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AN INTEGRATION OF COGNITIVE ACADEMIC LANGUAGE
PROFICIENCY AND CONTENT-BASED INSTRUCTION

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Education:
Teaching English to Speakers of Other Languages

by
Fu-Chuan Wang
December 2003

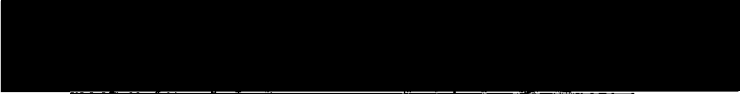
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Sept. 23, 2003
Date

ABSTRACT

Cognitive Academic Language Proficiency (CALP) is a crucial skill for English as a Second Language (ESL) students who wish to succeed in their academic studies. Today, the requirements for ESL students in content areas are tougher than ever before. Students are required to attain the same academic levels as native-English speakers within a limited amount of time. Because of this, ESL teachers' roles are broader than those of traditional content area teachers. The purpose of this project is to provide more effective teaching strategies for ESL students through the integration of CALP and content area teaching.

This project consists of five chapters. Chapter One, the introduction, provides a general understanding of the project. Chapter Two, the review of the literature, investigates the theoretical concepts through four key words and related research. Chapter Three, the theoretical framework, provides a design for CALP based on the theoretical concepts in Chapter Two. Chapter Four, the curriculum design, explains how CALP is developed within specific content areas. Chapter Five, the assessment model, describes how to evaluate the effectiveness of different learning strategies in the content area. Finally, the

Appendix contains a teaching unit that incorporates the conceptual model of CALP.

ACKNOWLEDGEMENTS

This project is dedicated to the memory of my father, Fu-Lo Wang, who encouraged me to pursue and finish my higher education in the United States despite the stresses of living, financial hardships, and survival from robbery, burglary and various other criminal activities that occurred regularly in the notoriously criminal Pomona neighborhood where I once lived. As a solitary adult learner, I have experienced many constraints in time and financial responsibility that may not exist for younger learners. Without the assistance of the CSUSB staff or many prominent professors, my educational goal would have been impossible to reach. I would like to thank those who have contributed to my success in graduate studies. First of all, my deepest and most sincere thanks go to Dr. Lynne Diaz-Rico, for her patience. Secondly, I would like to thank Dr. Deborah Stine for her writing course, my first class and a unique experience at CSUSB.

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TABLE OF CONTENTS

ABSTRACT	iii
ACKNOWLEDGEMENTS	v
LIST OF FIGURES	x
CHAPTER ONE: INTRODUCTION	
Background of the Project	1
Problems of Traditional English as a Second Language Teaching	2
The Complexities of Second Language Acquisition	3
Purpose of the Project	6
Content of the Project	7
CHAPTER TWO: REVIEW OF LITERATURE	8
Cognitive Academic Language Proficiency	9
Defining Cognitive Academic Language Proficiency	9
Components of Cognitive Academic Language Proficiency	12
Features of Cognitive Academic Language Proficiency	19
A Conceptual Model of Academic Language Acquisition	24
Suggestions for Cognitive Academic Language Proficiency	26
Second Language Acquisition and the Cognitive Approach in Academic Learning	28

Communicative Competence in Academic Language	29
Cognitive Academic Language Learning Approach	30
Whole Language and Academic Language Development	33
Summary	36
Learning Strategies in Various Content Areas	37
Cultural Influences on Learning Strategies	38
Learning Strategies and Definitions	40
Metacognitive Strategies in Content Areas	41
Cognitive Strategies in Content Areas	43
Social and Affective Strategies in Content Areas	44
Suggestions for Learning Strategies in Content Areas	46
Cognitive Theory and Educational Application	47
The Evolution of Cognitive Development Theory	47
Cognitive-Development Theory and Knowledge Acquisition	51
The Cognitive Theory and Learning Approach	55
Conclusion	58
Computer-Assisted Language Learning in Cognitive Learning	59

The World Wide Web and the Internet Provide Unlimited Learning Resources	63
Roles of English as a Second Language Teachers in the Development of Computer-Assisted Language Learning	65
Summary: Computer-Assisted Language Learning Applied to Academic Study	66

CHAPTER THREE: THEORETICAL FRAMEWORK

A Model of the Integration Process	68
The Philosophical and Psychological Domains of the Learner	71
Continuity of Background Knowledge and Schema	73
The Principles of Integrating English as a Second Language Learning and Content Areas	75
Professional Knowledge and Technology Domains of Cognitive Academic Language Proficiency	75
Learning Strategies and Teaching Approaches Domain	77

CHAPTER FOUR: CURRICULUM DESIGN

Fundamental Concepts of Curriculum Organization	81
A Model of the Academic Language Proficiency Process	85
A Technology-based English as a Second Language Curriculum	86
English as a Second Language Teaching for Content Integration	87

The Role of Language in Cognitive Development	89
CHAPTER FIVE: ASSESSMENT	
The Purpose of Assessment	92
Assessment Content	93
Evaluation for Technological Literacy	93
Scholastic Achievement in English as a Second Language Learning	95
APPENDIX A: INSTRUCTIONAL UNIT ONE	97
APPENDIX B: INSTRUCTIONAL UNIT TWO	109
APPENDIX C: INSTRUCTIONAL UNIT THREE	119
APPENDIX D: INSTRUCTIONAL UNIT FOUR	129
BIBLIOGRAPHY	139

LIST OF FIGURES

Figure 1. Language Acquisition for School	25
Figure 2. A Model of Cognitive Academic Language Proficiency	70
Figure 3. A Model of Curriculum Design	82

CHAPTER ONE

INTRODUCTION

Background of the Project

Due to a lack of basic English language skills and academic knowledge, English as a Second Language (ESL) students struggle to attain success in the American educational system. Advancing in academic studies and scholastic achievement is a struggle for the growing ESL learner population. The stresses and opportunities of a multicultural society and the progressive integration of digital technology into instructional activities have altered the structure of contemporary learning environments. These influences have introduced new complexity into the context of ESL teaching.

In an attempt to cope with these problems, many types of bilingual program models have been implemented. But many of these models, including transitional, immersion, and maintenance programs with tutorial and supplementary instruction, often provide inadequate results for ESL learners in facilitating the development of academic language. The integration of traditional ESL teaching into

subject areas appears to be the direction that ESL educational programs and curriculum design are now taking.

Problems of Traditional English as a Second Language Teaching

Too often, current bilingual education programs fail to create classroom environments conducive to the academic success of the ESL student. Levine (1990) claimed that traditional ESL teaching categorizes ESL students as "inferior" and "having no language." ESL classrooms may serve as a dumping ground or a safe haven. Many provide few opportunities for content area academic study.

As a result, ESL students may fail to commit to their studies and become alienated from classroom learning. Collier (1995) found that, contrary to the common belief that a motivated student can acquire a second language in a short amount of time, learners may need four to twelve years to reach the level of academic proficiency necessary to compete with native speakers. Levine (1990) observed that traditional ESL programs provide no substantial assistance to accomplish these goals. ESL learners need effective learning skills and strategies more than other students in order to succeed in academic learning in the subject areas.

The Complexities of Second Language Acquisition

Second language teaching programs and curriculum are not like industrial engineering, in which correct specifications and parameters, always produce constant values under various circumstances. However, a well-designed curriculum and effective teaching methods, although not as precise in outcome as the products of engineering, should provide ESL teachers with appropriate teaching strategies.

In defining an effective method of ESL learning, it is necessary to specify what one means by "language." Webster's II New Riverside Dictionary (1996) defined language as "The sounds, words, and combinations of words that constitute a system for the expression and communication of thoughts and feelings among a number of people, as those with a shared history or set of traditions" (p. 388). Mandler (1983) declared that language is a type of representation that includes intellectual operations, processes, codes, data structures, networks, concepts, and words that describe what the thinking process is all about. Representation of empirical experiences has a communicative function. In the same way, a word stands as a piece of shared knowledge.

Savignon (1993) offers a definition of language as a social system of communication. Individuals develop their language skills through use and through involvement in communicative events. Diaz-Rico & Weed (1995) suggest that second language acquisition involves interaction with others. Psychological and socio-cultural factors play important roles in a learner's success in acquiring and using a second language.

Researching second language acquisition is unlike studying other natural sciences. For centuries, language teaching approaches and theories have developed dynamically from one paradigm to the next. Celce-Murcia (1991) stated that language teaching methodology has vacillated between two types of approaches: one approach focused on using the language whereas the other focused on analyzing the language.

Chomsky (1983) declared, "Anybody who teaches at age fifty what he was teaching at age twenty-five had better find another profession." Unlike some professional fields, such as physics or mathematics, in which certain laws are immutable, theories of teaching do not always remain the same. For example, there has been no change in Newton's laws since their conception, but second language

acquisition theories have been developing for many centuries. In second language learning, the most fundamental issues are still being studied and many research projects are yet in progress.

In the twenty-first century, second language acquisition theory has expanded by additional dimensions and increased in complexity as the result of rapidly changing technology and the unlimited resources of worldwide intercultural communication. Second language theories and teaching approaches are continuously redefined and modified as a function of time and innovations in technology. Digital technology may have greater impact on ESL teaching methods than the printing machine of Gutenberg had on the medieval era. Keeping up with the changing environments of the world and the innovations of technology is essential to successful ESL teaching.

A fundamental issue in second language learning is the dynamic and constant development of language. Second language acquisition should be discussed and researched within physical and practical contexts. The interaction among learners, learning theories, and living environments must be taken into consideration.

Purpose of the Project

The purpose of this study is to provide an effective teaching method for second language learning in content areas and to aid in the development of cognitive academic language proficiency (CALP) for the English learner through the integration of cognitive academic language proficiency and content-based instruction.

The structure and theories of conventional ESL programs are derived from Skinner's behaviorism of the 1930s. Behaviorism as a theory is based on the results of experiments and research conducted on various animals such as rats, pigeons, and monkeys. The principles of behaviorism are based on stimulus and response experiments, methods of shaping, and constant or partial reinforcement. Assuming that these methods will yield similar results in human students lacks credibility. ESL teachers should never be seen as trainers hired to produce a standardized outcome through language exercises and drills.

This project offers pedagogical innovations as an alternative to traditional instruction, in order to facilitate the ESL learning in content areas. A language learning experience which includes the study of academic content improves the efficiency of ESL learning as a whole.

Content of the Project

This project introduces contemporary teaching methods based on a comprehensive theoretical framework, and provides a curriculum for the development of CALP in ESL learning. The purpose is to promote ESL learners' success in academic study, and meet the challenges of the highly developed technological environment of American society.

Chapter One describes what an effective method in ESL learning would be, and the complexities of acquiring a second language. Chapter Two explores four major concepts: cognitive academic language proficiency, second language acquisition and cognitive approaches to academic learning, learning strategies in various content areas, and cognitive theory in its educational applications. Chapter Three integrates the experimental concepts explored in Chapter Two and provides a model of an innovative curriculum for the development of CALP. Chapter Four introduces a teaching unit, including a technology-based ESL curriculum and metacognition-enhanced ESL teaching. Chapter Five provides both ESL teachers and learners with concepts and methods of assessment. Finally, the Appendices present the instructional units.

CHAPTER TWO

REVIEW OF LITERATURE

The role of today's ESL teacher is expanding as students face increased linguistic demands from a culturally diverse and increasingly technological Western society. ESL teachers need to address the challenges and opportunities created by the rapidly increasing number of language minority students in American classrooms and communities.

An important goal of ESL instruction in public schools is for students who successfully complete instruction in ESL education to achieve success in programs and curriculum designed for native English speakers. Designing an effective curriculum for current environments involves a review of educational research and literature that encompasses multiple domains. These domains include cognitive academic language proficiency, second language acquisition and the cognitive approach in academic learning, computer-assisted language learning, learning strategies in various content areas, cognitive theory, and educational application. The following presents literature

in which each of these selected domains are discussed and examined.

Cognitive Academic Language Proficiency

The acquisition of a second language for academic study through school curricula is a complicated process. Many misconceptions exist and must be addressed. In the learning process, the cognitive dimension plays an important role in the teaching of academics for many ESL students who previously have been schooled in their first language and demonstrate knowledge in content areas. Cognitive Academic Language Proficiency (CALP) is the level of language proficiency that ESL students must have to perform successfully in an academic environment.

Defining Cognitive Academic Language Proficiency

Cognitive Academic Language Proficiency is academic language skill. Chamot and O'Malley (1999) observed that many ESL students, who could speak and understand English fairly well continued to encounter serious difficulties in content classrooms, where they were expected to use English as a tool for learning other concepts.

Cummins (1984) found that although most students learned sufficient English to engage in social

communication in about two years, they typically needed five to seven years to acquire the cognitive academic language skills needed for successful participation in content classrooms. Knowledge and literacy together make up what Cummins refers to as "cognitive academic language proficiency" (CALP). Diaz-Rico and Weed (1995) reiterated that CALP is the language tool needed to perform school tasks successfully, because students rely primarily on language to attain meaning.

Collier (1995) offered a conceptual model for acquiring a second language for school, one in which the four major components (socio-cultural, linguistic, academic, and cognitive processes) are interdependent. She emphasized the crucial role of cognitive development in the first language and observed that during earlier decades in the United States, teaching the second language was emphasized as a priority while the teaching of other academic subjects was postponed. Research has shown that postponing or interrupting academic development is likely to promote academic failure.

Ramirez, Yeun, and Pasta (1991) found that most traditional transitional bilingual education programs last only two to three years. This is long enough for students

to achieve basic interpersonal communication skills (BICS), but not long enough for children to build CALP. Many currently practiced methods of bilingual education and ESL curricula fail to facilitate the development of CALP. It then becomes difficult for students to succeed in further study, or use critical thinking skills, learning strategies or problem solving in content areas because they don't have the language to do so.

Cummins (1984) found that students who appear to be fluent enough in English to survive in an English classroom may actually have significant gaps in the development of academic aspects of English. Participating in everyday conversations, playing games, developing basic vocabulary, and participating in school activities all involve interpersonal communication, but these do not equip students to succeed academically.

Contrary to the common misconception that a motivated student can acquire a second language in a brief span of time, Collier and Thomas (1996) claimed that 4 to 12 years of second language development are needed for even the most advantaged student to reach advanced academic proficiency. The process of acquiring academic proficiency in a second language is very different from that of acquiring BICS. For

ESL students, acquiring CALP means attaining grade-level mastery in academic subjects.

Mitchell and Myles (1998) theorized that the learner operates a complex processing system that deals with language in ways similar to the methods by which other types of information are processed. Information processing models are summarized as follows: humans are viewed as autonomous and active, and the mind serves the general purpose of processing symbol systems for assimilating new information. Learning is a cognitive process because it is thought to involve internal representations that regulate and guide performance. Automation, self-initiated efforts to learn, and restructuring (personalizing the organization of newly acquired information) are central to cognitive processing.

Components of Cognitive Academic Language Proficiency

Diaz-Rico and Weed (1995) postulated that CALP is comprised of distinct components: communication, conceptualization, critical thinking, culture, and context. Each of these will be examined in turn.

Communication. Diaz-Rico and Weed (2001) emphasized the importance of acquiring reading, listening, speaking and writing skills in the development of CALP. The ability

to speak and listen in basic, everyday situations is the beginning of cognitive academic language proficiency and success in academic studies. Reading skills include using context clues to guess vocabulary meanings and mastering a variety of genres in fiction and non-fiction. Students should be able to follow verbal instructions, interpret nuances of intonation, and benefit from the help of peers. Oral presentations, smooth reading, and report writing are also of importance.

In the past, many researchers have focused on communicative learning activities. Freed (1992) stated that, in language-focused classrooms, a concern for developing communicative competence has led to a number of initiatives in terms of materials, scope, sequence, and classroom decentralization. Bilingual, ESL, and English-as-a-foreign-language (EFL) programs have concentrated on the development of academic reading, resulting in a wide array of attractive materials.

Dubin (1991) declared that reading as a learning tool introduces cognitively complex tasks in which students look at texts critically in order to understand the author's implied ideas, make inferences about the material at hand, and link the ideas in one text to those that have been

introduced in another. Individuals develop learning skills through their use and involvement in a variety of communicative events. Improving the four basic skills facilitates cognitive academic language proficiency. Communication consists of using language for interpreting and organizing experiences. When combined with the four basic skills, communication facilitates academic learning.

Conceptualization. The primary objective of CALP is to accomplish the teaching of academic content. EFL/ESL teachers are responsible for presenting cognitively demanding subjects in a manner that is comprehensible to second language students. Snow and Brinton (1997) proposed four areas for designing appropriate lessons for the development of conceptualization. These areas are as follows: 1) vocabulary instruction, 2) prioritization of objectives, 3) schema-building activities, and 4) learner grouping strategies.

Diaz-Rico and Weed (2001) provided the procedure for conceptualization in the following examples: 1) concepts become abstract and are expressed in longer words with more general meanings ("rain" becomes "precipitation"); 2) concepts fit into larger theories ("the precipitation cycle"); 3) concepts fit into hierarchies (from "rain" to

"precipitation" to "weather systems" to "climate").

Conceptualization is an advanced level within the second language program. Students need to be exposed to the kinds of reading, writing, listening and speaking tasks that will be expected in further academic studies.

Richard-Amato (1996) emphasized reading abstract materials, grasping key ideas from lectures, and writing critiques and summaries. She also proposed that knowledge and experience be introduced by three methods: 1) text-structure schema and conventional text-constructing devices, 2) cognitive and meta-cognitive strategies for reading and writing as it relates to the academic content being studied, and 3) synthesizing information from a wide range of reading materials in a single area of study. Conceptual development in a second language can be achieved if the path of development includes school learning and required textbooks with an appropriate design and learning strategies. Conceptualization is not just an individual's inner process, but also involves interaction between second language acquisition and the dynamic environment of society. This is a crucial challenge for ESL teachers.

Culture and Environment. Second language learning is a lifelong process involving culture and many other

environmental factors. A large portion of society shares attitudes towards minority cultures and languages that may affect this learning process. Bias and discrimination can be as subtle as lowered expectations, but can have devastating effects on the teaching process. Collier (1995) stated that prejudice and discrimination expressed towards groups or individuals in personal and professional contexts may influence a student's performance in school. These factors strongly influence the student's response to the new language and affect the process positively only when the student is in a socio-culturally supportive environment. Students' previous experiences and cultural backgrounds are other decisive factors in the outcome of their academic studies.

Diaz-Rico and Weed (1995) provided examples of enriching ESL learning experiences and the interplay of culture and environment. Supplementary educational experiences such as field trips, guest speakers, films, experiments, discovery centers, music and song, and poetry or other literature arouse student interest and reinforce academic development through CALP. Prior knowledge of a topic may be tapped in order to determine the extent of a student's existing concepts and understandings. Many

students may have experiences to share that are relevant to the topic of the lesson.

Bernhardt (1996) concluded that connecting "topic knowledge" with ESL students' backgrounds generally promoted the effectiveness of second language learning. A number of studies have investigated the manner and type of background knowledge that might be given to student readers in order to increase language comprehension.

Diaz-Rico and Weed (1995) posed the question, "If, as many believe, prolonged exposure to English is sufficient for mastery, why then do so many students fail to achieve the proficiency in English necessary for academic success?" (p. 40). A well-meaning teacher, with the most up-to-date pedagogy, may still fail to foster achievement if the students are socially and culturally uncomfortable with, resistant to, or alienated from schooling. Research shows the process of acquiring a second language through the school curriculum is very different from learning any other subject through the school system. Sociocultural factors affect second language acquisition. The culture of language has a decisive influence in the development of cognitive academic language proficiency.

Critical Thinking. Connecting words with concepts in academic study involves finding effective teaching approaches and skills. There are many theories and phenomena in the natural sciences and social studies that cannot be explained and taught simply through sentences and short paragraphs. In content areas and grade-level subjects, ESL teachers provide not only instructional content but also procedural guidelines and learning strategies to develop the critical thinking skills of the ESL student. Effective teaching demands preparation that includes graphic organizers, solid text structures, symbolic representation, and metacognition.

Diaz-Rico and Weed (1995) suggested that graphic organizers help students order their thoughts by representing their ideas visually. Semantic mapping is a way of presenting concepts to show their relationships. After a brainstorming session, the teacher and students can organize their ideas into a semantic map with the main idea in the center of the blackboard and associated or connected ideas as branches from the main idea. A computer flow chart is one method of presenting more complicated concepts. A graphing calculator can also make mathematical models of scientific phenomena and abstract concepts easier to

understand and analyze than is possible through verbal explanation.

Tang (1993) similarly concluded from the results of research in Vancouver schools that adopting a model of instruction (explicit and graphic representation of knowledge structures and providing practice in constructing graphics from text) can help to increase students' abilities to read and write academic discourse. Cognitive academic language proficiency is a complicated process. ESL learners not only need time to adjust to new learning environments, but also require more learning strategies in order to succeed in their academic futures. Diaz-Rico and Weed (1995) also outlined other important learning strategies in the development of critical thinking, including using textual structures, symbolic representations, "reading between the lines," and meta-cognition to plan activities and monitor progress. These effective learning strategies benefit the learning processes of ESL students in second language acquisition.

Features of Cognitive Academic Language Proficiency

Providing Authentic Materials and Settings. Having attained CALP, ESL students can learn academic course matter in the subjects of science, social studies,

mathematics, language arts, and computer science. These subjects will satisfy high school or college breadth requirements and also meet the rationale of curriculum and methodology of K-12 government-regulated ESL programs.

The Foreign Language Framework for California Public Schools at the Kindergarten Through Grade Twelve Level

(1989) recommended that ESL programs continuously present authentic, integrated oral and written language used and understood by native speakers in a wide variety of social, interpersonal and academic settings. Additionally, language presented in core curriculum materials should be authentic and drawn from literature and outside sources such as history, international studies, geography, science, and mathematics.

Authentic materials and academic settings stimulate higher levels of cognitive development for further study in content areas and other subjects. ESL teachers need to judge what kind of materials would be authentic in curriculum design. Chapelle (1999) suggested that evaluating the authenticity of second language tasks relies on an analysis of the correspondence between second language learning tasks and tasks that the learner is likely to encounter outside the classroom. All ESL students

need to pass the minimum requirements of currently prescribed high school tests.

Facilitating Traditional English as a Second Language Learning with Content Knowledge. Traditional ESL curriculum includes two to three years of building vocabulary, learning grammar, completing workbook exercises, and reading prescribed texts. Standardized textbooks and typical ESL learning experiences lack motivational power and result in an absence of a desire to learn. Freire (1970), in his careful analysis of the teacher-student relationship in traditional classroom activities, revealed many dehumanizing educational practices. "The teacher talks about reality as if it were motionless, static, compartmentalized and predictable. The teacher's task is to 'fill' the students with the contents of his narrative - contents which are detached from reality, disconnected from the totality that engendered them and give them significance. Words are emptied of their concreteness and become a hollow and alienated verbosity." (p. 212). ESL classroom learning activities reflect similar conditions in high school ESL curricula and adult educational institutions. Lack of modern technology, relevant materials, and real-world problem solving has caused ESL

learners to lose their interest and motivation to study and develop academic language. Daily repetition of vocabulary drilling and reviewing prescribed texts and teacher-centered learning activities increase the ESL student dropout rate.

Ineffective Traditional English as a Second Language Learning Methods. In traditional ESL learning activities, ESL students tend to approach all content study and subject materials in the same way. They rely on different types of bilingual dictionaries, like the electronic pocket translator, without understanding how to deal with conceptual learning and critical thinking skills. In scientific and mathematic subjects, translators cannot solve problems without appropriate and effective strategies.

Kinsella (1997) suggested that the structure and organizational features of mathematic and scientific textbooks are significantly different from those of a social studies textbook. The fiction in a literature textbook also takes on many forms that challenge students' solutions for abstract concepts of suspense and foreshadowing in both literature and scientific studies.

The Importance of Sociocultural Development of English as a Second Language Learners. Traditional ESL learning ignores the importance of the social-cultural development of a student in an unfamiliar society or country. The increasing numbers of ESL students attempting to assimilate into mainstream academic study cannot be isolated from the real world.

Socio-cultural development of the ESL student is an invisible factor that highly influences the success of the learner. Diaz-Rico & Weed (1995) suggested that as one masters a language, one is also becoming a member of the community that uses this language to interact, learn, conduct business, love or hate. This process of linguistic and societal integration involves participation in a myriad of social activities. For this reason, ESL learning cannot be achieved apart from social activities. ESL teaching and curriculum design need to consider the implications of ESL students' experiences with two distinct cultures.

Curriculum design in CALP must be built upon the foundations of cognitive development, sociocultural experiences, and academic backgrounds of ESL learners. The implications of CALP should be incorporated in second

language teaching and academic study at all levels of school system.

A Conceptual Model of Academic Language Acquisition

The process of acquiring a second language is complex and dynamic, involving multicultural interaction with modern society. Heath and Serrano (1996) claimed that diversity among ethno-linguistic groups contributes to difficulties in school, and the steady increase in the number of English language learners entering public schools has placed a tremendous strain on teachers. These issues cannot be resolved without an understanding of the fundamental processes by which a student acquires a second language.

Collier (1995) created the following diagram as a conceptual model representing the development of academic language acquisition in a multidimensional prism (see Figure 1). The four major components, social and cultural processes, language development, academic development, and cognitive development, are interdependent and complex. From this conceptual model, ESL teachers can see that the development of CALP is extremely complex. Despite more than thirty years of research in second language acquisition, many U.S. policy makers and educators assume that ESL

teaching consists only of providing linguistic knowledge in a stimulating environment. Empowering ESL students' language skills in CALP has become a complicated task that impacts all ESL teachers and educators who are part of the U.S. education reform efforts. As early as the 1960's,

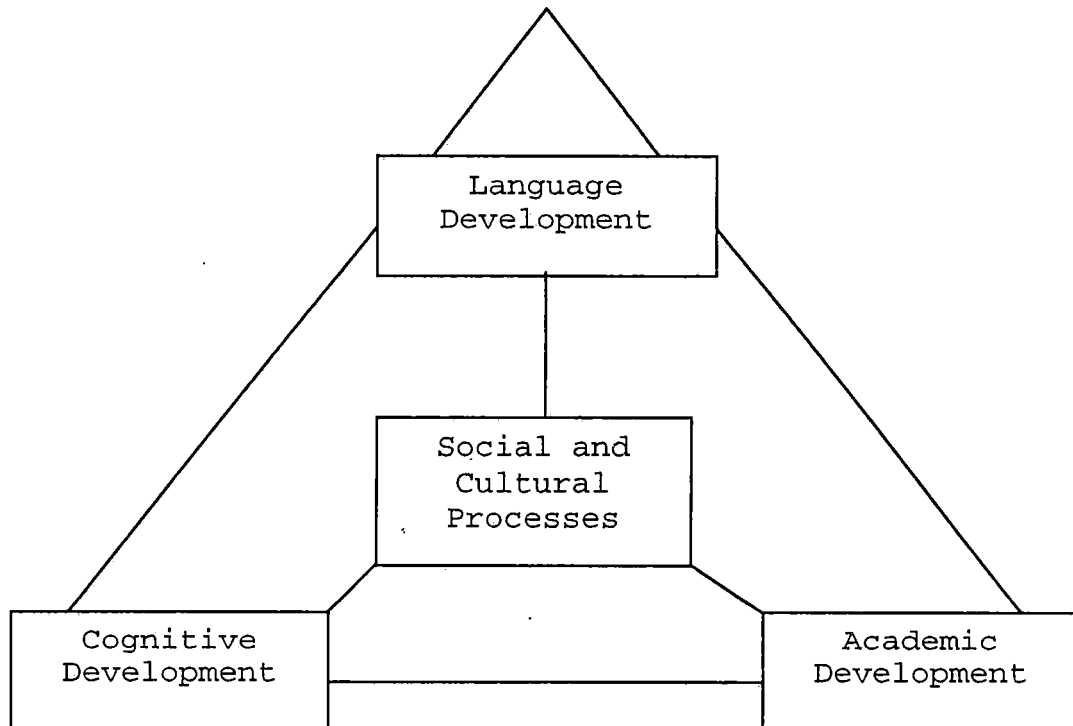


Figure 1. Language Acquisition for School (Collier, 1995, p. 9)

Loban, Ryan and Squire (1969) stated that language, thought and feeling are interrelated. Problems concerning all three have roots deeply embedded in the intricacies of individual and social behavior because language does not "stand apart

from or run parallel to direct experience but completely interpenetrates with it" (p. 18).

By the 1990's, research produced evidence to support a conceptual model of academic language acquisition. Collier (1995) and Cummins (1984) hypothesized that different levels of language proficiency are needed depending upon the context of language use. Academic language acquisition is a lifelong process that includes the experience of first language and uninterrupted cognitive development along with a supportive sociocultural context of schooling. External societal factors in the U.S. may have major influences on language acquisition. The conceptual model helps teachers understand the dynamic process of second language acquisition.

Suggestions for Cognitive Academic Language Proficiency

With an understanding of the conceptual model and CALP, ESL teachers may be able to identify the areas of weakness in the development of CALP. The solution is to examine the parameters of the curriculum design and instructional materials.

The current trends of bilingual education have suggested a clear shift in focus. Haynes and O'Loughlin (1999) claimed that the standards movement sweeping the

United States has directly impacted the curriculum and methodology of K-8 ESL programs. ESL learners, as well as mainstream students, will be required to learn state-prescribed content curriculum and to demonstrate proficient knowledge through performance on state-mandated tests. The Imperative for Educational Reform (U.S. Government Printing Office, 1983) suggested that to ensure a skilled, literate and civil society, schools need to uphold rigorous academic standards that require mastery of such skills and subjects.

Governmental regulation provides many outlines for curriculum design. The Foreign Language Framework for California Public Schools (1989) emphasizes that instructional materials should develop comprehension, reading, speaking and writing skills in an interdependent fashion and encourage continuous progress from beginning levels through higher levels of interpersonal and academic language proficiencies.

Collier (1995) suggested that ESL curricula at the secondary level should include the following: 1) second language taught through academic content, 2) conscious focus on teaching learning strategies needed to develop thinking skills and problem-solving abilities, and 3)

continuous support for staff development emphasizing activation of students' prior knowledge.

Collier (1995) showed that postponing or interrupting academic development is likely to promote academic failure. The research has also show that for young children and adolescents in grades K-12, uninterrupted cognitive, academic, and linguistic development is essential to success in a school setting.

In summary, the implications from current research, trends, needs of ESL learners, and government regulations have caused CALP to become indispensable to ESL education. The roles of teachers have expanded in many ways. ESL teachers should understand the complex parameters and contexts in order to provide an effectively designed curriculum for the development of CALP.

Second Language Acquisition and the Cognitive Approach in Academic Learning

There are many approaches to developing academic skills and integrating CALP into the curriculum. Traditional ESL teaching and textbooks have many shortcomings. A wave of reform in curriculum and teaching methods is directing attention to the quality and the

practicality of new approaches. In this cognitive approach there are three instructional models to be examined:

- 1) communicative competence in academic language learning,
- 2) cognitive academic language learning approach, and
- 3) whole language and academic language development.

Communicative Competence in Academic Language

Savignon (1993) believed that academic language is developed through both competence and performance. The descriptive vocabulary that has come to be associated with communicative language teaching includes the following terms: learner need, approximation, functions, abilities, discourse, interpretation, interaction, negotiation, context and appropriateness. ESL learners use their native language as a tool to increase their knowledge of English and to succeed in their studies.

Savignon (1993) presented language use as an expression of creativity. Learners use whatever knowledge they have of a language system to express meaning in a variety of ways. Therefore, communication is a continuous process of expression, interpretation, and negotiation. Communicative competence applies to both written and spoken language, as well as to many other symbolic systems. Competence refers to what a student knows, whereas

performance is how a student does. Only performance is observable, however, and it is only through performance that competence can be developed, maintained, and evaluated.

Regardless of the differences in the definition of communicative competence on the part of diverse scholars, it is a very important part of second language acquisition. Successful experiences in second language communication will lead to further learning and positive results. Frustration could cause maladjustments for the ESL learner and failure in school learning experiences. Therefore, ESL teachers should assist ESL learners in developing communicative competence using a variety of strategies.

Cognitive Academic Language Learning Approach

Chamot and O'Malley (1988) defined the Cognitive Academic Language Learning Approach (CALLA) as an instructional model that meets the academic needs of students learning English as a second language in American schools and provides explicit teaching of learning strategies within academic subject areas.

CALLA was conceived in the 1980's as a means of teaching learning strategies directly. Yalden (1987) observed that the traditional role of the teacher was

called into question by contemporary research findings; she claimed that the nature of second language teaching should be re-examined and perhaps redefined. ESL teachers are not only to provide linguistic knowledge, information about English, and personal communication skills, but they should also help ESL students apply their previous academic knowledge in the content areas.

Chamot and O'Malley (1999) suggested that the CALLA approach was appropriate for three groups of ESL students: 1) students who have developed communicative skills through ESL classes or exposure to an English-speaking environment, but have not yet developed academic language skills appropriate to their grade level; 2) students who have acquired academic language skills in their native language and proficiency in English, but need assistance in transferring learned concepts and skills to English; and 3) bilingual, English-dominant students who have not yet developed academic language skills in either language. The application of CALLA represents different conceptual models and domains in traditional second language acquisition.

Similarly, Chamot and O'Malley (1999) claimed that the cognitive mode of learning is based on the principal that learning is an active, dynamic process in which learners

select information from their environment, organize the information, and relate it to what they already know.

Anderson's work (1990) provided a theoretical foundation for CALLA, cognitive learning theory, and teaching approaches which combined the development of language knowledge and usage with strategy training to promote independent learning. Anderson suggested that learning skills, language skills, and knowledge follow a general sequence of stages of learning from the cognitive stage, to the associative stage, to the autonomous stage. Once the autonomous stage has been reached, performance becomes automatic and requires little effort in applying language to a wide variety of contexts and in mastering complex language learning.

Teaching ESL learners language skills alone is not sufficient to enable students to succeed in public academic learning environments. Instead, students need to develop their own learning strategies and become autonomous performers in solving problems and developing their capabilities to learn complex concepts. CALLA's purpose is to integrate language learning with content study and learning strategies in order to promote the success of ESL learning.

In summary, CALLA should be one of the basic procedures in effective academic language development. ESL teachers should know how to apply learning strategies, empower ESL learners with language skills, and implement learning strategies in academic study. These teachers need to also be familiar with the methods of CALLA and assume more responsibility for developing students' academic learning strategies.

Whole Language and Academic Language Development

According to Vacca (1994), teachers should design activities around cross-curricular themes to encourage learning through interdisciplinary connections and social interactions. Organization of thematic units gives students multiple directions of perception and opportunities to restructure content.

Goodman (1986) stated that instructional materials should include a range of real sources, particularly those already familiar to the learner. These include signs, cereal boxes and T-shirts, and later, textbooks. Whole language experiences empower students through creative activities. ESL teachers should provide a variety of writing programs to help expand students' language skills

and encourage the understanding of theoretical concepts in developing academic reading proficiency.

Crawford (1991) stated that the whole language philosophy is particularly relevant and important to language minority students because their previous schooling may have been fragmented and disengaged. In the whole language view, second language acquisition should stimulate learner motivation, and integrate real language with learning activities that facilitate academic language development in an unconventional direction.

Whole-language proponents see reading as part of general language development, which includes listening, speaking and writing. For ESL learning, CALP requires participating in many instructional activities and support from teachers and parents.

Expansion of Whole Language Curriculum. Literacy in context is the linguistic basis for integrating ESL learning into content areas. As early as 1985, Ernest Boyer's concept of language, "Language is not just another subject. It is the means by which all other subjects are pursued" became a widely accepted generalization. Many reading experts emphasize ESL learner's comprehension as a matter of construction. Ryan and Copper (1995) suggested

that whole-language proponents see reading as part of a general language development, which includes listening, speaking, and writing. The success of the reading curriculum is central to student success in all other subjects.

The Whole-Language Approach Facilitates Cognitive Development. Glatthorn (1988) defined the whole-language approach as follows: 1) it provides a literate environment that stimulates and supports the use of language; 2) it integrates language arts skills and knowledge by requiring their use in real life situations; 3) it emphasizes the pupil's own oral language; 4) it uses children's literature to develop an interest in reading and broaden reading horizons; and 5) it stresses the functional use of language. The whole-language approach provides methods that develop the skill of literacy in ESL learners.

Thomas and Collier (1996) suggested that instructional approaches for ESL learners employ whole language and natural language acquisition through all content areas; utilize cooperative, interactive and discovery learning; and promote cognitive complexity. Their research provided data that proved ESL learners' ability to reach the 50th percentile of a normal curve.

Diaz-Rico and Weed (1996) suggested that cognitive academic language proficiency can be developed by the elements of whole language. These elements are: 1) interacting with authentic texts, 2) journal writing, 3) higher-order thinking skills and discussion, and 4) personal communicative purposes. Those elements should also integrate ESL teaching with content study for cognitive academic language proficiency purposes. They further recommended that the content knowledge acquisition process can be accomplished more effectively through reading in a larger context. Students may engage in group activities, work collaboratively, and read and write texts for communicative purposes.

The expansion of whole language use provides new opportunities for the development of cognitive academic language proficiency. With the appropriate arrangement of learning environments, ESL learners can reach proficiency content study more quickly.

Summary

The challenges for ESL teachers are to understand the needs, attitudes and aptitudes of individual ESL students, and the requirements of instructional environments. In summary, a variety of teaching methods are beneficial to

academic study and ESL learning. No single method may be practically applied to all students. The development of CALP is the ESL teacher's responsibility and goal in second language acquisition. The attainment of these objectives depends on effective techniques of ESL teaching.

Learning Strategies in Various Content Areas

During the 1980's and 1990's, a series of national reports on the conditions of American education, A Nation at Risk, recommended "educational institutions reinforce the learning of the 'five new basics' in high school students" (Ornstein & Levine, 1997). These basic areas were defined as English, mathematics, science, social studies, and computer science.

American Memory: A Report on the Humanities in the Nation's Public Schools also echoed the importance of these core themes. Cultivating knowledge of national history, mathematics, science, English, and foreign languages has become a critical issue of concern.

In addition to the emphasis on content mastery, contemporary theorists have stressed the importance of students learning how to learn. Kinsella (1997) supported the importance of teaching learning strategies, because ESL

students often feel daunted by unwieldy academic tasks and are often insecure about how to proceed. For content area teaching, teachers who conscientiously design lessons for optimal content and language comprehension while neglecting strategy learning integration may unintentionally send ESL students demoralizing messages about their chances for success in various subject areas. ESL students need learning strategies even more than native language speakers.

Mohan (1986) warned that assisting ESL students in developing academic survival skills should not be delayed until they are ready for integration into mainstream courses. Learning strategies must be included in ESL instruction.

Cultural Influences on Learning Strategies

Foreign students often use learning strategies they have developed from previous learning experiences in their native countries that may not meet the challenges of the new learning environments. Jordan (1997) stated that major influences which condition or shape the way ESL learners think and study include the native culture's educational system, sociocultural background, and other personal variables. Jordan also suggested that ESL teachers pursue

investigation and research that would help them understand the crosscultural predilections of ESL learners. In mainstream classrooms, more active participation, creativity in academic study, and use of different learning styles should be encouraged.

For many Asian ESL students, the pressures of traditional societal values and family expectation have made it difficult for skills to emerge requiring creativity and imagination. The creative abstract thinking skills required in academic and content area study cannot be taught or developed through the use of a bilingual dictionary or mechanical pattern practice.

To offer an example, comprehension of Newton's three laws, all which involves abstract concepts, requires observation and experimentation. One cannot expect ESL learners to understand this in hour-long lectures without related learning strategies. Similarly, studying Dickens' Great Expectations in a freshman English course is not easy to accomplish without an understanding of the complicated historical-social background of the 18th century European industrial revolution. ESL students are more likely to develop misconceptions and conflicting ideas of Western civilization when studying these tumultuous times. To

compensate for their lack of historical and cultural background knowledge, ESL learners need to apply more learning strategies to their academic study in the American school system.

Learning Strategies and Definitions

The definition of learning strategies differs from person to person. Chamot and O'Malley (1994) stated that learning strategies are language learning activities based on specific types of functions performed effectively in language skills. Examples of such functions are analyzing, evaluating, justifying, and persuading. Students develop academic language skills in English through cognitively demanding activities in which scaffolded instruction guides the acquisition of content. Learning strategies assist students in self-monitoring, organizational planning, using resources and reference materials, grouping, summarizing, using imagery, information representation, cooperation, and questioning for clarification.

Thomas and Collier (1995) recommended that instructional approaches emphasize activation of students' prior knowledge, respect for the students' home language and culture, cooperative learning, interactive and discovery learning, intense and meaningful

cognitive/academic development, and ongoing assessment using multiple measures. Generally, the use of learning strategies is based on the principle that ESL learning is an active and thoughtful process, and, through different types of cognitive activities, ESL learners can develop effective language learning skills.

Chamot and O'Malley (1994) proposed three types of strategies: 1) metacognitive strategies--planning for learning, monitoring one's own comprehension and production, and evaluating how well one has achieved learning objectives; 2) cognitive strategies--manipulating the material to be learned mentally or physically; and 3) social/effective strategies--either interacting with another person in order to assist learning, as in cooperative learning and asking for clarification, or using effective methods and interpersonal relationships to assist learning tasks.

Metacognitive Strategies in Content Areas

Meyers (1999) defined metacognition as "knowledge about our own thinking processes" (p. 60). It has been described as "people's awareness of their own cognitive machinery and how the machinery works. This knowledge is used to monitor and regulate cognitive processes,

reasoning, comprehension, problem solving and learning." (p. 60). People obviously differ in how much and how fast they are capable of learning.

Oxford (1990) added that metacognitive strategies allow learners to control their own cognition, focus on new learning by close attention, and link new learning with already-known material. Other metacognitive strategies include setting goals and objectives, maintaining a strong purpose for learning English, seeking practice opportunities, and organizing conditions for optimal learning.

As current educational environments for ESL learning are expanding, traditional methods of ESL learning need to be addressed. For ESL students, mastering content is more challenging than mastering basic classroom survival skills. As such, more time is required to develop these skills. Accomplishing long-term goals and objectives requires more assistance from ESL teachers, building on existing skills from past experiences in the native language.

Chamot and O'Malley (1994) described classroom learning strategies as follows. Planning should focus on advanced organization, selective attention, and self-management. According to the text, learning task and types

of information, the teacher designs the learning plan. Monitoring emphasizes evaluating comprehension during listening or reading and checking ESL students' oral or written production. Evaluation operates as self-assessment-judging how well one has accomplished a learning task. All three steps can be differentiated to apply to different learning tasks and have broad applications. Metacognitive strategies and applications, and teachers' content area knowledge, should encourage ESL students to learn English more effectively.

Cognitive Strategies in Content Areas

The human mind is an active organizer, and learning is a prime motivator. The process and the final product are both important in ESL learning activities. Chamot and O'Malley (1994) stated that there are numerous cognitive strategies that link new information to prior knowledge. The term cognitive strategy is often used as a generic category that includes other strategies, such as imagery, summarization, transfer and deduction. Unlike metacognitive strategies, which tend to have broad applications, cognitive strategies are often linked to individual tasks.

According to Chamot and O'Malley (1987), cognitive strategies include using reference materials resourcefully,

taking effective notes, summarizing materials adequately, applying rules of induction or inference, remembering information using visual images, making auditory representations or elaborating associations to new knowledge, transferring prior skills to assist comprehension, and grouping new concepts, words or terms to maximize understanding. All these elements express the basic concepts and procedures of cognitive strategies. Teaching learning strategies to assist ESL student development of academic language acquisition could be very beneficial in today's classroom activities.

Rubin (1983) suggested that students need to acquire particular content-area concepts and to present these in a way that will promote independent vocabulary development. ESL students need to master English and content area knowledge through support from their native language in order to succeed in academics and in mainstream culture. As such, they must complete ESL learning in a more thorough fashion.

Social and Affective Strategies in Content Areas

Diaz-Rico and Weed (1995) stated that language cannot be learned in a vacuum; it involves interaction with others. Psychological and socio-cultural factors play

important roles in using a second language. Each learner is simultaneously an individual and a member of a group.

Chamot and O'Malley (1994) defined social/affective strategies as follows: 1) questioning for clarification--getting additional explanation or verification from a teacher or other authority; 2) cooperation--working with peers to complete a task, solve a problem and receive feedback; and 3) self-talk--using affirmations to reduce anxiety by improving one's sense of competence.

Mitchell and Myles (1998) stressed that the attitude of the learner towards the target language, its speakers, and the learning context, may all play some part in fostering success or the lack of it. Affective strategies influence second language learning in many forms. These forms involve motivation, self-esteem, anxiety, and culture shock.

Mitchell and Myles (1998) highlighted the social nature of the ESL learner's identity. The relationship between the individual learner and the social context of learning is viewed as dynamic, reflexive and constantly changing. Social strategies are essential to second language learning. In content areas, these three types of

learning strategies combined with subject knowledge will provide learners with a powerful tool for academic success.

Suggestions for Learning Strategies in Content Areas

Learning strategies facilitate ESL learners' understanding and assimilation of new information and are more likely to result in success with academic studies. Time is the most important element in ESL learning. ESL students cannot be isolated from the development of cognitive academic language proficiency for two or three years. The delay of academic studying will only impede the student. There are many suggestions and implications for learning strategies in content areas. They not only provide important applications in ESL learning, but also become the fundamental concepts for curriculum design.

Teaching learning strategies is not an easy task for traditional ESL teachers whether using prescribed texts or teacher-centered learning activities. Curriculum that is designed for grammar practice, translations between two languages, or pronunciation drills will not foster the development of learning strategies. Frustration and boredom in ESL learning activities are likely to reduce the motivational factor and add to the difficulties of ESL learning. The methods of traditional ESL teaching tend to

produce only basic interpersonal communication skills and separate basic mechanical language translation from cognitive academic study. This practice hinders the development of an ESL learner.

In sum, many researchers have proven that the use of learning strategies as the primary method of second language acquisition is highly effective. Learning strategies are powerful tools for thinking and problem solving. Trial and error and memorization does not facilitate the development of learning skills in ESL learners. Teaching learning strategies to ESL learners has become a critical point for the ESL teacher.

Cognitive Theory and Educational Application

In the development of children's intelligence, there are two facets that concern psychologists and educators: nature and nurture. Although early studies showed that development depends on vigorous interaction with the environment and other nurturing factors, the nature-versus-nurture debate has yet to reach definitive conclusion.

The Evolution of Cognitive Development Theory

In the 1950's, behaviorists dominated the United States intellectual field. Celce-Murcia (1991) stated that

audio-lingualism was a reaction to traditional reading approaches and the lack of emphasis on oral-aural skills. This approach and its philosophy are still prevalent in educational institutions. Much of it is based upon the direct approach but adds features from structural linguistics and behavioral psychology. Active nurturing and environmental factors affect language learning. These early approaches feature the typical behavioral psychology of B.F. Skinner.

In the 1900's, anthropologist Claude Levi-Strauss and linguist Noam Chomsky claimed that an innate form of mental structure exists. Since then, the nature side of the debate has begun to gain more respectability.

Jean Piaget (1896-1980) also hypothesized about children's learning processes and the development of intelligence in different stages. Unlike behavioral psychology, he suggested the following: 1) motivation and rewards are not necessary; 2) the structures in a child's mind lead to a kind of spontaneous development; and 3) the teacher plays a limited role.

He proposed that children's cognitive development could be viewed in a sequence of four stages: sensorimotor, preoperational, concrete operational, and formal

operational. In the concrete operational stage, the child first applies simple logic to arrive at a conclusion and learns to reason deductively. The most important stage is formal operation in which the child reasons abstractly and solves problems through inductive reasoning and employs logical thought. According to Piaget, children are not little adults. They think and deal with problems differently. Development involves the continuous alternation and reorganization of the ways in which one deals with the environment.

Bruner, Olver and Greenfield (1966) stated that cognitive development starts with representation, which is first evident in enactive, then iconic, and finally symbolic modes of thought. Each succeeding mode incorporates a new, more powerful system for representing objects and states of the physical world. Symbolic thought acquires its power from language and begins to influence thinking in children around 7 or 8 years of age in societies where formal education is provided and conventional schooling fosters acquisition of this final mode of representation.

Vygotsky (1962) proposed four major developmental principles of cognitive theory: 1) in their ontogenetic

development, thought and speech have different roots; 2) in the speech development of a child, a pre-intellectual and pre-linguistic stage may be identified; 3) up to a certain point in time, to follow differences, independently of each other; and 4) At a certain point, these lines meet as thought becomes verbal and speech rational. According to Vygotsky, as one comes to internalize language, the ability develops to represent concepts in a way other than via concrete instances and the simple associative principles that operate over those instances.

Cognitive development research conducted over the last thirty years revealed partial evidence that an infant's mind is not exactly a tabula rasa (blank slate). Daehler and Bukatko (1985) stated that the newborn is capable of registering visual, auditory and other sensory information and systematically responding to them. Moreover, within a matter of weeks, or perhaps days and hours, a memory system appears to begin influencing behavior. Considerable evidence is being gathered to show that the infant is a more cognitively sophisticated organism than originally believed, especially in respect to sensory registration.

Today, few psychologists and educators claim to assert either extreme in the nature versus nurture controversy.

Cognitive development of the human mind is a complex phenomenon that cannot be limited to a simple theory.

Cognitive-Development Theory and Knowledge Acquisition

Cognitive development theory was ignored in the United States until the 1960's when the work of Chomsky paved the way for the contemporary study of cognition. Cognition is defined as the act of knowing. The analysis of the act and its components are therefore the core of psychologists' and educators' attempts to understand the mind and its development.

The impact of cognitive developmental theory was very significant in many professional fields. In educational circles, the study of knowledge acquisition of human beings is even more powerful than the behaviorism of the 1950's. Gholson and Rosenthal (1984) stated that the Bourbaki group of logicians provided Piaget with a model for the development of children's reasoning. Advances in linguistic theory by Chomsky supported the contemporary notion of the mind as an innate system of plans and rules that underlie our competence to know things, particularly language.

Language learning theory made a dramatic turn in the post-Sputnik curriculum reforms. Chomsky and his

contemporaries showed that the language the child acquired, particularly during the first two years, seemed entirely too complicated to have been simply shaped by environmental contingencies that followed the child's babbling. Gholson and Rosenthal (1984) observed that many psychologists and educators turned away from learning theories and their emphasis on reinforced associations between stimuli and responses and instead turned towards the study of cognition which was emerging as a new approach to understanding higher mental processes.

Representation is a central function in the human organism's learning capacity. Daehler and Bukatko (1985) listed three types of representation: enactive, iconic, and symbolic. Bruner, Olver and Greenfield (1966), label the earliest form of representation as enactive. Within this type of representation, an object or event is understood, known or represented by the action that is performed on it.

The second type of representation is the iconic mode, which is viewed as a type of imagistic, or configurational mental skill. This is relatively independent of action and the temporal and physical realm.

The third form is symbolic. Symbolic representation operates in codes that bear little, if any physical

resemblance to the concepts or ideas for which they stand. Natural languages have this characteristic. The words we use seldom look or sound like the referents they identify. Understanding the cognitive capacities of the learner is the beginning of the application of cognitive-developmental theory. Bruner, Piaget and Vygotsky's research provide working hypotheses about the role of language learning and cognitive development in the complex mental activities of learners.

In the 1970's, a newer model emerged, borrowed from computer engineering. It was based on the model of the mind as an information processor that did many of the tasks a computer was capable of and was similar to what Gholson recognized in 1984 when the cognitive psychologists analyzed the reading process.

Gholson and Rosenthal (1984) claimed that the applications of cognitive developmental theory coupled with models of the mind as an information processor constitute the approach to the science of the mind known as cognitive psychology. Those techniques and theories have analyzed the reading process as using sequential mental operations, and educators have been quick to see the implications for the sequencing of curricular information.

There are many aspects of cognitive development in language acquisition that need to be specified. Gholson and Rosenthal (1984) stated that the structural cognitive theories of the Piagetian type focus on the development of the human subject's knowing a special category of information that is necessarily true. Information processing cognitive theories treat all information as if the epistemic subject processed it.

The second model suggested by cognitive psychologists is a mental model of semantic awareness. Perner (1988) provided three levels of semantic awareness: 1) Presentation--having a mental model, 2) Re-presentation--using mental models, 3) Meta-representation--modeling mental models. By conceptualizing the mind as a representational medium, the language learner gains a theoretical understanding of the role of mental states in acquiring information and in guiding behavior. In the second mental model, the learner can understand false beliefs and appearance-reality distinctions by forming an explicit understanding of the semantic procedures that link a mental model to the external situation that the model presents.

Taken together, the results of the above research underscore the importance of cognitive development theory in influencing the language learner's performance and the necessity of studying cognitive theory as part of second language acquisition.

The Cognitive Theory and Learning Approach

Since the 1970's, there have been many experiments and related research testing Piagetian theory in cognitive psychology. From a student's conception of geometry and space to topological imaginary concepts and measurement of two-dimensional and three-dimensional figures, the effects of academic study in their content areas can be seen in all levels of school systems.

The Information-Processing Approach. Gholson and Rosenthal (1984) proposed that in the information-processing model, the components of cognition include short and long-term memory storage, processes of retrieval from memory, pattern recognition capacities, comparison processes and symbolic representation and manipulation. This information-processing model treated the mind as a computer metaphor and nourished the theories of cognitive psychology.

Using the information processing model as a guide may suggest that a successful transition from traditional ESL teaching methods to teaching cognitive academic language proficiency in various subjects will require more effective learning strategies. These strategies are necessary for processing and comprehending the increasing information requirements of the current era.

Strategy Consistency. Beilin and his research associates (1984) researched two principles in the application of cognitive theory: cognitive economy and task tuning. They explained that the cognitive economy principle holds that ESL learners should use the most advanced strategy in their repertoire to match academic knowledge with content areas and problem (task) demands. The task tuning principle predicts that students adapt their procedures (solution strategies) to specific task demands, using less-advanced strategies to minimize effort in solving a problem in their classroom learning activities. Both principles aid the understanding of primary development in the cognitive model. Gholson and Rosenthal (1984) provided the example that school children who know the appropriate arithmetical facts still count on their

fingers at times. He specifies that when a student is tired, regression to a more primitive strategy may occur.

Cognitive economy shows that a child's word recognition and language proficiency shifts among various sources of information available in many learning activities. This indicates that linguistic utilization and contextual cues are important elements in cognitive development in content areas. These principles and implications are important in relation to the abstract thought and development. The second language learner builds higher levels of cognition upon previous academic experience.

Consistent strategies and the flexibility and adaptability of an ESL learner are important factors in CALP and in the transition from rote vocabulary drills to the study of content materials. Students tend to apply their own personal strategies developed during previous experiences. This minimizes the amount of effort required for problem solving and completing individual tasks even when approaching new and different subjects. ESL teachers must consider and employ appropriate teaching strategies and curriculum to help ESL learners develop learning strategies to meet individual task demands according to

different levels of cognitive academic language proficiency. Strategy consistency and cognitive economy emphasized curriculum design in developing cognitive academic language proficiency.

Conclusion

Schneider and Weinert (1990) concluded the following:

1) metacognition is imperative to influencing student performance; 2) studying metacognition is a necessity of second language acquisition, including cognitive and motivational variables; and 3) students' cognitive and metacognitive developmental perspectives are a product of instructional practices and belief systems of teachers and parents. How to incorporate cognitive and metacognitive aspects of learning into academic study in ESL instruction has become an important issue in relating second language learning to acquisition of content knowledge.

Together, the use of cognitive learning strategies and metacognitive knowledge have become important performance predictors in second language acquisition. However, the reluctance of traditional ESL teachers to alter their habits and the prevalence of a behaviorist curriculum continue to hinder ESL students' academic development at all levels of educational institutions.

In sum, cognitive theory has become the cross-disciplinary study of structure and the processes of human cognition. In cognitive academic language proficiency, cognitive theory gives insight into metaphorical processing, conceptual structure, learning strategies, visual perception, and reasoning in content areas. The phenomenon of human learning behavior can no longer be treated in a pre-prescribed way. Traditional ESL teaching activities cannot ensure that ESL learners will master academic language within just two or three years. A well-designed curriculum and appropriate learning strategies are necessary for the success of academic study in ESL learning and content instruction.

Computer-Assisted Language Learning in Cognitive Learning

Computer technology has dramatically impacted schooling and curriculum design across the globe. Krajka (2001) declared in his article, "Using the Internet in ESL Writing Instruction," that the advent of the Internet and the widespread use of technology in modern life has created new opportunities for language learning. Because most Internet content is in English, the teacher of English gains access to an enormous variety of authentic materials

relating to all spheres of life at almost no cost. The rapid advancement of computer technology in hardware and software has changed the application of computers in ESL teaching. Computer technology in ESL offers a whole new realm of language resources.

Peyton (1999) stated that the computer network as a medium for communication has created opportunities for writing and learning that were never before possible. Texts and speeches are available in the classroom in addition to a rapidly expanding universe of resources not bound by physical space. This accelerates a move beyond language acquisition to the development of thought and the gaining of new knowledge in content areas. Multimedia computer technology has drastically changed ESL learning in many ways.

Egbert (1999) stated that in second language acquisition (SLA), ESL, and learning in general, many researchers have documented new and effective approaches, from interaction and negotiation of meaning to the emphasis on authentic audiences. Adequate time and feedback create an optimal language-learning environment. What is known, however, is that the optimal learning conditions vary in

different classrooms depending on factors such as student population, content area, and learning context.

To promote cognitive academic language proficiency, ESL teachers should understand those conditions and tailor learning content of software to meet the learning strategies and proficiency level of the students being taught. Hanson-Smith (1999) stated that a clear advantage of the Computer Assisted Language Learning (CALL) environment is the computer's ability to provide contextual support in a wide variety of media to help nurture students' learning skills.

Nagel (1999) recently introduced "Email in the Virtual ESL/EFL Classroom." This deals with more advanced issues connected with the use of e-mail in teaching and specifically with how to be more effective and reap optimal results in the use of e-mail and academic writing. He views e-mail functions as a learning tool. Likewise, Belisle (1996) in his article, "E-mail Activities in the ESL Writing Class," explored student and teacher benefits of using electronic mail in ESL writing instruction. Activities in the electronic community can help learners create, analyze, and produce information and ideas more easily and efficiently.

Liao (2000) described his experiences in EFL education, giving insight into the intercultural aspects of e-mailing and offering solutions on how to improve communication between students from different cultures. E-mailing incorporates the use of authentic language in developing CALP and has been implemented in many educational environments. This trend has become so widespread in society and school systems that computer literacy is almost mandatory for all language learners who desire to be successful in academic studies.

CALP integrated with computer competency is the inevitable direction in which language learning strategies are headed. Applying new computer technology and sophisticated software to classroom learning activities are new challenges for language teachers of the future.

North Central Regional Laboratory (NCREL, 2000) concluded that technology provides diverse tool-generic and context-specific fundamentals to learning how to work in the twenty-first century. These tools begin with "basics" like databases, spreadsheets, and word processing, as well as higher levels of context specific technology, such as the use of sonar equipment in oceanographic research. Another indicator of functionality is the extent to which

the technology incorporates media such as color printers, video cameras, audio and video recording and editing equipment, and graphics. Computer-based technological orientation has become a fundamental topic in language learning and academic study of the future.

The World Wide Web and the Internet Provide Unlimited Learning Resources

Academic language development of the ESL student is a complex process requiring long-term schooling. Standardized textbooks and printed materials are no longer the only resources for academic language development. Opp-Beckman (1999) concluded that the increasing ease of access to the Internet can bring people together in ways that were formerly impossible.

Authentic language opportunities abound through the Internet and the World Wide Web. Students can converse with cyber-buddies in Asia, chat with peers from around the world in a virtual university or MOOs (multi-user object oriented domains), receive assistance from educators in an OWL (Online Writing Lab), do research in databases and archives across Europe and North America, and access real-time news at their convenience.

On the Internet, the resources and contents of academic language development are almost infinite. It provides students with endless websites to visit and view. As an exercise, students could each be encouraged to research different topics, later relating their findings to the class orally. This activity adds speaking and listening development to the lesson plan.

CALP with Internet content could individualize lessons, as opposed to the one-size-fits-all approach of using traditional textbooks. Krajka (2001) stated that the benefits of Internet lessons are that the web materials are completely authentic, unabridged, and not prepared with a specific learner in mind, which can be difficult sometimes in terms of language, but extremely rewarding when students realize that what they read or write is real, belongs to the outside world, and is not limited to the world of classrooms and textbooks.

The Internet has changed the traditional coursework of ESL learning. Under this technological orientation, there are many critical issues that should be taken into consideration: 1) building students' ability to evaluate the reliability of data and information, 2) understanding the difference between cultural backgrounds and how to

accommodate them in electronic communications, and 3) discussing safety issues and protection of students' privacy. The infinite resources of the Internet have become a new challenge for ESL teachers. The evaluation of learning materials, selection of updated software, and the innovative development of the electronic communications have changed the role of ESL teachers in second language acquisition.

Roles of English as a Second Language
Teachers in the Development of
Computer-Assisted Language Learning

Change in modern society has become rapid and unpredictable. However, these changes in technology also provide new opportunities for the next generation. Lee (2000) stated that the more important issue is how technology is utilized. Computers will never replace teachers but can offer new opportunities for enriched language practice. The next generation of students will feel much more confident with information technology, practice language skills more thoroughly, and solve language-learning problems with more ease.

Today's highly competitive and sophisticated software industry provides extremely advanced word processing and multimedia presentation tools, which have had very powerful

effects on English learning. This includes the benefits of spelling and grammar checks, and multi-language translation for both writing and speaking. The roles of ESL teachers in the development of CALP have changed. NCREL (2000) claimed that teachers are now facilitators, guides, and co-learners. As facilitators, teachers provide learning environments, experiences, and activities. They should create opportunities for students to work collaboratively, to solve problems, to perform real life tasks, and share knowledge as well as responsibility.

ESL teachers should learn to accept new technology and learn how to apply it to ESL teaching effectively and appropriately. As technology advances, every teacher, especially language teachers, becomes a learner as well.

Summary: Computer-Assisted Language Learning
Applied to Academic Study

Computer-assisted language learning has many implications in cognitive academic language proficiency. It has become an important direction and trend in educational environments. There is no absolute standard or final conclusion for teaching methods. This suggests that more responsibilities and teaching skills are required for ESL teachers who face the challenges presented by new

technology. The role of ESL teachers has continued to expand despite the incongruities of development in different cultural contexts and the impact of a technology-based society.

In summary, communicative competence, the cognitive academic language learning approach, whole language philosophy and computer-assisted language learning methods have implications for the use of strategies on the part of ESL learners in technological-specific environments. Efficient strategy use and the possession of strategy knowledge have become central issues in ESL teaching and teaching in content areas.

CHAPTER THREE

THEORETICAL FRAMEWORK

A Model of the Integration Process

The previous literature review suggests that several factors influence the cognitive academic language proficiency development of English as a second language learner. In this theoretical framework, concepts include the philosophical and psychological development of the learner, higher standards and professional knowledge for ESL teachers, adapting appropriate learning strategies, a variety of successful teaching approaches, and computer technology and telecommunication for ESL learners. These constitute overlapping frames of references (see Figure 2).

Each of these factors no longer exists in an isolated environment. Language acquisition is a complex process of human development and is interwoven with many other external and internal factors such as the diverse cultural backgrounds and varying degrees of self-motivation on the part of learners, and the political and economical systems of the 21st century. This model provides ESL teachers, bilingual educators, and ESL learners with a better

understanding of cognitive academic language proficiency and will enrich ESL teaching in content area learning.

ESL teachers face more challenges now than ever before. ESL education is no longer limited to simply teaching English vocabulary and grammar. Because American culture has increased in social and psychological complexity, the experience of ESL learning and cultural assimilation is a rapidly changing phenomenon. ESL teachers need continual professional development and regular communication with student communities.

Based on the this theoretical framework, ESL teachers should possess knowledge and experience in varying aspects of language learning that are affected by new technologies. The implementing of lesson plans for CALP learning activities demands not only an active and dynamic involvement with ESL learners in a changing environment, but it also involves the integration of English language, technological knowledge, learning strategies, and content knowledge in all levels of schooling.

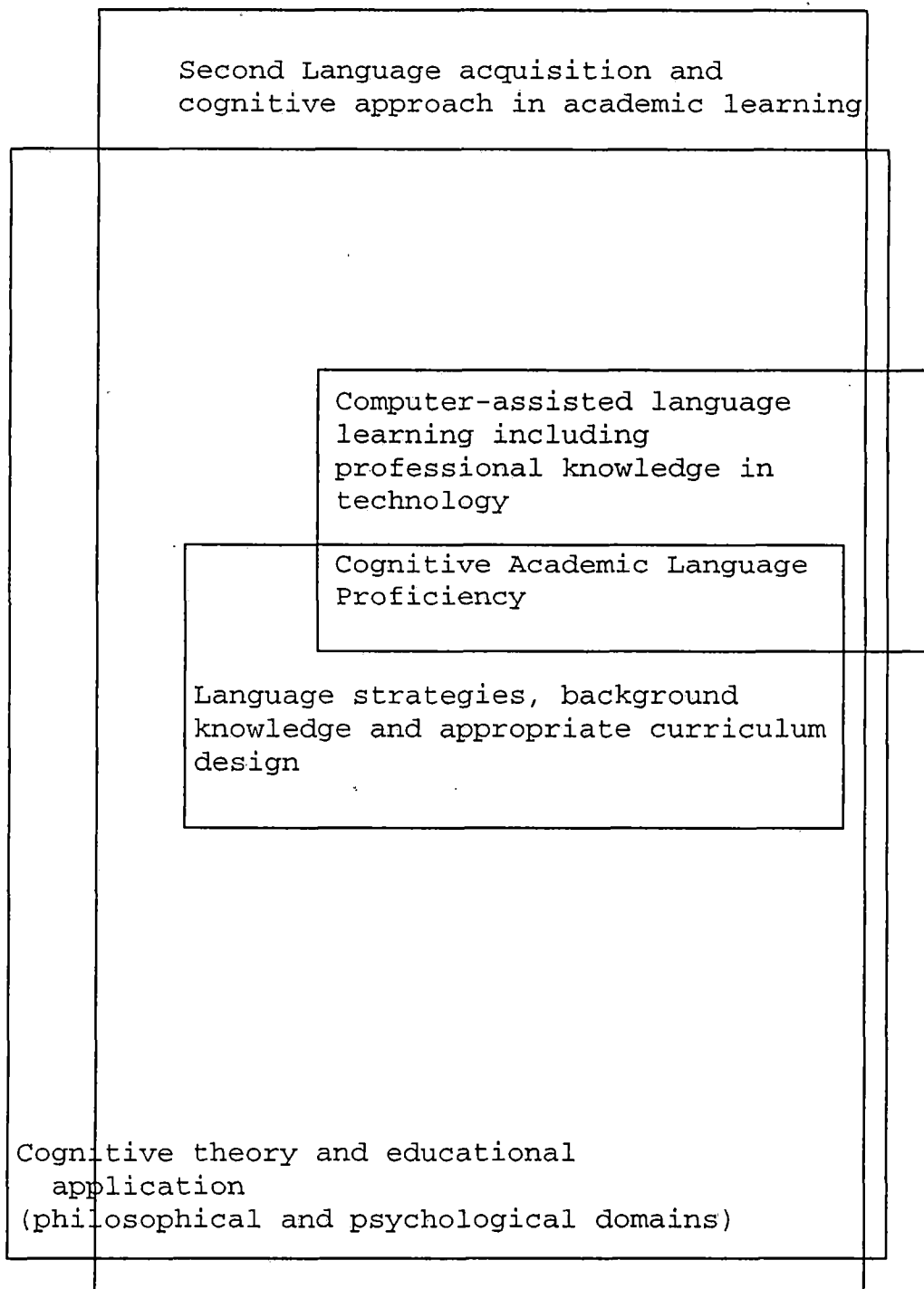


Figure 2. A Model of Cognitive Academic Language Proficiency

The Philosophical and Psychological Domains of the Learner

Academic language development starts in the mind. The fundamental framework of this model shows the nature of human comprehension, interaction with the environment, and the process of ESL acquisition. Research done within the last 30 years has documented the importance of learner-central instruction; the cognitive performance and processing capacity of human beings should be the critical point in current educational environments.

This model of CALP provides that language instruction be interactive and collaborative in ways that are compatible with students' learning styles and academic traditions. This is especially true because technological progresses in digital communication have changed the relation between epistemology and the process of ESL learning.

The continuity of academic development in ESL learners is a critical factor in academic transfer to new environments. The student's intellectual development and knowledge acquisition should be successive and constant. The sequence, nature and timing of environmental input are paramount to ESL learning and cognitive development.

The literature review in Chapter Two has shown that the longer the gap of discontinuity in academic language development in ESL learning, the more difficult it will be to sustain students' academic skills in academic content area. Also, research has provided much evidence that cognitive academic language proficiency may take from five to seven years or more to develop. Immigrant and ESL learners cannot afford to waste that amount of time in the trial and error of different theories and curricula. Delayed learning also increases the financial burden on the educational system.

Cognitive theory is concerned with how mental processing functions during learning and how the ESL learner is modified by experience and maturity. Continuity in the psychological development of the ESL learner involves qualitative and quantitative changes in the capacity, efficiency, or organization of cognitive structures and processes. Emphasizing psychological aspects of the learner helps to develop an understanding of ESL teaching. Therefore, in order to design a curriculum for CALP, the philosophical and psychological development of learners must be taken into consideration.

Continuity of Background Knowledge and Schema

Background knowledge is a basic element in cognitive academic language proficiency. This theoretical model expands the key elements of background knowledge of ESL learners that can be activated in order to enhance classroom activities in CALP. A good example of background knowledge is an ESL student who produces a better quality of work on assignments involving international economics and politics because he/she is already familiar with the topics that involve international relationships.

Also, active participation from the student and prior knowledge of a topic may be directly related to his or her performance in further study. Curricula should provide content area instruction that incorporates fundamental principles of good teaching like active participation, social interaction, real tasks, and background knowledge plus the ability to communicate, effective organization of instruction, and modification of complex information to make it understandable to students.

Gaining understanding of new materials is possible only when it is connected with previously acquired background knowledge and experience. This model combines the concept of schema with background knowledge in

accomplishing academic tasks. A schema is any representation, typically of an object or an event that specifies general properties that shows how these properties are related to each other. Schema theory claims that understanding discourse involves more than extracting information from a text. Much of the necessary information and content knowledge are supplied by the listener in the form of schematic background knowledge. When promoting CALP, the ESL teacher facilitates activation of the appropriate schemas and provides new information that can be integrated into existing schemas.

From the research in background knowledge and schema theory, one might say that a schema organizes texts, whether spoken or written; does not carry meaning in itself; and provides direction for listeners or readers as to how they should retrieve or construct meaning from their own previously acquired knowledge.

The comprehension of text is an interactive process between the text and the reader's background knowledge. ESL learners can effectively connect and restructure their perception in academic study and content areas. ESL learning and cognitive academic language proficiency starts with a sound foundation of background knowledge.

The Principles of Integrating English as a Second
Language Learning and Content Areas

Professional Knowledge and Technology Domains
of Cognitive Academic Language Proficiency

During the 20th century, rapid social progress and technological innovations in digital technology have changed the environments of ESL learning and theories in many ways. Many researchers have claimed that the challenge of content instruction in K-12 classrooms is to incorporate content-based instruction with digital technology and computer programming skills. Through computer applications and the use of advanced technology, content materials used by ESL students in subject area classes may be adapted to provide comprehensible input in science, mathematics, social studies and language arts. In this rapidly progressing environment, ESL teachers need a strong computer background in both hardware and software applications because computer technicians are not always available during computer classroom learning activities.

The unlimited resources of the Internet challenge traditional models of learning. ESL teachers in modern times cannot be merely information providers. For the development of CALP, teachers should be seen as facilitators, guides, and co-learners. As such, they can

provide rich learning environments, experiences, and activities, create opportunities for students to work collaboratively to solve problems and complete authentic tasks, and share in student knowledge and responsibilities.

In the new age of computer-based education, with its many challenges, ESL teachers should consider themselves life-long learners, willing to take risks to explore areas outside their expertise. How to empower ESL teachers through new technology is an inevitable question in the future of the 21st century.

In integrating ESL learning with content knowledge, awareness of the powerful applications of digital technology make incorporating ESL learning with content knowledge more crucial than ever before. ESL teachers need continuous professional development to prepare learners for the demands of knowledge they will face over the years to come. For CALP and content areas, the ESL teacher needs basic computing skills such as knowledge in PowerPoint presentation, web page designing, computer-aided drawing, on-line navigation, database use, and many other applications.

For content study, research and teaching applications, there is an abundance of easily accessible knowledge on the

Internet that is not limited by geographic locale. Furthermore, ESL teachers should preferably possess knowledge of the new digital technologies that can innovative ESL pedagogy. Rudimentary equipment includes the TV and VCR. More advanced items are the New Digital System and SVGA projector with laptop computer, writing courses through telecommunication, and many advanced applications. Instructional activities should not be interrupted or halted by the absence of computer technicians or technical support. Teachers must be familiar with both the software and hardware applications of popular computers.

Learning Strategies and Teaching Approaches Domain

The following describes how teaching approaches may integrate concepts of content areas and authentic tasks into practical classroom applications. These play an important role in ESL course design and classroom teaching activities in this theoretical model.

Theme-based Courses. Three examples of theme-based courses are current events, literature courses, and academic reading courses. Many of these courses are appropriate for ESL students who are not prepared to handle the intensive study of authentic material. Academic strategies can usually be effectively taught in a themed

course using special topics for motivating ESL learners with related background knowledge.

Adjunct Courses. There are many kinds of adjunct courses for developing academic strategies. The first type is designed primarily for the ESL learner who graduates from local high schools. Adjunct courses will provide academic learning skills and strategies for mastering academic subject matter and for earning a passing grade. Adjunct courses may be offered through freshman summer programs at educational institutes. Another source is the ESL adjunct courses that were designed for international study. The majority of students there are international students who have just arrived in the United States. These courses preview academic study and content material for future studies. Adjunct courses provide an authentic setting in which ESL students can learn necessary academic strategies through content materials.

Sheltered Courses. At the college and high school levels, sheltered content area instruction is specifically designed for academic instruction in English. In the current U.S. school systems, many local schools provide Specially Designed Academic Instruction in English (SDAIE) for newcomers to academic study. The distinction between

SDAIE and content-based English instruction is that SDAIE features content instruction taught by content area teachers with English language support. Content-based ESL features the use of content area materials as texts for ESL lessons.

Comparing these models of content-based instruction and teaching approaches, the current curriculum design offers assistance in the development of CALP.

Sheltered courses require extensive management and cooperation with school staff and are conducted by content area teachers who enhance ESL learning by using authentic texts to facilitate the development of academic language in English. Communication and organization among content area teachers, ESL teachers, and administrative staff are vital in the design of sheltered classes.

The ESL knowledge and teaching skills of content area teachers play an important role in sheltered courses. ESL teachers need to actively participate in curriculum design and administration. The resulting effect should be a broadening of the horizons of professional knowledge in second language acquisition and experience.

In summary, this theoretical model suggests many channels for the development of CALP. Integrating ESL

learning with content area knowledge should involve all the domains, in order for students to succeed in today's classrooms and in many other educational and social environments. Teachers should constantly update themselves to new techniques and apply modern technology to the classroom setting. Successful ESL learning in new environments and countries depends heavily upon the ESL teacher's abilities and preparation.

CHAPTER FOUR

CURRICULUM DESIGN

Fundamental Concepts of Curriculum Organization

Ideally, curriculum design should implement contemporary theoretical research into ESL learning. This project offers an experimental unit for ESL teaching. This experimental curriculum design integrates digital technology with authentic materials and meaningful language experiences to address the weaknesses of traditional ESL learning program. For most ESL learners, especially those of Asian descent, mental capacities are focused on textbook materials, classmate competition, and exam grades. A more appropriate focus would be to teach English using rich content from the domain of technology. The curriculum units included in Appendix demonstrate how ESL and content instruction can be integrated.

ESL teachers are a critical element in this curriculum design. Knowledge of subject areas, skill in digital technology, and acceptance of new technologies make up the foundation for this teaching unit and its lesson plans. Appropriately designed curriculum and digital technology

<p>Unit 1: Basic Computer Operation and Basic Terminology for Academic Learning in ESL</p>
<ol style="list-style-type: none"> 1) To acquire a basic English vocabulary for computer operation 2) To learn basic computer operation skills
<p>Unit 2: ESL for Spatial and Cognitive Development</p>
<ol style="list-style-type: none"> 1) To develop ESL through use of spatial skills 2) To learn vocabulary about the American system of measurement 3) To apply visual-spatial skills in making a paper airplane
<p>Unit 3: Visualizing in Three Dimensions and Content Learning</p>
<ol style="list-style-type: none"> 1) To learn to think in three dimensions using axes of rotation 2) To develop to visualize solid object in isometric presentation 3) To apply problem solving strategies in learning about three dimensions studies

Figure 3. A Model of Curriculum Design

can completely change the way English is learned as a second language. Boring and dull mechanical drills and non-authentic materials are the main cause of the high dropout rate of ESL students from secondary and adult schooling.

This unit incorporates technology-based learning with traditional ESL instruction and content knowledge for improved cognitive academic language proficiency development. Enriching learning with technology motivates students. Traditional reward and punishment is unnecessary. The acquisition of new knowledge and experiences should generate the momentum for success in ESL learning.

Technology-based ESL learning refers to more than just computer-based learning. Other educational applications from related technologies are also beneficial to ESL learners in cognitive academic language proficiency and content area study. For example, new models of Texas Instruments graphing calculators, the TI-82, TI-83, and TI-86, have made studying scientific research and acquiring of abstract concepts much easier through visual presentations rather than by means of oral explanations.

The capacity for programming large amounts of memory and processing data make Palm Pilots and Notebook computers prime examples of technology that enriches ESL learning.

These new learning tools provide opportunities to gain more empirical experience in hands-on interaction and encourage ESL learners to explore language.

There are three kinds of curriculum design and lesson plans in this project. Unit One previews computer operations. Cognitive academic language is presented in the context of computer function. Words in context and sensory-motor experiences are appropriately selected, arranged, and included. Vocabulary capacity, text comprehension, and traditional language learning experiences are also included in the lesson plans.

For the technology-based lesson plan, ESL learners should have access to and become familiar with the basic configuration of computer systems. Introduction to digital technology and basic computer skills are encouraged if the prior experiences of an ESL learner are inadequate. Without this training, scheduled learning activities may prove difficult to implement. Most lessons contain test sheets designed to evaluate students' abilities and document the results in different proficiency areas. These tests help to find the areas of weakness in ESL learning. The results could also be used to continually revise and update current teaching methods and theories.

The Unit Two is designed for spatial and cognitive development in ESL learning. With real life examples from American daily activities, students learn the traditional system of measurement and apply hands-on experience in academic study in content areas. Unit Three focuses on visualizing three dimensions and content learning. Technological innovation has changed the world in many ways. ESL teaching needs to take responsibility for the students' development of three dimensional thinking and highly abstract concepts.

A Model of the Academic Language Proficiency Process

The design of this curriculum is based on the theoretical model described in Chapter Three. This design integrates ESL learners' background knowledge in science, social studies, mathematics, and other subjects with newly developed learning strategies involving technology as well as with traditional ESL learning activities. The following describes how the curriculum integrates concepts from the theoretical model into lesson planning.

A Technology-based English as a Second Language Curriculum

Familiarity with technology marks the foundation of the curriculum design. In the 1950's and 60's, all ESL learners were required to have a bilingual dictionary and a grammar reference book. By the end of the 20th century, electronic multi-lingual translators featuring native English-like pronunciation had grown increasingly popular. Computers have become a necessary tool for ESL learners. The multi-functional capacity of word processing in Microsoft Word (spell check, grammar correction, formatting and graphing design) enriches academic study. Recently, elementary school teachers in Palo Alto, CA, recommended that every pupil purchase their own personal \$2,000 laptop computer in order to process data and complete projects in everyday classroom learning activities. Technology-based ESL curriculum has become an inevitable trend.

To implement technology-based ESL learning, teachers must be familiar with the configuration of hardware, which is outlined in every lesson plan along with hardware requirements. Knowledge of Microsoft's PowerPoint presentation and operation of Super Video Graphics Array (SVGA) are also necessary. Knowledge of technology-based

classroom management methods and basic knowledge of trouble-shooting for related peripheral products are recommended when lab technicians are not available for classroom learning activities.

ESL teachers and learners participating in the curriculum unit should have an awareness of the revolutionary capacity of digital technology and motivation to upgrade their computer skills. Because everyone is ideally a lifetime learner, professional development to incorporate innovation is imperative.

ESL teachers should explore the benefits of innovation and be familiar with methods of applying them to ESL instruction. In this unit, teaching integrates the objectives of each lesson plan, cognitive academic language proficiency, content knowledge, and learning strategies with activities that use programming skills and a concept of the English language as a whole. Technology has become an alternative path for ESL learning and an effective instructional tool in the 21st century.

English as a Second Language Teaching for Content Integration

The target ESL levels of this project and curriculum design are the high school and adult levels. Cognitive

academic language proficiency and early learning experiences may determine student success in higher education and employability in the future. Computer technology instruction helps to provide new learning experiences for the ESL learner.

The examination-oriented education systems of Asian countries have long dominated the daily life and learning experiences of Asian students at every level. A deeply ingrained focus on earning good grades causes the course focus to center on preparing for tests rather than preparing for future use of English in society. These types of cultural value differences complicate English teaching. Cultural influences will affect ESL learning regardless of what methods of teaching or what types of learning materials are utilized in the classroom setting.

In this curriculum there are more flexible and creative-oriented authentic materials than have previously been included in prescribed text-oriented materials. The main objective of the lesson plan is to explore an ESL learner's potential for acquiring technological literacy in an American school. Objectives are clearly expressed in each lesson plan and are followed by appropriately related learning activities.

ESL learners have many learning experiences that are incongruent with that of the mainstream student's experiences in an American school. Their perspectives include multi-cultural and multi-lingual educational backgrounds brought from their homeland.

Today's ESL learning activities should include sensory-motor projects, thematic ESL learning, computer programming, web-page designing, expressions of creative imagination, and web quests. Lesson plans and experiments are but the beginning of a personal journey. There should be an orientation period or formal tracking system to explore the potentials of high school students for academic success in higher education. ESL learning for creativity could be a relevant phase and aid in investigating students abilities and orientation toward academic study in the future. These are the types of long-term concepts that are built into the units.

The Role of Language in Cognitive Development

The rapid-paced technological environment of American society has caused the contents of its language to change dramatically. The plethora of over one hundred thousand English dictionary entries, along with increasing numbers of new technological terms and cultural slang, easily

overwhelms many ESL learners. Vocabulary items in this instructional unit have been selected largely by analyzing the requirements of academic study in content areas.

Traditional ESL learning focuses on language for testing and translations, with exercises like comparison between synonyms and antonyms, which only adds to the frustration of ESL learners. Language acquisition for cognitive development and academic study cannot be learned from a bilingual translator or even by knowing a large English lexicon. Vocabulary words from the SAT (Scholastic Aptitude Test), Homer's epics, or a Shakespearean masterpiece are not illustrative of language found in metacognitive development. Rather, they are but a series of "files" which the mind is forced to shuffle around. Students of a second language are often obligated to repeatedly "open a file, create a file." In this unit, vocabulary selection focuses on concepts that ESL learners may need later in academic studies, and learning strategies.

ESL teachers should always be aware of how times change. Different contexts affect the contents of lesson plans and language in cognitive development. In this unit, multi-media functions of computer technology are necessary

equipment for academic study and language learning in these new times.

To summarize, methods of ESL teaching and curriculum design should remain flexible and be regularly renovated to be reflective of the new century. The ESL teacher is a key figure in the success of ESL learning activities. The skills and knowledge of ESL teachers are developed to adapt to never-ending learning in the new environment of technology. This instructional unit features the application of a theoretical model of cognitive academic language proficiency. ESL teachers should incorporate various teaching strategies to meet the needs of ESL learners in various academic settings.

CHAPTER FIVE

ASSESSMENT

The Purpose of Assessment

In this project, alternatives to assessment and evaluation are suggested in order to improve the effectiveness of traditional ESL learning. Traditional assessment in ESL learning is no longer effective in measuring and evaluating what and how students have learned.

Today's ESL high school students are not simply trying to learn and pass the state's requirements in ESL curriculum. They are also attempting to prepare learning strategies for further study in content areas and academic study. Assessment in this unit and each lesson plan are appropriately designed to identify the weak points in students' learning habits and encourage them to confidently express their thoughts in English writing and conversation.

Appropriately designed assessments yielding numerical results can help ESL teachers and students understand how to improve ESL learning. In this project, the reliability and validity of assessment and evaluation are taken into consideration. Cognitive academic language learning

strategies are difficult to measure with simple instruments or multiple choice questions. Instead, several technological applications can be involved in assessment.

Assessment Content

In this project, the concepts of assessment in each lesson plan can be divided into two distinct dimensions: evaluation of individual creativity in learning strategies and technology-based learning, and traditional assessment of performance in ESL learning.

Evaluation for Technological Literacy

The design of assessment in this curriculum is based on the theoretical model of this project and the needs of ESL learners. In order for ESL students to live, study, and work in America, they must learn to plan, organize, prepare, and monitor their learning. ESL teachers should be facilitators, and no longer act as conductors of traditional ESL learning. Project-based activities need to replace the traditional recital of textbook material.

Assessment and evaluation do not comprise the final stages of ESL learning. Cognitive academic language proficiency continues to develop through all content areas in high school and outside of educational institutions. ESL

teachers, school staff and faculty members need to understand the burdens of mastering the English language. Comprehension of content subjects in high school is difficult to accomplish within the given three- to six-year learning period. Assessment and evaluation of ESL learning document effective teaching methods and are not intended to add extra frustration to the ESL experience. Therefore, ESL teachers must design and implement effective assessment to facilitate students' cognitive academic language proficiency.

Many Asian students have a tendency to obey authority without question and seem less willing to take the lead in class discussions, cooperative learning activities, and group projects. In this unit, oral presentations, creative projects, and demonstration of self-esteem are all encouraged. Assessments accompany these activities.

The emphasis on new experiences in ESL learning and communicating with confidence should motivate academic learning. The traditional notion of examination-oriented teaching should be re-adjusted to avoid the mechanical memorization of textbook data and text-centered studies. Science projects and individual research should be included in assessment and lesson plans. Comprehensive evaluation in

ESL learning needs to match the theoretical model of CALP, and promote the unique experience of ESL learners.

In a technology-based lesson plan, the assessment focuses on computer literacy in order to bridge the gaps between a student's native language and the content knowledge and learning strategies required in the lesson. Computer terminology and English vocabulary are addressed for further application in academic study and content area. Experience and communication skills are later evaluated using assessment sheets.

Scholastic Achievement in English as a Second Language Learning

Traditional assessment techniques include multiple choice questions, word-in-context problems, word matching, grammar practice, and state standardized tests. In this unit, many different subjects are included on the test sheets. Assessments feature authentic materials with color pictures, figures with text, vocabulary, and concepts drawn from the practice exercises found on focus sheets, worksheets and assessment sheets.

Traditional methods of mechanical drill and memorization should not comprise the majority of learning activities for ESL students. Communicative skills should be

developed through participating in group discussions and presentations. Students' learning progress may be evaluated by observing their performance in special projects with the background of the native country as the center of the ESL learning activities.

In summary, the traditional learning model is not relevant to ESL student needs in these technologically advanced times. Today's classroom environment and tomorrow's academic fields have even tougher and more numerous requirements than ever before. This project is built on the desire to help the ESL learner succeed in academics and find alternatives to the traditional methods of learning in order to gain momentum for future success. Teaching learning strategies empowers students to become intelligent analysts and problem solvers rather than mechanical recipients of the knowledge being taught to them. This trend is only beginning and for those teachers who are willing to take up the new challenge, there is an opportunity to write the future in a way that will greatly benefit our students.

APPENDIX A:
INSTRUCTIONAL UNIT ONE

Unit One: English Vocabulary of Basic Terminology for Basic Computer Operation

- Objectives:
- 1) To learn English vocabulary about the fundamentals of computer operation
 - 2) To acquire a basic knowledge through application of computer technology
 - 3) To learn basic computer operation skills

Computer Configuration and Materials

- 1) Window 98, RAM: 256MB, CPU: Pentium 2 or higher, CD-ROM drive, sound card, 56K ITU V. 90 Modem and Internet connection.
- 2) SVGA Projector and peripheral equipments.
- 3) Focus Sheet 1-1 and 1-2, Work Sheet 1-1, 1-2 and 1-3, Assessment 1-1, 1-2, and 1-3.

Involving Students' Background, Interests, and Prior Knowledge

Ask students the following questions:

- 1) How many students have access to a computer?
- 2) What is the Internet?
- 3) Who has an e-mail account?

Task Chain 1

- 1) Use Work Sheet 1-1 and 1-2 to evaluate the prior knowledge of vocabulary in computer science.
- 2) Students circle English vocabulary from the worksheets and discuss in groups.

Task Chain 2

- 1) Use Focus Sheet 1-1 and 1-2 to introduce the contents of lesson and explain English vocabulary in context with computer application.
- 2) Discuss and answer questions about the contents of learning materials.

Assessment:

- 1) Students should be able verbally explain basic concepts of basic computer technology.
- 2) Use Assessment Sheet 1-1, 1-2 and 1-3 to test and evaluate what has been learned.
- 3) Score and record assessment results:

100-90 A
89-80 B
79-70 C
69-60 D
59-0 F

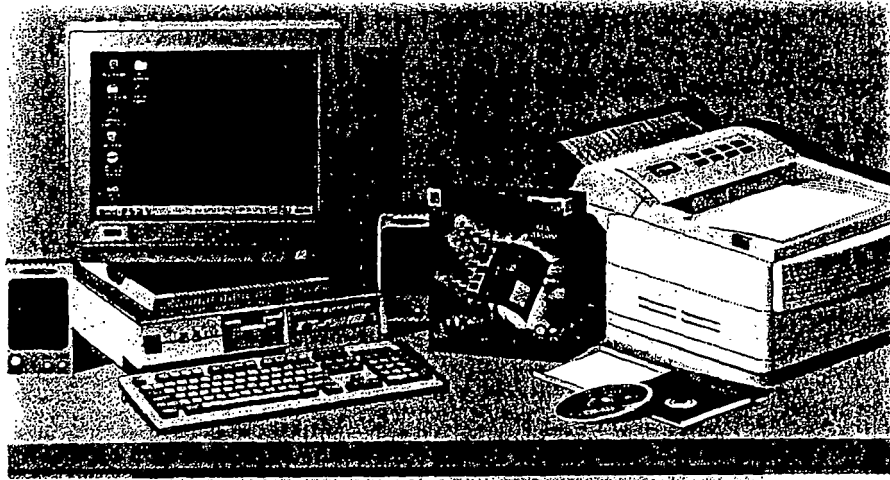
Focus Sheet 1-1

English Vocabulary of Basic Terminology for Basic Computer Operation

WINDOWS 98

Microsoft® Windows® 98 is a program that controls the overall activity of your computer.

Windows ensures that all parts of your computer work together smoothly and efficiently.



Work with Files

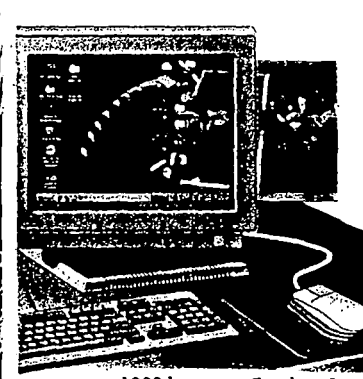
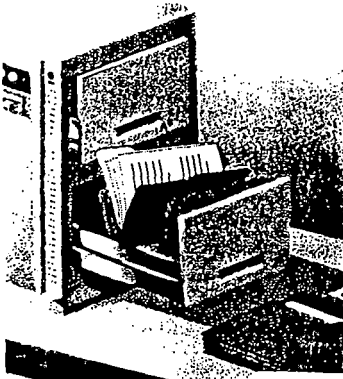
Windows provides ways to organize and manage the files stored on your computer. You can open, sort, rename, move, print, find and delete files. Windows also allows you to work with files stored on other computers on a network.

Write Letters and Draw Pictures

Windows includes a word processing program called WordPad, that you can use to write letters. Windows also includes a drawing program, called Paint, that you can use to draw pictures.

Customize Windows

You can customize Windows in many ways. You can add a colorful design to your screen, change the way your mouse works and change the amount of information that fits on the screen.



Teach Yourself Windows® 98 VISUALLY™ 1998 by maranGraphics Inc.
5755 Coopers Avenue
Mississauga, Ontario, Canada

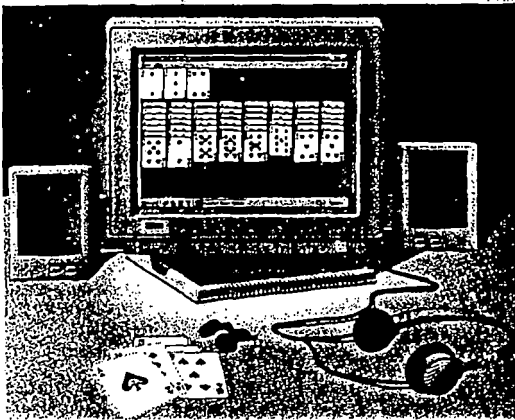
Focus Sheet 1-2

English Vocabulary of Basic Terminology for Basic Computer Operation

WINDOWS BASICS

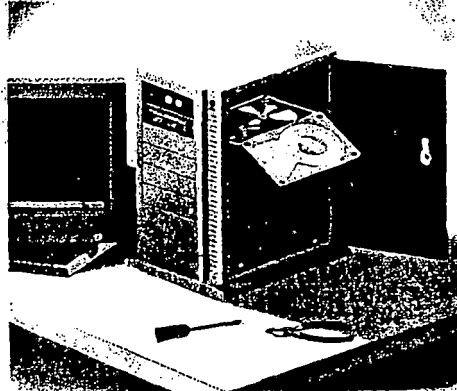
Have Fun with Windows

You can have fun with Windows. You can play games, play music CDs and assign sounds to program events.



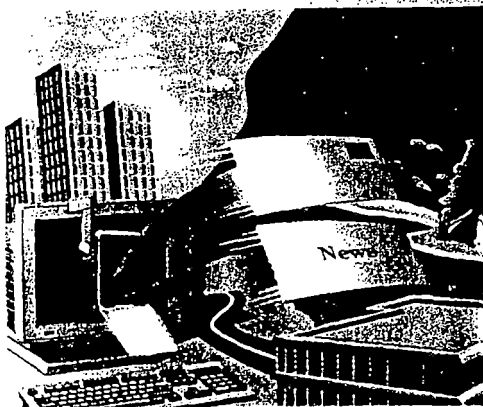
Optimize Your Computer

Windows provides tools to help you optimize your computer. You can check your hard disk for errors, remove unnecessary files and defragment your hard disk to improve its performance.



Exchange E-mail and Join Newsgroups

Windows allows you to exchange electronic mail with people around the world. You can also join newsgroups which allow people with common interests to communicate with each other.



Browse the Web

Windows lets you browse through the information on the World Wide Web. You can access information on any subject imaginable. You can review magazines, encyclopedias, travel guides, famous speeches, recipes, job listings, airline schedules and much more.



Teach Yourself Windows® 98 VISUALLY™

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Mississauga, Ontario, Canada

Work Sheet 1-1

English Vocabulary of Basic Terminology for Basic Computer Operation

Name: _____

Date: _____

Computer Knowledge and Language Proficiency Level Test 1

Circle the terms and concepts that you are familiar with

File	Sharing	Desktop	Space bar
Rename	Connection	Icon	Insert
Delete	Front-page	Displays	Cut
Sort	Installed	Program	Copy
Screen	Folder	Menu	Save
Customize	Document	Keyboard	Open
CDs	Network	Accessories	Window
Electronic	Recycle	Memos	Font
Optimize	Taskbar	Search	Bold
Disk	Mouse	Enlarge	Italic
Defragment	Background	Contents	Underline
Browse	Click	Maximize	Edition
Schedules	Double click	Minimize	Automatic
Versions	Button	Position	Text
Enhancement	Performing	Location	Edit
Feature	Thumb	Scroll	Website
Upgrade	Rightmost	View	Access
Download	Drag	Cascade	Channel
Internet	Graphical	Overlap	Password
E-mail	Dialog	Alignment	Shut Down

Work Sheet 1-2

English Vocabulary of Basic Terminology for Basic Computer Operation

Name: _____

Date: _____

Computer Knowledge and Language Proficiency Level Test 2

Circle the terms and concepts that you are familiar with

Active desktop items	Hyperlinks	Microsoft Excel
Active windows	Inbox folder	Microsoft Word
Address book	Internet explorer	PowerPoint
Auto arrange feature	ISP	DSL
Blind carbon copies	FTP	Modem
Bold text	HTML	Hard-drive
Compose	URL	Digital camera
Default printer	CDRW	Laser jet
Defragment hard disks	CD-ROM	HTTP
Directories	JPEG files	Homepages
Disk clean up	Action button	Drag and drop
Diskette	Auto content wizard	Favorites
Domain name	Clip art	Design template
Emoticons	Clip gallery	

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POWERPOINT PRESENTATION
 DIGITAL TECHNOLOGY and ESL LEARNING
 FUCHUAN WANG
 SEPTEMBER 2001

Subject / Topic Areas: ESL
 Objective: To Integrate Digital Technology
 Into ESL Learning
 Grade Level: Adult (middle level)
 Designed by: Fuchuan Wang
 Time Frame: 4 Weeks
 School District: Fontana Adult School

Lesson Plan #1

English vocabulary and basic terminology
 of computer technology

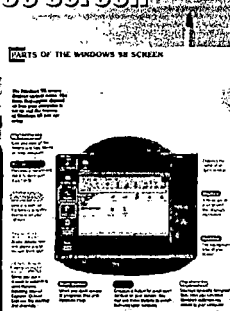
- 1) To understand how technology affect ESL learning
- 2) To learn English vocabulary and concepts of computer
- 3) To enrich ESL learning experience

Computer knowledge and proficiency level check:

- Window - the operation system developed by Microsoft
- Software - program to operate computer
- Program - the coded instruction to be performed by computer
- Desktop - the background area of your computer screen
- File - an orderly arrangement of document or data
- Link - web pages contain highlighted text or images
- URL - uniform resource locator

Parts of Windows 98 screen

An operation system designed by Microsoft. See Microsoft
<http://www.microsoft.com>

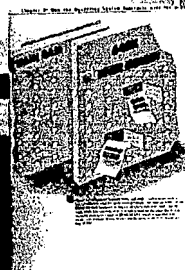


PARTS OF THE WINDOWS 98 SCREEN

Software stores in memory

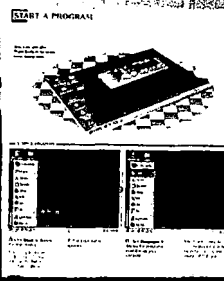
- Software is a program to operate computer.
- Memory is the power or capacity to store software.

Check Software
<http://www.soft99.com> or free Software
<http://www.download.com>



Programming and Menu

All Design-coded instructions to be performed by computer menus (study of program) in screen.
 Visit HTML FOR Beginner
<http://www.htmlfor.com>



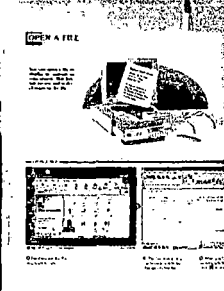
Show the desktop

By minimizing two open windows you see the desktop clearly.
 Link to Vista
<http://www.thinair.com> or
<http://www.altavista.com>




Open a file

File is an orderly arrangement of document or data to display its contents.
 Open My Documents from desktop. This let you review and make change to the file.




ESL learning is a exciting job

A new and old way of learning
 to learn English
 Check Picture Show
<http://www.picture.com>



ESL learning is watching movie

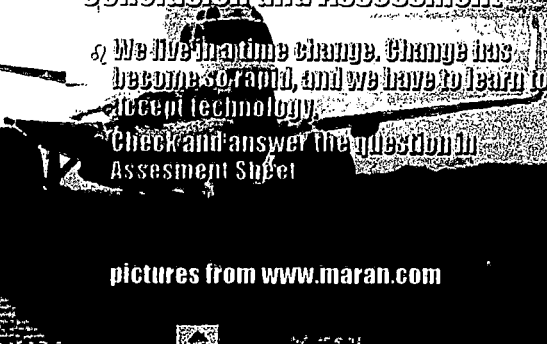
Check this interesting movie



Conclusion and Assessment

We live in a time change. Change has become so rapid, and we have to learn to accept technology.
 Check and answer the questions in Assessment Sheet

[pictures from www.maran.com](http://www.maran.com)



Assessment Sheet 1-1

English Vocabulary of Basic Terminology for Basic Computer Operation

Name: _____

Date: _____

1. Multimedia computers in ESL learning are connected through
 - a) electrical connections
 - b) reading computer books
 - c) computer networks
2. The effective use of computer-assisted language learning is based on
 - a) placing all students at the same level
 - b) placing emphasis on students' needs
 - c) the program of the students preference
3. Internet skills are involved in
 - a) updating hardware
 - b) choosing a search engine
 - c) purchase of programs
4. Which of the following terms are similar to the term "surfing the net" ?
 - a) browsing
 - b) e-mail
 - c) connecting
5. In order for your web pages to be viewed by the public, they must be saved on a server.

A server...

 - a) provides repair services
 - b) designs programs
 - c) displays pages on the internet
6. Search engines "crawl" through the Internet, looking for web pages with keywords.

Define crawl.

 - a) grow
 - b) search
 - c) practice often
 - d) move slowly

Assessment Sheet 1-2

English Vocabulary of Basic Terminology for Basic Computer Operation

Name: _____

Date: _____

1. Microsoft Windows is a program that controls
 - a) Apple computers
 - b) PC or PC compatible
 - c) both computer types
2. Minimum hardware requirements of the Windows 98 operating system are
 - a) 8 MB RAM and 386 CPU
 - b) 16 MB RAM and 486 CPU
 - c) 64 MB RAM and Pentium 90 CPU
3. You can view all the folders and files stored on your computer under
 - a) my documents
 - b) my computer
 - c) desktop
4. Mouse actions include
 - a) click and double click
 - b) right click
 - c) drag
 - d) all of the above
5. Microsoft windows is controlled by
 - a) the mouse
 - b) the keyboard
 - c) both the mouse and keyboard
6. Windows provides many programs which include
 - a) Wordpad
 - b) Microsoft Word
 - c) Microsoft Excel
7. To shut down windows
 - a) turn off the power source
 - b) type "shut off" on the keyboard
 - c) go to "shut down" option under the start menu button
8. What does MB mean?

9. How many MB are in a floppy disk?

10. What does CPU mean?

Assessment Sheet 1-3

English Vocabulary of Basic Terminology for Basic Computer Operation

Name: _____ Date _____

A) Language Skill Proficiency	Needs improvement					Good
1) Speaker spoke clearly	1	2	3	4	5	
2) Speaker spoke at a good volume	1	2	3	4	5	
3) Speaker spoke at a good pace	1	2	3	4	5	
4) Speaker faced the audience	1	2	3	4	5	
5) Speaker made eye contact	1	2	3	4	5	
6) Speaker provided good examples	1	2	3	4	5	

B) Computer Operation Skills

1) Use of mouse to start the computer was clear	Yes	No
2) Program was started in the correct sequence	Yes	No
3) Windows was properly operated	Yes	No
4) Desktop and toolbar were properly operated	Yes	No
5) The computer was shut down properly	Yes	No

APPENDIX B:
INSTRUCTIONAL UNIT TWO

Unit Two

Lesson One: ESL for Spatial Development and Measurement

- Objectives:
- 1) To understand vocabulary, definition and applications of the English measurement system
 - 2) To learn how to convert the metric measurement into English measurements for diverse applications in American society
 - 3) To develop English skills using visual spatial intelligence

Warm Up and Prior Experience:

Ask students to identify a ruler, a thermometer, and a gallon measure.

Task Chain 1

- 1) Review the international metric system.
- 2) Introduce the basic concepts of the English system by using Focus Sheet 1-1 and 1-2.
- 3) Practice by using the measuring system, manipulative, and hands-on experience.
- 4) Review fraction notation and fractional operation at the pre-algebra level.

Task Chain 2

- 1) Explain the functions of language and presentation in measurement using Work Sheet 1-1 and 1-2.
- 2) Students memorize the basic vocabulary from work sheet.
- 3) Students circle and discuss new vocabulary in group activities.

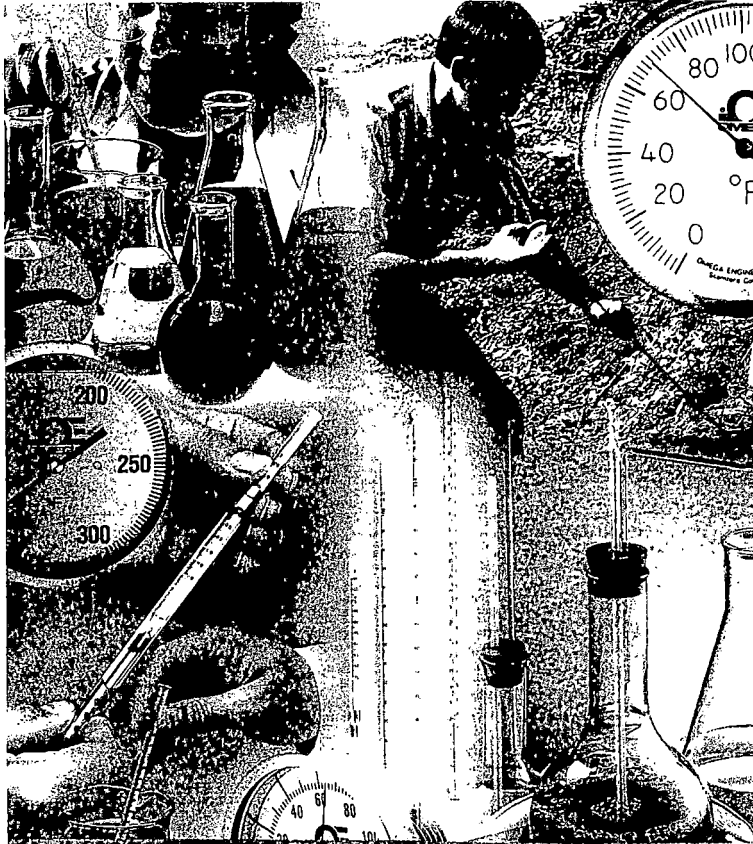
Task Chain 3

- 1) Teacher explains the conversion table, using focus sheets and work sheets.
- 2) Students work on examples and practice individually.
- 3) Students present and compare the results from their solutions.

Final Assessment

- 1) Using Assessment Sheet 1-1, students check their understanding in language skills for developing visual spatial intelligence, then grade and record the test results.
- 2) Use Assessment Sheet 1-2 to evaluate the students' mathematical application ability in language developments, then grade and record the test results.

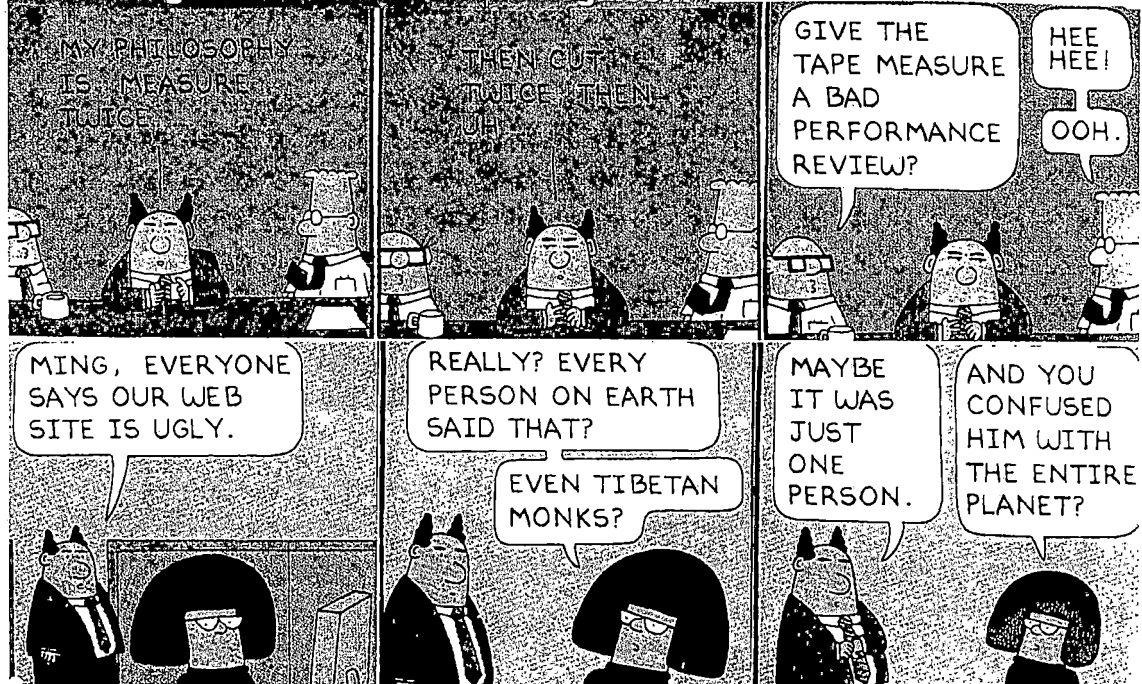
Focus Sheet 1-1
 ESL for Spatial Development and Measurement



TERMINOLOGY

- ACF = Actual Cubic Feet
- A/D = Analog to Digital
- ATM = Atmospheres
- BTU = British Thermal Units
- cc/min = Cubic Centimeters per Minute
- CFH = Standard Cubic Feet per Hour (SCFH)
- C_p = Specific Heat
- C.S. = Carbon Steel
- D = Diameter
- Dia. = Diameter
- Diam. = Diameter
- D/A = Digital to Analog
- EMI = Electromagnetic Interference
- EPR = Ethylene Propylene Rubber
- FDA = Food and Drug Administration
- FNPT = Female National Pipe Thread
- FPM = Feet Per Minute
- FPS = Feet Per Second
- F.S. = Full Scale
- FT = Feet
- gals = Gallons
- gpm = Gallons Per Minute
- gph = Gallons Per Hour
- H_f = Latent Heat of Fusion
- H/L = High-Low
- H_v = Latent Heat of Vaporization
- I.D. = Inside Diameter
- I/O = Input/Output
- k = Thermal Conductivity
- lbs = Pounds
- lbs/in² = Pounds Per Square Inch
- lpm = Liters Per Minute
- L/min = Liters Per Minute
- mL/min = Milliliters Per Minute
- MNPT = Male National Pipe Thread
- ms = Milliseconds
- m/s = Meters Per Second
- MSEC = Milliseconds
- NICad = Nickel Cadmium
- NO/NC = Normally Open/ Normally Closed
- NPT = National Pipe Thread
- O.D. = Outside Diameter

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Focus Sheet 1-2
ESL for Spatial Development and Measurement

The two most important measures of 3-dimensional figures are *surface area* and *volume*. They are the counterparts of perimeter and area in 2-dimensional figures. Surface area, like perimeter, is a measure of a boundary, the surface of a 3-dimensional figure. Volume, like area, is a measure of the space enclosed by the figure.

Surface Area
helps in determining:

Volume
helps in determining:

how much paper is needed to make a box,



how much the box can hold,

how much land there is to explore on the moon,



how much material makes up the moon,

how much heat a bird loses through its skin,

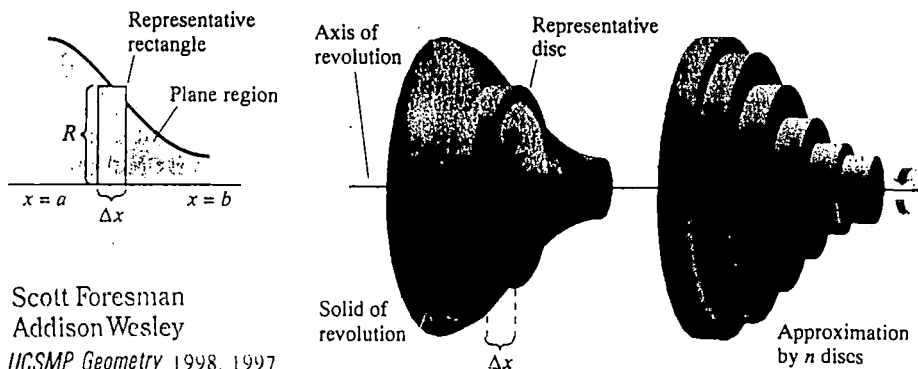


how much the bird weighs,

how much fabric is needed to cover a toy.



how much stuffing is needed to make the toy.



Scott Foresman
Addison Wesley
UCSMP Geometry 1998, 1997
Scott, Foresman and Company, Glenview, Illinois.

Work Sheet 1-1
ESL for Spatial Development and Measurement

Vocabulary and Concepts in Measurement

Bushel (BU)	Half-gallon	Milliliter (ML)	Celsius (C)
Hectometer (HM)	Millimeter (MM)	Fahrenheit (F)	Inch (IN or “)
Ounce (OZ)	Centimeter (CM)	Kilogram (KG)	Peck (PK)
Cup (C)	Kilometer (KM)	Pint (PT)	Decimeter (DM)
Liter (L)	Pound (LB)	Dekameter (DAM)	Meter (M)
Quart (QT)	Error of measurement	Mile (MI)	Ton (T)
Foot (FT or ‘)	Milligram (MG)	Yard (YD)	Gallon (GAL)
Numerator	Centigrade	Gram (G)	Denominator

Directions: Answer the following questions, working individually.

- 1) How do you measure the objects in daily activities, give examples in length, weight and capacity?
- 2) Which mathematic notation do you use more often- Decimal or fractional notation?
- 3) What are the differences between the English measurement system (Customary system) and the Metric System (International System)? Explain your answer and give examples.

Work Sheet 1-2
ESL for Spatial Development and Measurement

What is the English measurement system?

1) The table below lists the relationships that students should understand and memorize.

The time conversions are used in both the English and Metric System.

Length

1 foot = 12 inches

1 yard = 3 feet

1 mile = 5280 feet

Weight

1 pound = 16 ounces

1 ton = 2000 pounds

Capacity

1 cup = 8 fluid ounces

1 pint = 2 cups

1 quart = 2 pints

1 gallon = 4 quarts

Time

1 week = 7 days

1 day = 24 hours

1 hour = 60 minutes

1 minute = 60 seconds

2) How has the English measurement system evolved?

As we can see, there is no simple or easy way to convert these measurements into others.

The English system evolved over hundreds of years and was based on a variety of

“standards.” For example, one yard was the distance from the tip of a king’s nose to his thumb when his arm was outstretched. An inch was three dried barley corns laid end to end.

3) Manipulatives and measuring activities

a) Length : pencil, 8 ½” by 11” (216 mm by 279 mm), one-dollar bill (six inches), rulers with English and metric systems, micro meter, dial caliper, and other precision tools.

Work Sheet 1-3
ESL for Spatial Development and Measurement

Metric- English Conversion and Temperature

1) Until the United States switches completely from the English System to the Metric System, it will be necessary to make conversions from one system to another. For ESL/EFL students, these conversions need practice and memorization in order to improve their mathematical application in language development.

The following table has been rounded to the nearest hundredth.

Metric to English	English to Metric
1 kilometer = .62 miles	1 mile = 1.61 kilometer
1 meter = 1.09 yards	1 yard = .91 meters
1 meter = 3.28 feet	1 foot = .3 meters
1 centimeter = .39 inches	1 inch = 2.54 centimeters
1 liter = .26 gallons	1 gallon = 3.78 liters
1 liter = 1.06 quarts	1 quart = .95 liters
1 kilogram = 2.2 pounds	1 pound = .45 kilograms
1 gram = .04 ounces	1 ounce = 28.35 grams

Assessment Sheet 1-1
ESL for Spatial Development and Measurement

Directions: Answer the following questions or fill in the blanks.

- 1) 9 gallons = ____ quarts 2) 45 Feet = ____ yards
3) 135 minutes = ____ hours 4) 9 inches = ____ feet
5) 3 ½ pounds = ____ ounces 6) 5 days = ____ minutes

Write the most reasonable metric unit in each blank. Choose from km, m, cm, mm, l, ml, kg, g and mg.

- 7) My husband weighs 75 _____.
8) I hiked 5 _____ this morning.
9) She bought 125 _____ of cough syrup (medicine).
10) This apple weighs 180 _____.
11) My watchband is 10 _____ wide.
12) This page is 21 _____ wide.
13) I bought 10 _____ of soda for the picnic
14) The bracelet is 16 _____ long.
15) Stan's cat weighed 3 kg 740 g. His dog weighed 10 kg 60 g. How much heavier is the dog in kilograms?
16) Denise is making five matching pillows. She needs 1 m 35 cm of braid to trim each pillow. How many meters of braid should she buy?

Pick the Celsius or Fahrenheit temperature that is most appropriate in each situation.

- 17) The water is almost boiling. 210 C 155 C 95 C
18) The tomato plants may freeze tonight. 100 F 70 F 32 F

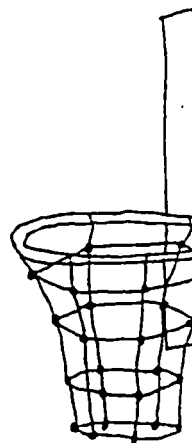
Assessment Sheet 1-2
ESL for Spatial Development and Measurement

Place the decimal point in each number so the measurement makes sense.

1. a. height of a basketball hoop: 3 0 4 m
- b. length of a football field: 9 1 4 m
- c. width of a classroom: 6 0 9 m
- d. length of notebook paper: 2 7 9 m
- e. Add the four measures. _____
You should have a total between 100 m and 101 m.

2. a. height of a man: 1 7 9 5 cm
- b. length of a dollar bill: 1 5 5 4 cm
- c. width of notebook paper: 2 1 5 9 cm
- d. length of a pencil: 1 9 0 5 cm
- e. Add the four measures. _____
You should have a total between 235 cm and 236 cm.

3. a. thickness of a dime: 1 0 2 0 mm
- b. width of a dollar bill: 6 6 0 mm
- c. length of a paper clip: 3 1 5 0 mm
- d. height of a cup: 9 5 6 0 mm
- e. Add the four measures. _____
You should have a total between 194 mm and 195 mm.



APPENDIX C:
INSTRUCTIONAL UNIT THREE

Unit Three: Making a Paper Airplane

- Objectives:
- 1) To sequence written directions using context clues
 - 2) To distinguish simple sensory-motor action
 - 3) To make an airplane from paper and test its balance
 - 4) To learn the basic geometric shapes from lines to complicated shapes
 - 5) To self assess a student's visual/spatial intelligence

Warm Up and Prior Experience:

Ask students about the experience in Origami. Pass out paper, scissors, and glue and ask if anyone knows how to make a paper airplane. If anyone does, recruit him or her as an assistant in Task Chain 3.

Task Chain 1: Sequential Directions

- 1) The instructor demonstrate what visual-spatial intelligence is, by using Focus Sheet 1-1.
- 2) The instructor explains the tasks, sequence the written directions using context clues.
- 3) Pair students. Each pair should receive paper with directions on how to make a paper airplane.
- 4) When the sequencing task is completed, the instructor should show the model for comparison.
- 5) Groups and self assess their accuracy.

Task Chain 2: Vocabulary of Sensory-Motor Actions

- 1) Each team chooses ten new words from the directions.
- 2) The first group writes their ten new words on the board. Second group writes their ten words. If one of their words is already on board, they put a check beside it, writing only words that have not appeared.
- 3) The instructor lists out 10 words with the highest number of checks as the vocabulary.

Task Chain 3: Make an airplane

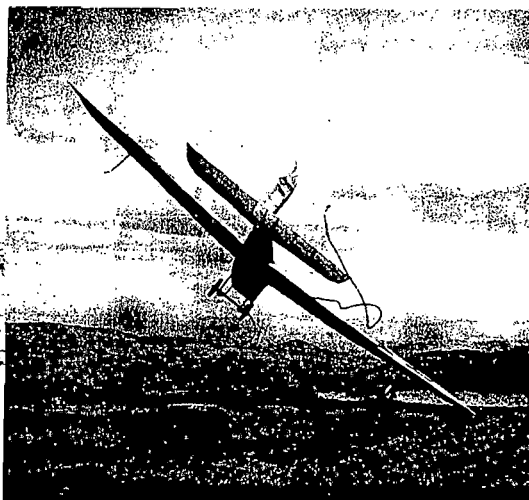
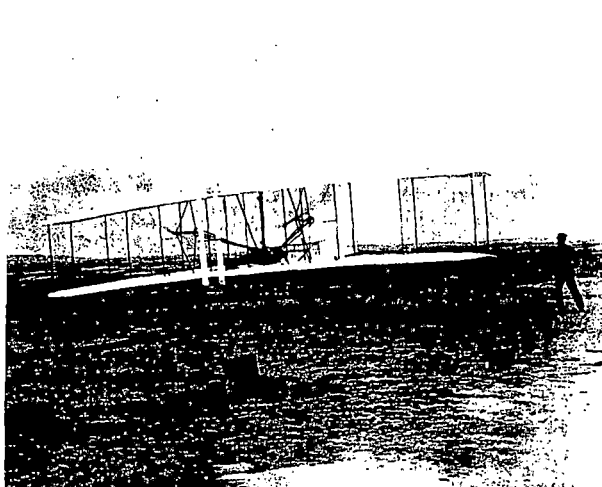
- 1) Demonstrate how to make an airplane following the directions on focus sheets.
- 2) Allow students to recognize the simple geometric concepts and develop into different complicated shapes making a paper airplane.
- 3) Students present and check their progress by monitoring their results in every step.

Final Assessment

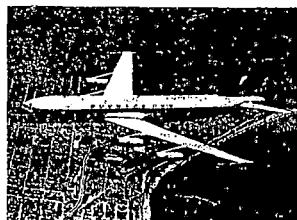
- 1) Using Assessment Sheet 2-1, students check their awareness of sequences, knowledge of vocabulary and context for sensory/motor actions.
- 2) Use Assessment Sheet 2-2 to review their understanding of geometric shapes (from lines to the airplane), and sequence of developing more complicated concepts in three dimensions.

Focus Sheet 1-1

The History of Flight



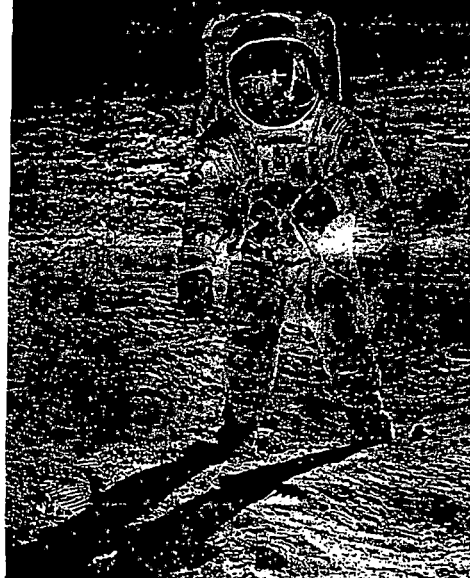
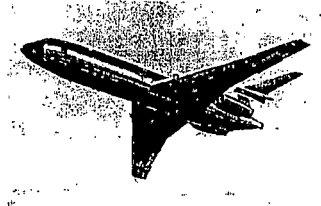
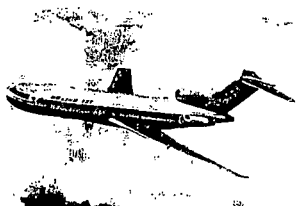
Man's dream of powered flight came true on December 17, 1903, when Orville Wright flew a gawky contraption for 12 seconds at Kitty Hawk, North Carolina. Coast Guardsman John D. Daniels, from a nearby station, took the picture above just at the moment when brother Wilbur released the wing and the air age was born.



BOEING AIRCRAFT CO.
BOEING DC-8, a long-range jet airliner that carries up to 176 passengers, also exists in a cargo version known as the Jet Trader.



THE BOEING CO.
BOEING 727, a wide-glethed short-to-medium-range transport, has a passenger compartment as wide as those of big long-range transports.



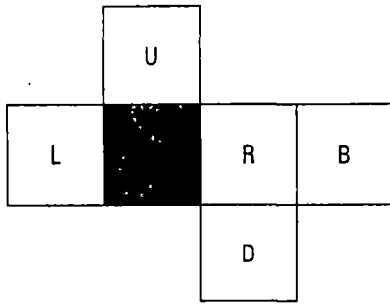
Sixty-six years after the Wrights' airplane wobbled aloft, astronaut Edwin E. (Buzz) Aldrin Jr. stood on the surface of the moon, 239,000 miles from home. Reflected in his visor (right) are pieces of scientific equipment, the moon-landing craft Eagle, and his fellow voyager Neil Armstrong, who took this photograph.

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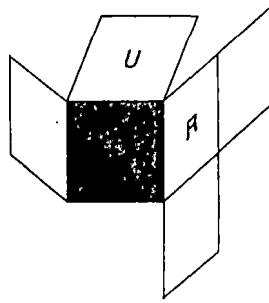
Focus Sheet 1-2

Making a Paper Airplane

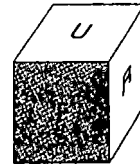
Shown below is a net for a cube. We have named the six faces by the first letters of the words up, down, left, right, back, and front. When you cut around the outside boundary, and folded along the common edges as shown, you formed a cube.



net for a cube

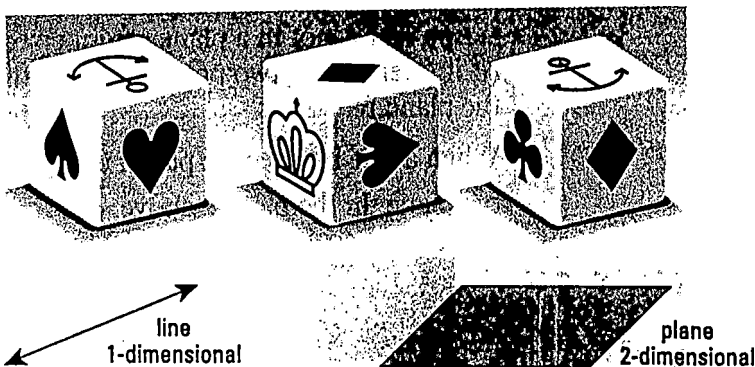


folding process

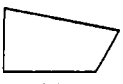










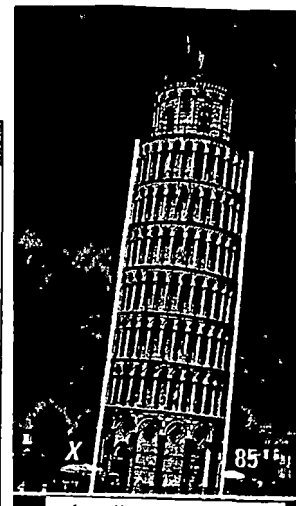
cube

Three identical cubes used in the British game Crown and Anchor are pictured below. What symbol is on the face opposite the crown?



Just as the 1-dimensional line has the plane as its 2-dimensional counterpart, every 2-dimensional figure has its counterpart in three dimensions.

2-dimensional figures		3-dimensional figures		
Polygons		Polyhedral Surfaces		
 quadrilateral	 triangle	 prism	 pyramid	
Curves		Curved Surfaces		
 circle	 ellipse	 cylinder	 cone	 sphere



<http://www.sf.aw.com>

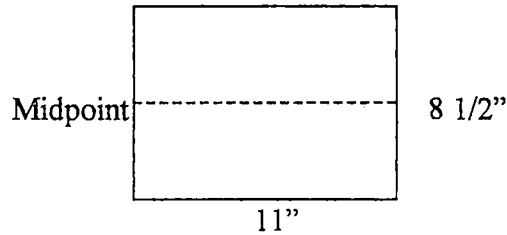
Work Sheet 1-1
Making a Paper Airplane

- 1) Select one sheet of clean 8" by 11" paper.
- 2) Place one in front of each student.
- 3) Fold one side of the paper over where it matches the other side of the paper.
- 4) Make two consecutive angular bisectors between the central line and the shorter sides of the paper.
- 5) Form two isosceles right triangles from the shorter sides.
- 6) Have the students unfold the paper and check if it is in a balanced position.
- 7) Test the airplane to see how smoothly it flies.

Work Sheet 1-2

Making a Paper Airplane

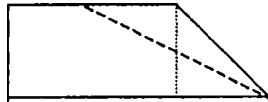
Step 1: Locate the midpoints of the shorter sides and the central line



Step 2: Fold the paper from the central line then align the edges and the four right angles of the paper.



Step 3: Make two consecutive angle bisectors between the central line and the shorter sides of the paper.



Step 4: Unfold the paper and check if it is in a balanced position.



Central line

Assessment Sheet 1-1
Checking the Directions for Making a Paper Airplane

I) Awareness of sequence: Number these steps in their correct order.

- _____ Form two isosceles right triangles from the shorter sides.
- _____ Select one sheet of 8" by 11" paper.
- _____ Locate the middle points of both short sides.
- _____ Line up the edges of the short sides with the central line.
- _____ Make 2 angle bisectors from the base angles of the isosceles triangles.
- _____ Have the students unfold the paper and check to see if it is balanced.
- _____ Test the airplane to see how smoothly it flies.

II) Knowledge of Vocabulary: Draw a circle around the words that describe an action that takes place in the directions above.

Right	Triangle	Sides	Both	Central
Select	Point	Make	Middle	Line up
Airplane	Unfold	Paper	Angle	Check
Isosceles	Balance	Fly	See	Line
Test	Position	Shorter	Paper	Order

III) Context for sensory-motor actions

Write "yes" if the bold word is used correctly in a sentence. Write "no" if it is not.

- 1) _____ We see two isosceles triangles from shorter sides.
- 2) _____ Students both the edges of the shorter sides with the central lines.
- 3) _____ Test the airplane to see how well it flies.
- 4) _____ Have the students fold the paper and check it.

- 5) _____ Making an airplane **form** papers.
- 6) _____ Locate the **middle** points of the shorter sides.
- 7) _____ **Make** one sheet of paper 8" by 11".

Assessment Sheet 1-2
Making a Paper Airplane

Directions: Answer the following questions and make the object with the supplied worksheet.

1) A) Do you think that you are gifted in the area of visual-spatial skills?

B) Explain your answer.

2) A) How do you think that you can improve your visual-spatial intelligence?

B) Give two ways you think that you can improve your skills.

3) Working individually, make a tetrahedron with scissors and glue, then turn it in to be graded.

APPENDIX D:
INSTRUCTIONAL UNIT FOUR

Unit Four: Visualizing in Three Dimensions

- Objectives:
- 1) To learn to think in three dimensions by using the axes of rotation
 - 2) To learn to visualize object from different points of view and draw objects isometrically
 - 3) To understand the concepts of graphics in a solid object

Warm Up: Introduce the concepts of AutoCad (Computer Aided Drafting) and the important aspects of three dimensions, using basic geometry and advanced computer technology.

Task Chain 1.

- 1) The instructor explains the task, rectangular systems, and the concept of three dimensions.
- 2) Each student receives Focus Sheet 1-1, the instructor explains the concept of the X, Y, and Z axes, and what is rotated around in 3D.
- 3) Students work on Work Sheet 1-1.

Task Chain 2

- 1) The instructor hands out Focus Sheet 1-2.
- 2) Individually, each student reads the Focus Sheet 1-2.
- 3) The instructor explains the concept of isometrics and students follow the directions to work on Work Sheet 1-2.

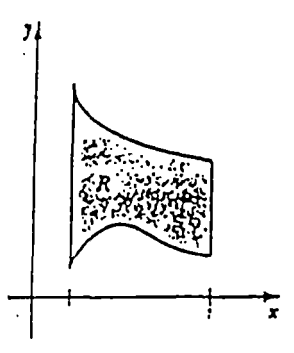
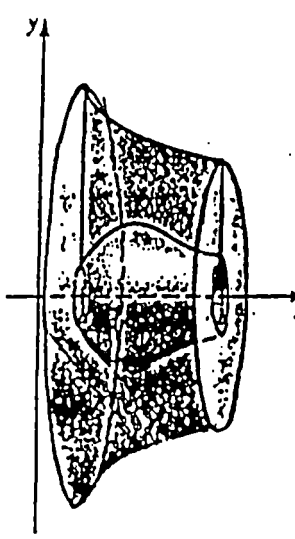
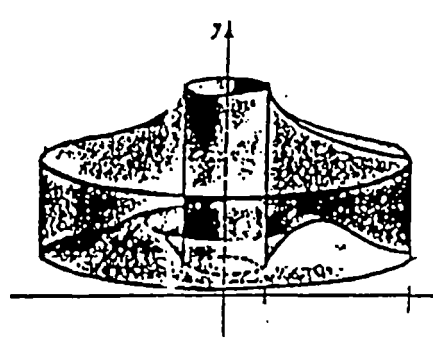
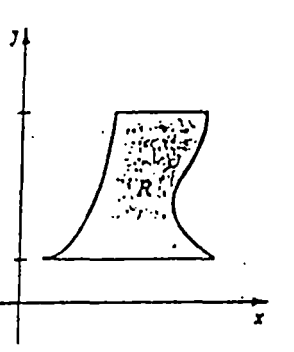
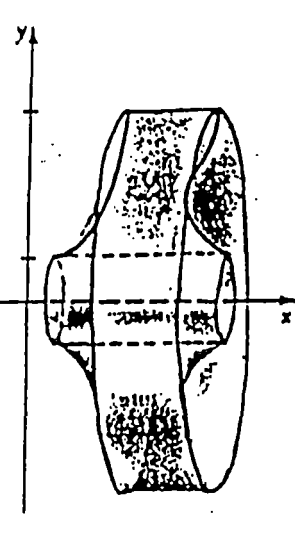
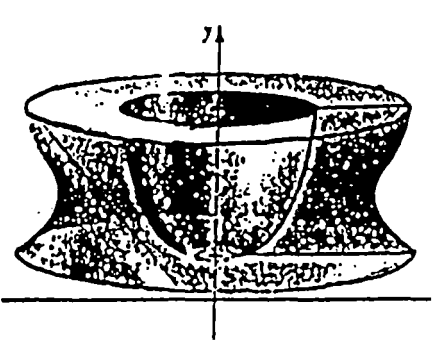
Task Chain 3

- 1) Place the students into pairs. Each student receives Work Sheet 1-3.
- 2) Each group reads and works on Work Sheet 1-3, then compares and discusses the results of the graphics.

Assessment

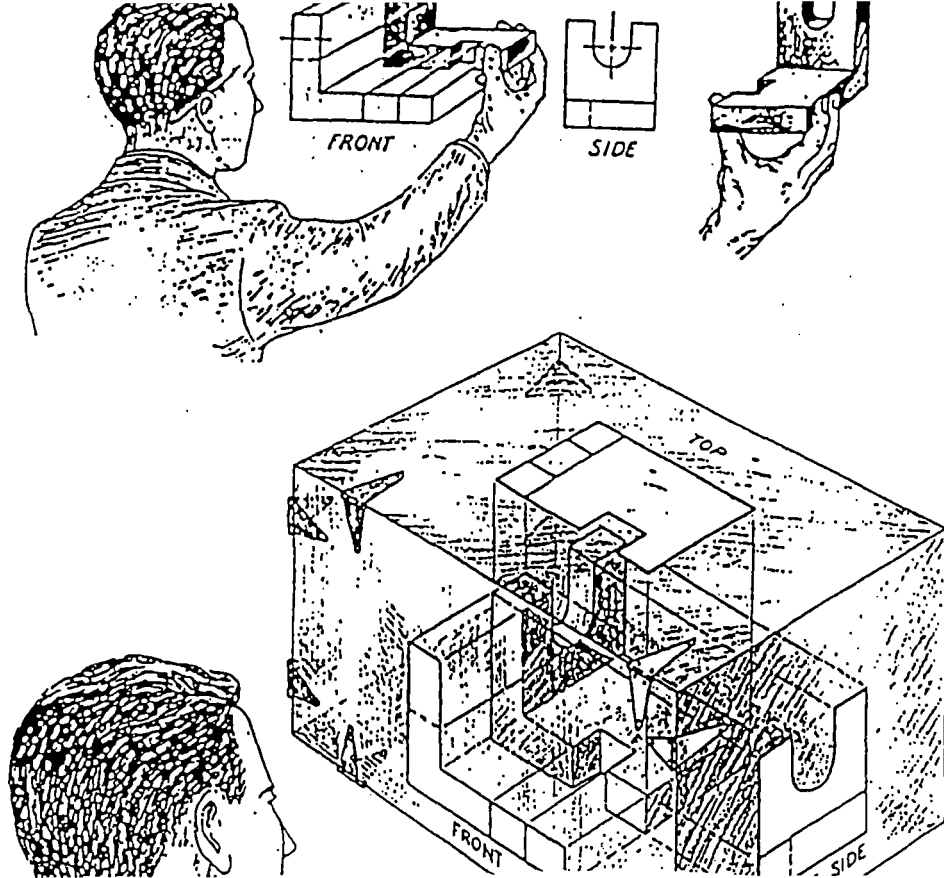
- 1) Using Assessment Sheet 1-1, students check their knowledge of vocabulary related to 3D graphics.
- 2) Using Assessment Sheet 1-2, students demonstrate their visual spatial knowledge and skills.

Focus Sheet 1-1
 Visualizing in Three Dimensions

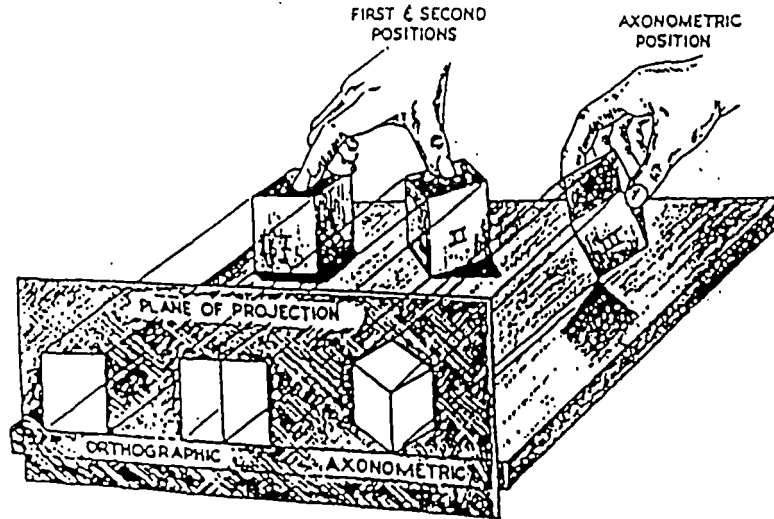
Region	Rotated about the x -axis	Rotated about the y -axis
		
		

Faires, J. Douglas.
 Calculus.

(The Random House/Birkhäuser mathematics series)
 First ed. published under title: Calculus and analytic geometry

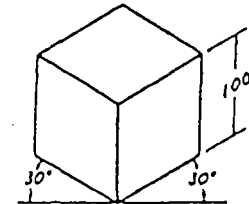


Focus Sheet 1-2 Visualizing in Three Dimensions

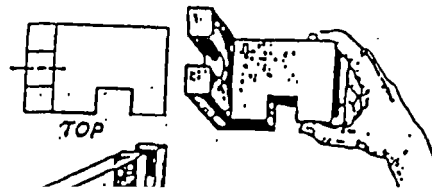


↓ Axes

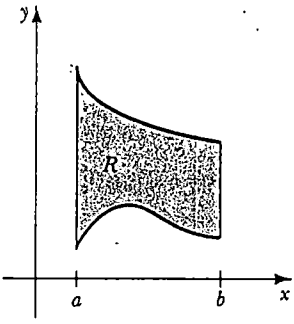
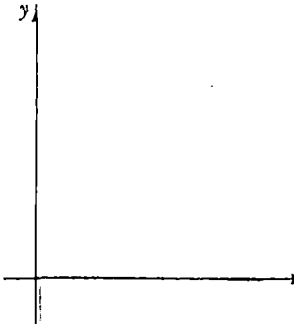
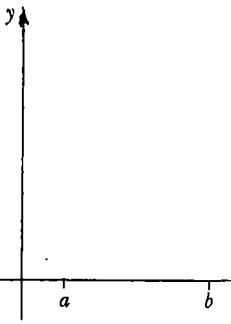
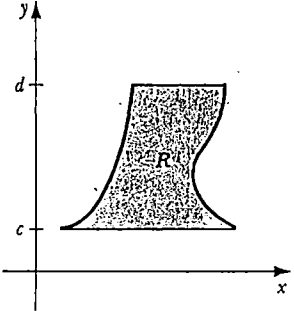
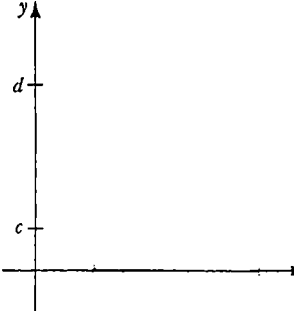
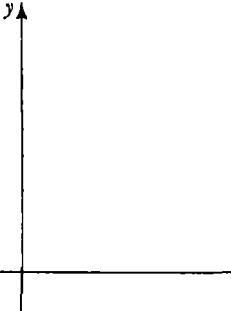
Full Lengths Are Laid Off Along Or Parallel To The Axes



ISOMETRIC DRAWING



Work Sheet 1-1
Visualizing in Three Dimensions

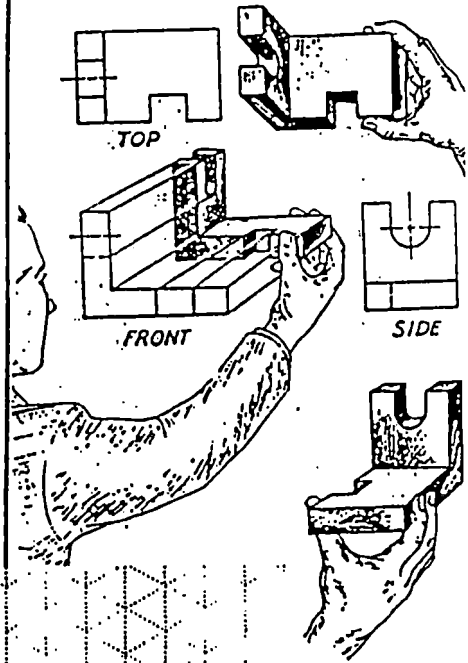
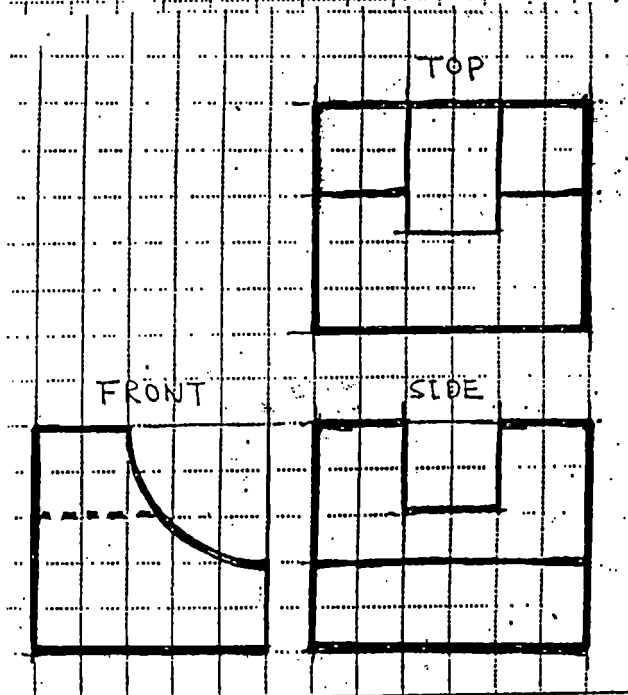
Region	Rotated about the x -axis	Rotated about the y -axis
 <p>A Cartesian coordinate system with x and y axes. A shaded region R is shown in the first quadrant, bounded by the y-axis, the x-axis, and two curves between $x=a$ and $x=b$.</p>	 <p>An empty Cartesian coordinate system with x and y axes.</p>	 <p>An empty Cartesian coordinate system with x and y axes. Points a and b are marked on the x-axis.</p>
 <p>A Cartesian coordinate system with x and y axes. A shaded region R is shown in the first quadrant, bounded by the y-axis, horizontal lines $y=c$ and $y=d$, and two curves between $x=a$ and $x=b$.</p>	 <p>An empty Cartesian coordinate system with x and y axes.</p>	 <p>An empty Cartesian coordinate system with x and y axes. Points c and d are marked on the y-axis.</p>

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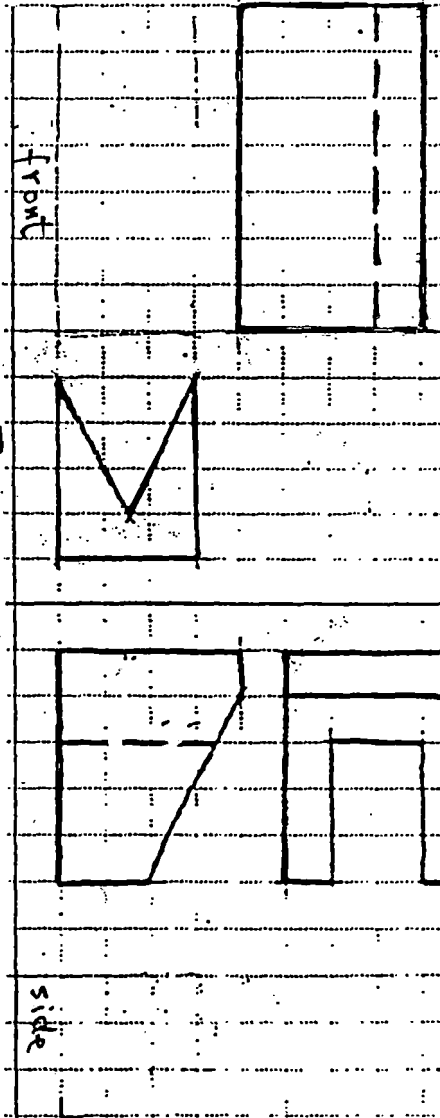
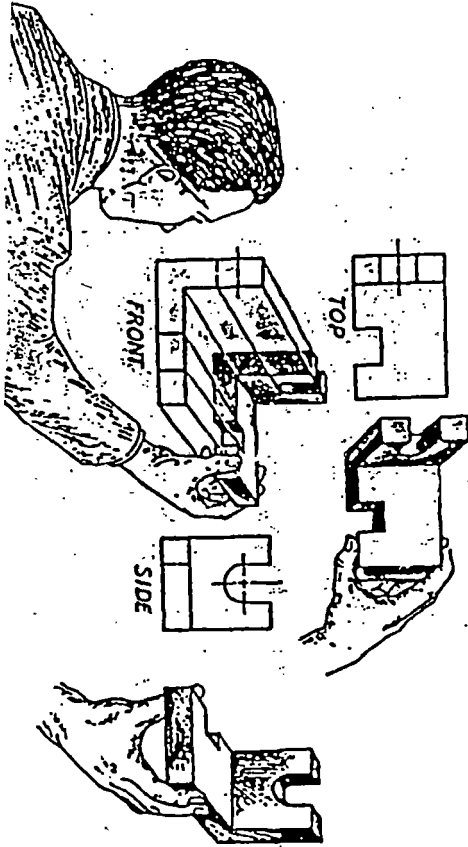
Work Sheet 1-2 Visualizing in Three Dimensions

COMPLETE AN ISOMETRIC SKETCH OF THE FOLLOWING OBJECT
CHOOSE THE MOST DESCRIPTIVE ORIENTATION. USE ISO GRID paper



Fundamentals of Engineering Drawing
for design, product development, and numerical
eighth edition control

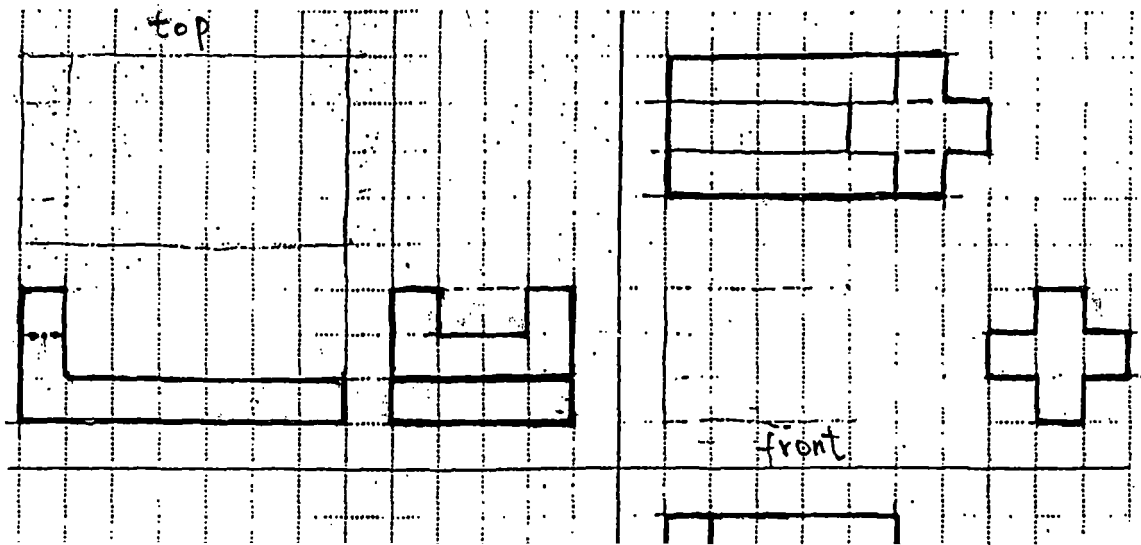
Warren J. Luzadder, P.E.



Fundamentals of Engineering Drawing
for design, product development, and
eighth edition numerical control
Warren J. Luzadder, P.E.

Work Sheet 1-3
Visualizing in Three Dimensions

COMPLETE THE MISSING VIEW OF EACH SINGLE SOLID OBJECT.



Assessment Sheet 1-1
Visualizing in Three Dimensions

Knowledge of vocabulary: write down the meaning of the word that you learned in the lesson. Name _____

1) Rotated

2) Symmetry

3) Solid

4) Cylinder

5) Isometric

6) Projection

7) Region

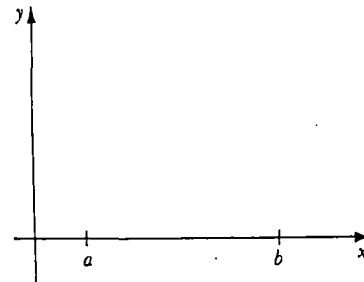
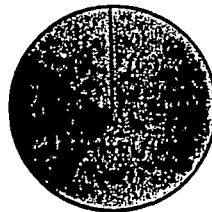
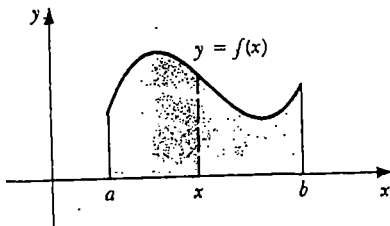
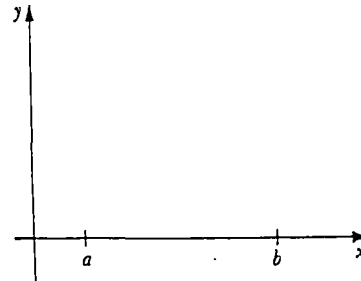
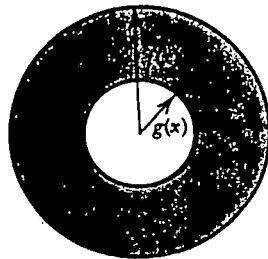
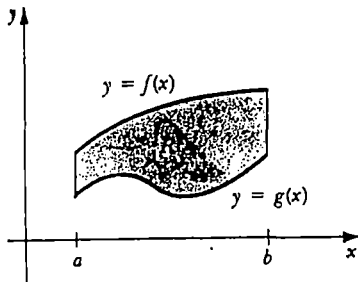
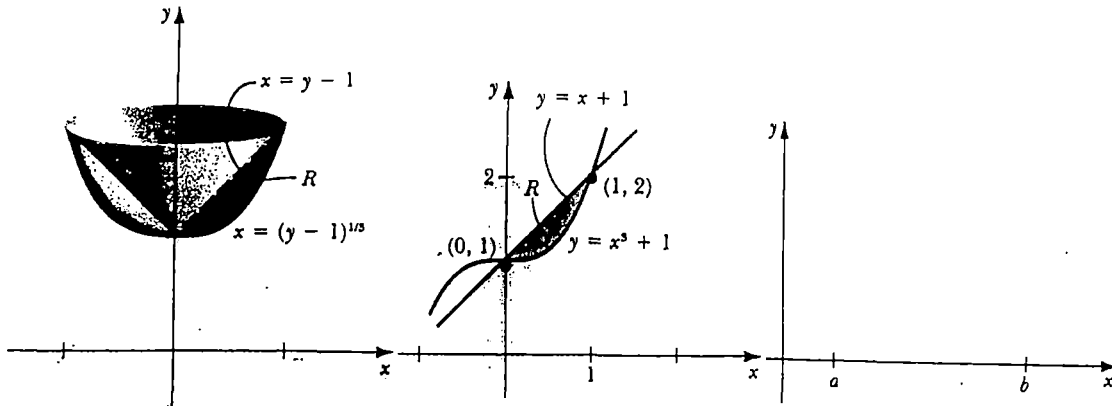
8) Sketch

9) Axis

10) View

Assessment Sheet 1-2
 Visualizing in Three Dimensions

Revolving the region about the X-axis in the following questions:



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 Calculus.

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