similar query but with a negative context. The statement read “The activities presented were not useful.” Six respondents stated that they “strongly disagreed” with the statement and three respondents “disagreed” with the statement and one respondent rated this as a “strongly agree.” However, because all respondents answered the first query with “strongly agree” it probably means the participants did not recognize the negativism of the question. The results from these two queries support the premise that Concept Attainment is a valuable instructional strategy.

The second, third, and fifth statements examine the potential that CA can have in the classroom. The second statement reads; “Concept Attainment will engage my students.” The third statement reads; “CA will provide students with a challenging learning task.” The fifth statement read; “I plan to use CA in my instruction.”

After tabulating results of the second query the response was shown to be overwhelmingly positive, all ten participants “strongly agreed” with the statement. The third query found six participants “strongly agree” and four participants “agree.” The fifth query again had six participants “strongly agreeing” and four educators “agreeing.” No other response was marked in the three queries. The participants indicate in decisive manner that CA has instructional merit for the classroom teacher.

The value and usefulness of the CA activities that were presented in the manual were also examined. This was done with the survey statements 6, 7, 8, and 12 of the
instrument. Statement 6 said, “The activities demonstrated in the manual served as plausible examples of the model.” All ten participants marked “strongly agree” with the statement. Statement 7 read, “Seeing an example of the activity helped me understand the model.” All ten participants again marked “strongly agree” with the statement. Statement 8 read, “Seeing an example of the activity helped me see how the model could be utilized.” Once again all ten participants recorded “strongly agree” answers with the statement. Statement 12 asked, “The activities presented were easy to emulate.” Five participants marked “strongly agree” and four participants marked “agree.” One participant was “undecided.” The results from these four queries indicate that the participants consider the Concept Attainment activities an integral and valuable inclusion in the manual.

The remaining four queries investigated the activities’ objectives of enabling teachers to design and construct their own CA instructional activities. Statements 4, 9, 10, and 11 were included to provide feedback on these queries. Statement 4 was worded as follows, “I now feel as if I can create my own CA activities.” Two respondents “strongly agreed,” seven participants “agreed,” and one teacher was “undecided.” Statement 9 read, “Seeing an example of the activity was useful in helping me write an activity.” Seven teachers “strongly agreed”, three respondents “agreed.” Statement 10 said, “I could have written an activity from the narration included in the text.” The responses would produce mixed results. One person “strongly agreed”; six persons would “agree”; two were “undecided.” Statement 11 probed, “The activities presented aided me in designing my own lesson activity.” The data results were as follows, six educators “strongly agreed”; one recorded an “agree” response; two persons were “undecided”; one person
“disagreed.”

The feedback gives credence to the fact that the educators who reviewed the manual rate Concept Attainment as a worthwhile instructional model. They also supported the contention that the manual’s activities were useful and representative of the model. As before the ability of the teacher to design and construct his or her own activities from utilization of the manual did not receive as strong an endorsement. The feedback again demonstrates the same hesitancy on the part of the teachers to agree in this area.

What Was the Feedback on Cooperative Problem Solving

Eleven educators participated in the feedback on Cooperative Problem Solving. They gave input on the section’s 13 questions (see Appendix F.) Two educators failed to respond to question 10 but did respond to the remaining 12 queries. The queries followed the same agenda and format as described in the previous sections of Problem Based Learning and Concept Attainment. In the script of the 13 questions, the words Cooperative Problem Solving were substituted for Problem Based Learning and the abbreviation CPS appears where PBL is used.

As before the very first probe in this section asked the readers to rate Cooperative Problem Solving as exemplified and as explained in the manual as an instructional model. It was done using the following query: “Cooperative Problem Solving is a useful instructional model.” All 11 responses were “strongly agree.” The thirteenth and final question to the instrument posed a similar query but with a negative context. The statement read “The activities presented were not useful.” Four respondents stated that they “strongly disagreed” with the statement and seven respondents “agreed” with the
statement. The results from these two queries support the premise that teachers view Cooperative Problem Solving as a valuable instructional strategy.

The second, third, and fifth statements examine the potential that CPS can have in the classroom. The second statement reads; “Cooperative Problem Solving will engage my students.” The third statement reads; “CPS will provide students with a challenging learning task.” The fifth statement read; “I plan to use CPS in my instruction.”

For the second query the response was overwhelming positive, ten participants “strongly agreed” with the statement while the remaining respondent marked “agree.” The third query found eight participants “strongly agree” and three participants “agree.” The fifth query again had five participants “strongly agreeing” and six educators “agreeing.” The participants indicate in strong manner that CPS has instructional merit for the classroom teacher.

The value and usefulness of the CPS activities that were presented in the manual were also surveyed. This was done with the survey statements 6, 7, 8, and 12 of the instrument. Statement 6 said, “The activities demonstrated in the manual served as plausible examples of the model.” All nine participants marked “strongly agree” with the statement. Statement 7 read, “Seeing an example of the activity helped me understand the model.” Four participants marked “strongly agree” with the statement, while seven teachers marked “agree.” Statement 8 read, “Seeing an example of the activity helped me see how the model could be utilized.” Once again strong support was demonstrated as five participants recorded “strongly agree” answers with the statement and six participants marking “agree” on their instrument. Statement 11 asked, “The activities presented were easy to emulate.” Two participants marked “strongly agree” and six
participants marked “agree.” Three participants “disagreed.” The results from these four queries indicate that the participants consider the Cooperative Problem Solving activities an integral and valuable inclusion in the manual.

The remaining four queries investigated the activities’ objectives of enabling teachers to design and construct their own CPS instructional activities. Statements 4, 9, 10, and 11 were included to provide feedback on these queries. Statement 4 was worded as follows, “I now feel as if I can create my own CPS activities.” One respondent “agreed,” but the remaining ten participants “agreed.” Statement 9 read, “Seeing an example of the activity was useful in helping me write an activity.” Three teachers “strongly agreed” and eight respondents “agreed.” Statement 10 said, “I could have written an activity from the narration included in the text.” The responses would produce mixed results. One person “strongly agreed”; nine persons would “agree”; one “disagreed.” Statement 11 probed, “The activities presented aided me in designing my own lesson activity.” The data results were as follows, two educators “strongly agreed”; six participants recorded an “agree” response; and three persons “disagreed.”

The feedback again demonstrates that the educators who reviewed the manual rate Cooperative Problem Solving as a worthwhile instructional model. They also supported the contention that the manual’s activities were useful and representative of the model. The feedback again demonstrates the same hesitancy on the part of the teachers to agree in the area of designing one’s own lessons. While not as strong an approval statement was given to the query that a teacher can construct a CPS activity from the examples and the narration given in the manual, the teachers do give the chapter an overall positive endorsement.
General Impression of the Manual

Participants were asked to consider the overall concepts behind the creation of the manual. The manual was designed to explain the principles behind each of the three instructional models. It was also to explain how each of the three instructional models works. The manual was to demonstrate a model with plausible examples of the strategy. Finally, participants were asked to comment on the utility of the manual and its place as a potential resource. Thirty-two educators participated and gave feedback.

The first seven questions of the instrument were written to gather feedback about the principles mentioned in the preceding paragraph. Three questions were devoted to determine if the manual was designed and written in a manner that was friendly to its intended audience. The first query in this section of the instrument asked, “The chapter/manual did not sufficiently explain the model.” The third query on the instrument asked, “The manual was clear and easy to understand.” The fourth query asked, “The manual was not succinct.”

The response for the first query was 15 respondents answered “strongly disagree” thereby affirming that they thought the manual did explain the model. Thirteen respondents marked the “disagree” response. No one marked “undecided.” Two respondents marked “agree” and two participants marked that they “strongly agree” with the statement. The implication is that a clear majority of the reviewers (88 %) thought the manual did an effective job of explaining the instructional models.

The response for the third query, “The manual was clear and easy to understand” was as follows. Eleven participants marked “strongly agree” and 18 participants marked “agree.” Two participant marked “undecided” and one participant marked “disagree.”
Again an overwhelming majority (91%) felt the manual was understandable, readable, and user friendly.

The fourth query, “The manual was not succinct” was another statement worded negatively. Thirteen respondents answered that they “strongly disagreed” with this statement. Twelve educators marked that they “disagreed” with statement. One was “undecided,” three marked that they “agreed” with the statement and the finally two respondents marked that they “strongly agreed” that the manual was not succinct. Twenty-five of the 32 participants rated the manual favorably, a percentage of 78.

Question 2 also examined the clarity and utility of the manual in handling the expressed purpose of explaining how a lesson plan could be developed with each of the models. Question 2 read, “The manual sufficiently explained how to create type of lesson.” Ten of the participants responded that they “strongly agree” with the statement and 19 responded that they “agree” a 91 percent approval rate. Two participants were “undecided” and one “disagreed.”

Questions 5 explore the efficacy of the sample lessons in both explaining the model and demonstrating the model. Question 5 read “The lessons plans presented in the manual were useful.” One hundred percent of the responded gave a favorable rating to this query. Sixteen respondents marked “strongly agree” and 16 respondents marked “agree.”

The remaining questions explored the utility of the manual. Question 6 read “The manual is a useful resource for teachers.” Fifteen respondents gave a response of “strongly agree” and 17 participants said that they “agree” with the statement for another 100 percent approval rating. Question 7 read, “I will use this manual.” Eighteen educators
marked “strongly agree;” and 13 educators marked “agree” with one educator indicating that he was “undecided.” This equates into a 97 percent approval rating.

Summary of the Feedback Activity

The manual’s usefulness seemed to win a nod of approval. Feedback seemed to support the contention that the manual’s existence could assist teachers with their planning of instruction and their actual instruction in the classroom. Its targeted audience, practitioners in the classrooms and in central office, found some value in its applicability to assist teachers in their quest to vary their instructional delivery. The feedback gained in this particular inquiry would also seem to validate the author’s contention that such a manual could be a resource for teachers. As stated in Chapter One of this work, there are some instructional issues with the block schedule, such (but not limited to) as teachers not varying their instruction, teachers’ lack of knowledge of various strategies, and the absence of resources and training of teaching in an extended period of time. The manual was created to provide a small part of the solution to these issues. The feedback also seemed to validate the design in which the author chose to write the manual. Specifically, sample activities were included for each of the three models. The author designed each of these lessons. The purpose was to effectively demonstrate each model and what a lesson might look like using the specific strategy. Feedback seemed to support that the author had some success with this intention as well.

The feedback did not give as strong an affirmation in one area that the author hoped that the feedback might support. The author had tried to write the manual in such a fashion that teachers might readily create and construct their own lesson activities from
the narration found in the text. The evidence found in the feedback, while it did not
totally reject this premise, did not receive the approval scores that other intended
concepts received. Some respondents felt that they could indeed create activities but just
as many did not think they could.

This could have been a result of the author not providing enough detail and
instruction on how to actually construct each activity. Or the author relied too heavily on
the participants being able to pick up the skill of writing the activities by analyzing and
perhaps duplicating the example activities that were presented. Perhaps more varied
eamples of each of the activities should have been included. Another possible
explanation could be that some of the participants just did not feel that they were creative
enough to manufacture their own activities; they perhaps feel that they have to rely on
readymade activities to be provided for them.

An assumption might be had that if teachers were to use the activities over time,
they would come to know of the model, its nature, and how to conduct a class using the
model. Such continued use would mean success for the manual. And after continued use
it would be a natural assumption that the teacher would come to recognize and predict
moments where the model might be incorporated in the curriculum and in the instruction
provided by that teacher. Eventually it is hoped that the teacher could devise activities
from this continued use.

As a result of this feedback and the advice of the committee, this concern has
received attention. After sharing this data-collection with members of the dissertation
committee and upon their advice and guidance, additions and revisions were made to give
more teacher-friendly assistance. Explicit detailed statements were included to better
explain how to build activities. Language that speaks to content decisions (which content might be suitable for a particular model), and why the activity could enhance instruction were also included since the results of the feedback were interpreted. Future work with teachers who use this manual will provide the evidence that these changes help realize the goal of making the manual a generative tool for teachers as well as informative.

In conclusion, I would like to say that throughout this endeavor I tried to produce a product that could serve as a practical resource for teachers. I have tried to include learning models that I believe are robust and engaging for students and teachers. Subsequently the examples I provided were intended to demonstrate the utility of the model in real classroom settings. My hope is that I have served those teachers well who are looking for such assistance and who use the ideas in this manual. I designed the manual based on my experiences and it represents but one approach that was successful for me. My strong belief is that if they invest the time, these teachers will find these ideas enrich teaching and learning in their classroom as they did in mine.
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Appendix A

PROBLEM BASED LEARNING

After reading each statement, please place a checkmark (one per statement) that best reflects your sentiments on the particular query

1. Problem Based Learning is a useful instructional model.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

2. Problem Based Learning will engage my students.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

3. PBL will provide my students with a challenging learning task.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

4. I now feel as if I can create my own PBL activities
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

5. I plan to use PBL in my instruction.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

6. The activities demonstrated in the manual served as plausible examples of the model.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

7. Seeing an example of the activity helped me understand the model.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

8. Seeing an example of the activity helped me to see how the model could be utilized.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

9. Seeing an example of the activity was useful in helping me write an activity.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree
10. I could have written an activity from the narration included in the text.

___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

11. The activities presented aided me in designing my own lesson activity

___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

12. The activities presented were easy to emulate.

___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

13. The activities presented were not particularly useful.

___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree
Appendix B

Raw Data Results: Responses for Questions 1 – 13, Problem Based Learning.

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Appendix C

CONCEPT ATTAINMENT

After reading each statement, please place a checkmark (one per statement) that best reflects your sentiments on the particular query.

1. Concept Attainment is a useful instructional model.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

2. Concept Attainment (CA) will engage my students.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

3. CA will provide my students with a challenging learning task.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

4. I now feel as if I can create my own CA activities
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

5. I plan to use Concept Attainment in my instruction.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

6. The activities demonstrated in the manual served as plausible examples of the model.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

7. Seeing an example of the activity helped me understand the model.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

8. Seeing an example of the activity helped me to see how the model could be utilized.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

9. Seeing an example of the activity was useful in helping me write an activity.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

10. I could have written an activity from the narration included in the text.
    ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree
11. The activities presented aided me in designing my own lesson activity
___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

12. The activities presented were easy to emulate.
___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

13. The activities presented were not particularly useful.
___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree
Appendix D

Raw Data Results: Responses for Questions 1-13, Concept Attainment.

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Appendix E

COOPERATIVE PROBLEM SOLVING

After reading each statement, please place a checkmark (one per statement) that best reflects your sentiments on the particular query.

1. Cooperative Problem Solving (CPS) is a useful instructional model.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

2. Cooperative Problem Solving will engage my students.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

3. CPS will provide my students with a challenging learning task.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

4. I now feel as if I can create my own CPS activities
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

5. I plan to use CPS in my instruction.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

6. The activities demonstrated in the manual served as plausible examples of the model.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

7. Seeing an example of the activity helped me understand the model.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

8. Seeing an example of the activity helped me to see how the model could be utilized.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

9. Seeing an example of the activity was useful in helping me write an activity.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

10. I could have written an activity from the narration included in the text.
    ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree
11. The activities presented aided me in designing my own lesson activity
___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

12. The activities presented were easy to emulate.
___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

13. The activities presented were not particularly useful.
___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree
Appendix F

Raw Data Results: Responses for Questions 1-13, Cooperative Problem Solving.

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Appendix G

THE MANUAL

After reading each statement, please place a checkmark (one per statement) that best reflects your sentiments on the particular query:

1. The chapter/manual did not sufficiently explain the model.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

2. The manual sufficiently explained how to create each type of lesson plan.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

3. The manual was clear and easy to understand
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

4. The manual was not succinct
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

5. The lesson plans presented in the manual were usable.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

6. The manual is a useful resource for teachers.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree

7. I will use this manual.
   ___ Strongly agree ___ Agree ___ Undecided ___ Disagree ___ Strongly disagree
Appendix H

Raw Data from Feedback Instrument: Responses for Questions 1-7; The Manual

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<th>2's</th>
<th>3's</th>
<th>4's</th>
<th>5's</th>
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<tr>
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<td>2</td>
<td>13</td>
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</tr>
<tr>
<td>3's</td>
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<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
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</tr>
<tr>
<td>4's</td>
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<td>19</td>
<td>13</td>
<td>3</td>
<td>15</td>
<td>17</td>
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<tr>
<td>5's</td>
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<td>15</td>
<td>2</td>
<td>17</td>
<td>15</td>
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</tbody>
</table>
Appendix I

Hello

I'm asking a favor of you.

I'm working on my dissertation. I am trying to write an instructional manual for teachers. It features some classic instructional strategies. I try to describe the strategy, what it looks like, how it works, and possible usage in the classroom. I try to demonstrate to teachers how to create and build their lessons.

AND I've created sample lesson plans for each model.

My dissertation committee has charged me with doing a feedback activity on the usefulness of the manual, its purpose, and its structure and organization, and to a degree how well it is written!

I have to get at least 30 educators to look/read a chapter and answer questions (20) on a survey about the manual and a chapter (a second chapter if you would like to.)

I was hoping you might participate and provide me feedback...SO I'm attaching a chapter and a survey. They're both in Microsoft Word...The survey is not interactive... so I hope you would not mind downloading it...marking/indicating your responses in some form or fashion and sending it back to me as soon as you have time to attend to it. There are two other chapters with sample lessons in them as well if you (or friends/colleagues) might be interested.

The three models are Problem Based Learning, Cooperative Problem Solving & Concept Attainment.

Thanks

Mickey Hickman

mdhickma@pcva.us

540-643-0285
Survey Information Sheet

Date: ______________________
School: ____________________________
Subject (s) Taught: ____________________________

Instructional model reviewed:
___ Concept Attainment
___ Problem Based Learning
___ Cooperative Problem Solving

If you would be willing to engage in a short telephone interview or an electronic interview please indicate so by giving me either a telephone number or an e-mail address to make contact with you.

Telephone Number _____________________

Time of day to best reach you _________

E-mail Address __________________________
Appendix K

Table 6 Tobacco Economy Chart Answers

Tobacco Math Plantation Plot (Possible Solution)

<table>
<thead>
<tr>
<th>Worker A</th>
<th>Worker A</th>
<th>Worker A</th>
<th>Worker A</th>
<th>Worker A</th>
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<tr>
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FOOD CROPS

FOOD CROPS

FOOD CROPS

FOOD CROPS
Appendix L

WORLD RANKINGS

The following two tables give the rankings for the top ten nations per land mass and by populations. These answers are generated by the Cooperative Problem Solving Activity “World Rankings.” It is based on data from 2006.

Table 7 Top Ten Nations by Land Area

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
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<tbody>
<tr>
<td>1</td>
<td>Russia</td>
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<tr>
<td>2</td>
<td>Canada</td>
</tr>
<tr>
<td>3</td>
<td>USA</td>
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<tr>
<td>4</td>
<td>China</td>
</tr>
<tr>
<td>5</td>
<td>Brazil</td>
</tr>
<tr>
<td>6</td>
<td>Australia</td>
</tr>
<tr>
<td>7</td>
<td>India</td>
</tr>
<tr>
<td>8</td>
<td>Argentina</td>
</tr>
<tr>
<td>9</td>
<td>Kazakhstan</td>
</tr>
<tr>
<td>10</td>
<td>Sudan</td>
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</table>

Table 8 Top Ten Nations by Population

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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<tr>
<td>2</td>
<td>India</td>
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<tr>
<td>3</td>
<td>USA</td>
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<td>4</td>
<td>Indonesia</td>
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<td>5</td>
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<td>6</td>
<td>Pakistan</td>
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<td>7</td>
<td>Bangladesh</td>
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<td>8</td>
<td>Russia</td>
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<td>9</td>
<td>Nigeria</td>
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<tr>
<td>10</td>
<td>Japan</td>
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</tbody>
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Defense for Student-Centered Strategies for Engaging Instruction in the Extended Period

Michael D. Hickman
Doctoral Candidate Educational Leadership
Virginia Polytechnic Institute and State University

Committee: Dr. Richard Salmon, Chair; Dr. Jimmie Fortune, Co-Chair; Dean Jerome Niles, Member; Dr. Thomas E. DeBolt, Member.

What I did

- A dissertation consisting of five chapters whose primary audience is intended to be those who may be teaching in the block schedule
- Within the work is a manual that demonstrates examples of engaging and student centered instruction and the direction for teachers to design similar learning tasks
What I did (cont.)

- Chapter 1 is a narrative about the block schedule; what it is, why systems and schools have moved to it, how it works, and some problems and issues.
- Chapter 2 discusses the learning theory behind the included models.
- Chapter 3 introduces the manual.
- Chapter 4 is the manual.
- Chapter 5 discusses the perceptions of various educators about the utility of the manual.

Reason for the manual

- Research has shown that some teachers feel ill-prepared for teaching in the block schedule and some teachers face difficulty in actually effectively teaching in an extended period.
- This translates into two conditions that plague teachers teaching on a block schedule.
  1. Insufficient knowledge of a variety of instructional strategies
  2. Professional development opportunities have not been provided
- The manual is meant to be a contribution to help with these instructional issues.
Instructional models

- The three instructional models featured in the manual are:
  - Problem Based Learning (PBL)
  - Concept Attainment (CA)
  - Cooperative Problem Solving (CPS)

The Manual

- The three models featured are discussed, explained, and demonstrated in Chapter 4.
- The methods used to do this are similar to what I use in the professional development workshops that I have designed and presented.
- The model is presented; the teachers participate in the activity; the activity and the model are debriefed. Teachers are challenged with creating their own activity.
Feedback Activity

- The opinions and perceptions of educators that are the intended audience for the manual were solicited.
- This was done by using a survey instrument designed to gather information about the value and the utility of the manual.
- The questionnaire used a Likert Response format.

Feedback Activity (cont.)

- Participation by the targeted audience gave feedback on six queries:
  - Is the manual clear and readable?
  - Is the manual functional in that it has utility (usefulness and value)?
  - Do teachers view the manual as a resource?
  - Does it adequately explain the instructional models?
  - Does it adequately demonstrate the models?
  - Do the included activities have value in the following ways?
    - One, do they serve as a valid example of the model?
    - Two, do they convince a teacher of the model’s merit and effectiveness?
    - Three, do they support a teacher’s efforts to construct a similar activity?
Results of the Activity

- The overall feedback from participants was very positive.
- The manual’s efficacy and purposes were validated.
- The utility and value of each of the three instructional models were also supported by the feedback.

Implications

- The feedback participants acknowledged the manual as a positive entity. Teachers welcome this type of assistance.
- The feedback indicated the manual was not as strong in the area of enabling teachers to design and create their own PBL, CA, and CPS strategies.
- One interpretation from this specific feedback is that some teachers do not have the familiarity, comfort level, or in some cases the expertise to design other than direct instructional activities.