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Improving map literacy: The application of second language instruction views and techniques

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IMPROVING MAP LITERACY: THE APPLICATION OF SECOND LANGUAGE INSTRUCTION VIEWS AND TECHNIQUES

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ABSTRACT

Maps are a common and useful tool, yet many people do not know how to use them effectively. Map education has typically been inadequate for teaching people the skills involved in map use and map reading. Map education in schools, where people typically learn their mapping skills, can be improved. This thesis looks at specific ways to improve map education. Based upon previous research, it looks at cartography from a language perspective to determine whether findings from the language research can be applied to cartography, and more specifically to map education.

Maps serve to communicate information, and have been compared to a language by several different authors. A discussion of this comparison revealed that there are significant parallels between cartography and language. Cartography can be shown to have a well-established sign system, a grammar system acting for the map, and meaning resulting from the interaction of the signs and grammar. It has also been described as having analogous aspects to the cultural component and spoken form of a natural language. As such, the cartographic language can be defined as a systematic means of communicating meaning or ideas through the use of the set of cartographic symbols, which have understood meaning.

An exploration of the literature surrounding second language teaching was undertaken to determine its applicability to cartographic teaching. While language teaching has varied over time, there has been a move towards flexible language programs which focus on *using* the language rather than teaching *about* the language. The lexicon, grammar, meaning and the relationships between these, should form the basic content of a language program.

The second language literature can be applied, in part, to the cartographic language. In doing so, suggestions for what to teach and how to teach can be provided. Map education should incorporate aspects of the cartographic lexicon, grammar and meaning, as well as how these interact. Some of the specific teaching methods for languages have been adapted in order to teach the cartographic language. By also considering some of the important suggestions from the recent map education literature, a framework for teaching cartography can be developed.

Objectives for map education are outlined, and then five successive levels for teaching map comprehension to school children are proposed. Level One is ideally intended for Kindergarten and Grade One classes and teaches early map awareness and appreciation. The levels progress in difficulty until Level Five, which expects map proficiency for Grade Eight and Nine students. Specific learning goals plus suggested activities to achieve these goals are provided for each level.

This work can be valuable for educators. It places map education in a new framework and hopes to be able to improve the map literacy of students. Further work is needed to test the effectiveness of the proposed guidelines and to further develop the concepts of the cartographic language.

ACKNOWLEDGEMENTS

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CHAPTER ONE

INTRODUCTION

1.1 - STATEMENT OF THE PROBLEM

Maps have been defined as "any graphic, conventional representation of spatial information, drawn for a purpose" (Bailey, 1986). A map is a physical representation of some part of reality. They can exist in a wide range of shapes and forms, depending upon their function, medium, design and maker. Maps have become pervasive in our society. They can be found, for instance, on television, in books, in newspapers, on buses, in subway stations, in parks, shopping malls and libraries, as well as many other locations. It is easy to come into contact, at some point, with several different types of maps.

According to Keates (1996, 3), "people use maps to obtain information, to find something out, and they are aware, consciously or subconsciously, that for some purposes the map is far more effective than any other source." Maps can be used for many different purposes and reasons, and can prove invaluable for some tasks. For instance, maps could be used for finding a specific place, selecting a route, discovering the name of some feature, trying to memorise a route, or for navigating a ship in a narrow channel (Keates, 1996). Catling (1988, 168) describes maps as serving four functions:

- A map is a locational document. You can find places on a map, whether on an atlas map, a street map or a map in an advertisement showing where a particular shop is.

- A map can be a route-displaying document. It can be a great asset when wanting to get from A to B.

- A map can also show you what a place or an area looks like, its structure, shape and features. The use of a map to comprehend the look of the landscape is something which takes time, practice and patience to learn.

- A map is also a very useful way of storing and displaying information. There is a wealth of information depicted in maps, facts about places, what they look like, how they develop, what is there, and so on. They serve very well for displaying information which is not obvious on the ground.

Board (1981) proposes three major map purposes: navigation, measurement and visualisation. He explains that "each of these involves a rather different but increasingly more complicated set of operations which comprise the process of map reading" (Board, 1981, 68). It is this increasing complexity that leads to problems in map use.

Map ability is a skill (Catling, 1988). According to Camu (1965), few people know how to effectively use maps. Being able to use a map involves the reading, analysis and interpretation of geographical data (Saku, 1990). Camu points out that not only do people not know how to read the information on maps, but they even fail to realise the significance of the map information. This is an unfortunate truth considering the potential utility and value of maps for people. According to Ottosson (1988, 28), "the general public frequently considers the use of maps to be something relatively difficult. This difficulty is probably one of the reasons that maps are seldom introduced to children during their first years of schooling."

People generally learn about how to read maps while at school (Board, 1981). There is significant evidence which suggests that many adults are not competent in basic map use tasks (Blades & Spencer, 1987), indicating inadequate map education. For instance, Streeter and Vitello (1986, also in Blades & Spencer, 1987) conducted a study which looked at car drivers' abilities to plan routes between two locations on a road map. They found that 72 percent of drivers in their study were unable to correctly plan a usable route when they were unfamiliar with the area on the map. For those who were familiar with

the area, 41 percent still managed to propose impossible routes. Some of the errors included using railroads or rivers as roads, using limited-access roads or ending at the wrong location.

Garland, Haynes and Grubb (1979, in Blades & Spencer, 1987) had college students plan bus journeys using transit route maps. The journeys involved three trips (to two separate stops before returning to the starting location), and each trip required six pieces of information. Each of the students made at least 4 (out of 18 possible) errors in their planning, with an average of 6.18 errors per trip, suggesting they would have great difficulty planning a route on their own.

Streeter, Vitello and Wonsiewicz (1985, in Blades & Spencer, 1987) compared the use of taped directions versus a 'customised' road map for people driving a car. The maps showed the detailed route to be taken, including specific landmarks and distance between turns. Drivers were poorer at using the maps, despite the detail. Those with the tapes drove seven percent more than the average required mileage, while those with the maps drove twenty percent more miles than needed. When asked, all the subjects of a group which had been given both the maps *and* the taped instructions preferred taped directions to using conventional road maps.

Research by both Schneider (1976) and Giannangelo and Frazee (1977), (both reported in Blades & Spencer, 1987), found that teachers, many of whom were responsible for teaching children map skills, were poor at interpreting and understanding maps. They often made errors in answering basic questions related to locating places by using the map key or estimating distances on road maps.

Board (1981) reports on a study which found that many school pupils in their mid-teens had already forgotten some of the basics of map-reading, such as recognising conventional signs and being able to give grid references. Blades and Spencer (1987) go on to suggest that "it would appear from the results of both laboratory based tests and field studies of adults' ability that many individuals use maps inefficiently, and furthermore, that a large proportion of people do not feel confident with navigational maps and often avoid using them at all" (Blades & Spencer, 1987, 69).

This inefficient map use can result in increased travel time and costs (Blades & Spencer, 1987). Lunenfeld (1989) suggested that between six and fifteen percent of all highway mileage is wasted due to improper navigation or poor choice of routes. This extra driving can lead to squandered fuel and time, increased congestion, higher hydrocarbon and carbon monoxide pollution levels and a greater risk of accidents (Lunenfeld, 1989; Kamal, 1990; Peters et al., 1993; Srinivasan et al., 1995).

Current education appears to be getting a failing grade for teaching map skills (Board, 1981; Castner, 1987). It seems, then, that there is a need for different or better education in order to produce people literate in the language of maps. People should be educated in how to properly and effectively use maps.

1.2 - RESEARCH OBJECTIVES AND METHODOLOGY

This research is concerned with exploring ways to improve the instruction and education that is intended to foster cartographic competence and map literacy. *Map literacy* can be defined as the ability to effectively construct meaning from the symbols

found on a map, as well as understanding how to use map symbols to create meaning (adapted from Hudelson, 1994). *Map education* will be used to refer to this type of education, concerned with teaching map comprehension, and not the specific details associated with map production. In examining map education, a major goal is to propose general educational guidelines for teaching students how to effectively read and use maps. A second goal, due to the proposed similarities between cartography and languages, is to look specifically at language instruction research to determine what it can offer to map comprehension instruction. The following questions summarise these goals:

- How should map comprehension be taught in order to improve map literacy?

- More specifically, in what ways, if any, can the theory and techniques of second language instruction be applied to map education?

In order to carry out these goals, the work for this thesis comprised a review of the research surrounding the broad topics of the cartographic language idea, language education and map education. This was a research-based project, exploring the themes and trends within the research, synthesising this information and proposing new ideas based upon the research that had been done. It provides a review of the relevant literature and serves to contribute a solid background for further related research. This work provides a foundation and major directions for improvement of map literacy.

A comparison of maps and languages was undertaken in order to explore how languages and cartography are alike and in what ways they are different. This was in an attempt to answer the question of whether cartography can be considered similar enough to a language to warrant applying language teaching methods to cartography.

The research concerning language instruction, and particularly second language instruction, was then explored to determine how languages are learned. It also sought to determine the important aspects of language teaching and the dominant methods for instructing a second language.

Instruction for map comprehension over the past thirty years, as reported in the major cartographic and geographic journals, was then reviewed. This was in order to determine how map comprehension has been taught in the past. It also attempted to highlight the most useful portions of this research.

After reviewing the theory and research underlying these three areas, this research moved to provide some direction for map education, based upon a synthesis of the language and cartographic findings. It examined the application of language teaching ideas for teaching about maps and finished with proposed guidelines for teaching map comprehension to children.

1.3 - THESIS ORGANISATION

The body of this thesis is organised into five chapters:

Chapter Two, *Cartography and Language*, explores the links between language and maps. It begins by outlining the idea of the map as a communication system. It then moves to compare maps to languages, and examines the basic units, signs, grammar, and order of the proposed 'cartographic language'. The differences and the similarities between cartography and most languages are discussed. This chapter finishes with a look at the cognitive process of map reading, extending the language analogy and considering

map reading in the context of text reading.

Chapter Three, *A Review of Learning and Teaching Second Languages*, is a review of the state of language education. It looks initially at learning languages, the role of the brain in this process and the inherent uncertainties that underlie this learning. The theories behind first language acquisition theories are reviewed, as are the factors that affect language learning. It then provides detailed accounts of the major second language teaching methods. Based upon these reviews, it concludes with some general guidelines for teaching second languages.

Chapter Four, *A Review of Learning and Teaching Map Comprehension*, reviews the broad range of recent and current approaches to learning about maps. It looks at the important role that maps and cartography play in geographic education, and examines the literature on the issue of why and when cartography should be included in education. It then explores five suggestions which seem prominent in the development of map education.

Chapter Five, *Applying Ideas of Second Language Instruction to Teaching Map Comprehension*, looks at the differences that exist between teaching languages and teaching map comprehension. It examines the useful and appropriate aspects of the language literature in order to apply several ideas to map education. It proposes three interconnected components that should be included while teaching the cartographic language, and gives specific ways that language methods can be adapted to map education.

Chapter Six, *Guidelines for Teaching Map Comprehension and General Conclusions*,

suggests basic guidelines for map education. This includes five separate levels of education, each with specific learning goals and proposed activities to help achieve these goals. This chapter concludes with a look at the benefits and limitations to the proposed guidelines, as well as future directions for related research.

CHAPTER TWO

CARTOGRAPHY AND LANGUAGE

2.1 - INTRODUCTION

People have been creating maps for at least eight thousand years (Blaut, 1987). It has been within the last half century, however, that cartography has come to be thought of as a communication process. During this time, cartography has also been compared to a language. In the last forty years, there has been extensive research on both cartographic communication and the comparison between cartography and language. This chapter provides a review of this literature. It begins with looking at the map as a communication system. It establishes the idea that maps are able to communicate information. This is followed by a discussion of the 'cartographic language' concept and a description of the parallels between languages and cartography. Objections and limitations to the idea of the cartographic language are also considered in this section. The final section, using the cartographic language analogy, outlines the cognitive process of map reading, using text reading as a framework.

2.2 - THE MAP AS A COMMUNICATION SYSTEM

Dacey (1970) recounts how Ackermann, in 1957, proposed that humans are able to utilise four methods of communication: music, words, numbers and graphics. Although this could now be expanded to include other forms of communication, such as body language or telepathy, various graphical representations remain a prevalent communication

method. Ackermann, as a geographer, felt that maps were a most important form of graphical communication. Since that time, the idea of cartography, and specifically maps, as a significant communication technique has gained wide acceptance. For instance, Board (1973) described maps as two-dimensional visual devices specially designed to communicate geographical concepts. Meine (1977, 73) explained that we can "regard cartography as visual communication of a special kind which ... is superior to all other means of communication as far as certain messages are concerned." In essence, a good map should be able to effectively transmit information and to enhance the map user's understanding of reality (Guelke, 1976).

Cartography has been fitted to the information theory or communication processing model that was originally proposed for the transmission of information in electricity and electronics (Dent, 1972). The cartographic communication system involves the encoding, by the map maker, of real world information into symbols, and the subsequent decoding of these symbols, by the map user, into relevant and useful information (Robinson & Petchenik, 1975). As Wood (1972, 123) further explains, "cartographic communication describes the process whereby information is selected, symbolised on a map, and subsequently perceived, recognised and interpreted." The simplified process of cartographic communication, outlined in Figure 2.1, can be described as follows (adapted from Kolácný, 1969; Wood, 1972):

1. The cartographer observes reality with an intention and purpose. From this, a selective observation of reality can be made;

2. An intellectual transformation of the selected information from the cartographer's model of reality into cartographic information occurs;

3. The cartographic information is objectified and expressed as map symbols;

4. When using the map, the map user gains the facts contained within the map and these transform the map user's opinion about reality;

5. The cartographic information affects the map user's model of reality, and enriches their knowledge.

Cartography has what Dent (1972) describes as the required components of any human communication: communicator [cartographer], interpreter [map user], communication content [signs and symbols] and communication situation [using the map].

Figure 2.1: The Process of Cartographic Communication.
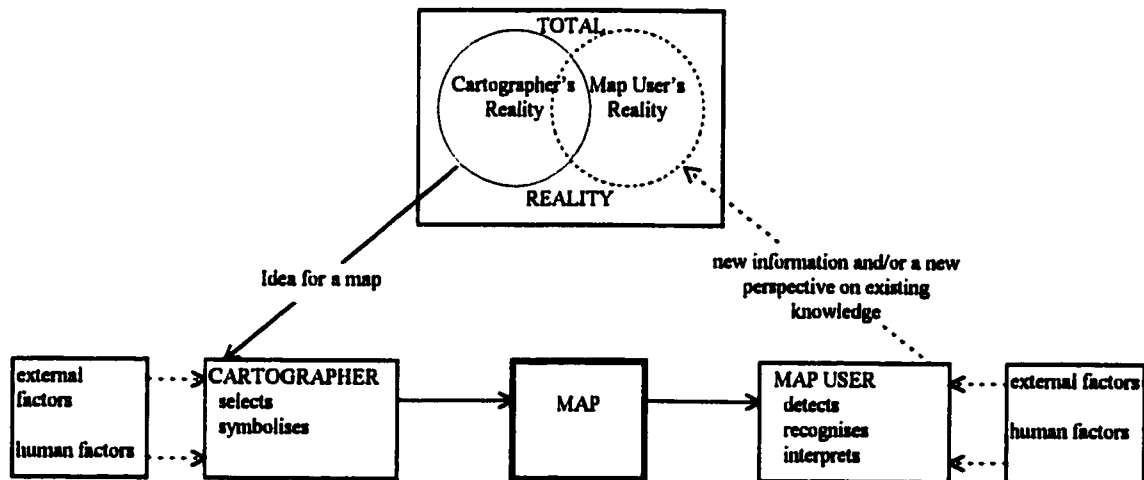
Source: Wood (1972, 124).

Alan MacEachren, in his book *How Maps Work* (1995), has opposed the idea of maps as a communication vehicle. He feels that maps are not always designed or geared towards communicating a specific message. As such, he suggests describing and exploring maps in the broader context of "representations of phenomena in space that a user may draw upon as a source of information or an aid to decision making and

behaviour in space" (12). He does not deny that maps can serve a communication purpose but feels that the communication model, by looking specifically at the message of a given map, can be limiting. He does, however, state that there is no single approach to how maps work and that his "view of cartography does not discount the importance of communication-oriented research" (1). As this thesis is exploring the links between language and cartography, looking at cartography as a communication vehicle remains useful. Maps, even as 'representations', do communicate information to the map reader whether it is a specific intended message or not. We need to consider cartographic communication in a broad context, and realise that the map acts as an extensive information source for the map user.

2.3 - A DISCUSSION OF THE CARTOGRAPHIC LANGUAGE

Language is the basis for communication (Brown, 1987; Stevenson, 1993). Because communication and language are closely linked and maps can act as communication vehicles, the similarities between cartography and natural languages have been explored and discussed by many different authors (see for instance Dacey, 1970; Board, 1973; Ratajski, 1975; Pravda, 1978; Head, 1984; Eastman, 1985; Lyutty, 1986a and b; Blaut, 1987; Eastman, 1987; Andrews, 1990). Pravda (1978) explains that the *cartographic language* can actually be more effective than a natural language for expressing cartographic concepts. He explains that both real objects on the earth and abstract ideas can be better processed and analysed when presented cartographically. Head (1984, 19) feels that recognising cartography as a language, "with a prime function of

communication", could help us improve the design of maps, as well as how we teach people to use them. Certainly, maps and languages have several common features. For example, Blaut (1987) feels that cartography emerges from the same root process as natural languages, and uses signs (as most languages do) to communicate. There are some differences, however, and Andrews (1990, 1), recommends treating "the map-language parallel not as a hypothesis but merely as a simile or metaphor." A further examination of the 'map language' and its constituents will help to clarify whether it is language and how this can be utilised for map education.

This section is a discussion of similarities and differences between cartography and specific elements of language. Cartography can be described as having several of the common elements of a language - a developed sign system, a code by which this sign system is generally understood and a system of rules or grammar. There has, however, still been some reluctance to consider cartography as a language. Several authors (Robinson & Petchenik, 1975, 1976; Keates, 1982, 1996; MacEachren, 1995) have discussed and criticised aspects of the cartographic language. The two major problems discussed were a lack of visual ordering, and an uncertainty of the basic units. Other language aspects that will be explored are the lack of a unique spoken form in cartography, and culture in language and cartography.

2.3.1 - The Signs of the Cartographic Language

As Keates (1996, 67) states, "all human communication, in its widest sense, involves the use of signs. Language, mathematics, art, music - all employ signs either to express feeling or emotion, or to communicate information." The signs and symbols of a language

can be combined into larger structures such as words and sentences (Goodman, 1986). Together, these signs are used to represent things, feelings or ideas. The cartographic language is created from a specialised set of cartographic symbols or signs.

Cartographic signs are able to portray information that relates to places in globe space (Schlichtmann, 1989). These signs are generally composed of point, line and area symbols. Most map information is represented as some combination of these symbols, although alphanumeric signs, words and standard elements, such as scales and north arrows, are also used in many cases (Gerber, 1981). Ratajski (1975) further differentiates the basic point, line and area symbols by the shape, direction, pattern, value and colour of the symbol. He describes the resulting fifteen classes as the 'cartographic alphabet'. Ratajski carefully points out that these signs are simply graphic expressions until they are placed on the map. Once on the map, they are situated in a system of spatial reference and they become cartographic signs. These signs are the physical representation of the cartographer's reality. They convey locational information, as well as additional substantive information (Schlichtmann, 1985). They have meaning, and are meant to impart that meaning to the map user.

Cartographic signs can be utilised to represent existing physical objects (for example, a church), as well as mental or abstract objects (for example, the religious backgrounds of people living in an area, or the imaginary line dividing two provinces) (Pravda, 1978). The physical landscape, as well as additional information about that landscape, can be presented simultaneously on one page using cartographic signs. When arranged together, these signs can create phrases or expressions (Dacey, 1970), and are able to represent a

range of diverse topics and geographical concepts such as the location and size of cities in a country, the climates of various regions, the varying depths of the ocean, the bus routes of a city, or the changing ethnic population of a community.

While some writers on the cartographic language are vague about the distinction between map marks and what they mean, most recent cartographic theorists make a clear distinction between the two, largely guided by Schlichtmann. He (1979) explains that each cartographic sign is made up of two parts: a graphic expression (the sign-vehicle); and a content or meaning. These are coupled by a code, or rules for the coding and decoding of the information (Schlichtmann, 1979). Ratajski (1975, 1), stresses that "the signs of this language must be clear, i.e. they must be understood in the same way by the sender and by the receiver." Both the cartographer and the map reader or user must have a common understanding of the code, or what the signs represent. To ensure this common understanding can be challenging, as most map readers and cartographers do not directly interact with one another.

The map provides several ways, or clues, to assist a map reader in understanding the signs contained within it. The map title should give a good general description of what is being pictured on the map. A map legend is also intended to help with this purpose. The legend, a key to identification, helps users understand the symbol meaning specific to the map that they are reading. A legend can be compared to a glossary of new terms in a language textbook. The important and unfamiliar symbols or words are explained for reference. It should be noted that not all maps include a legend. As well, certain conventional signs tend to be excluded from map legends (Wood and Fels, 1986), just as

common words are generally absent from language glossaries. Legends can, however, aid map readers in identifying the signs that are on the map.

The placement or location of map signs is also significant. According to Pravda (1978, 2), "cartographic signs have a logical spatial location." The mark on the map conveys the actual location of that object (on a globe surface) to the reader (Schlichtmann, 1985). By being aware of the context of a map sign, or its neighbouring signs, a map reader can begin to piece together a mental image of the area portrayed by the map.

Lastly, the more experience people have with maps, and the specific area being represented on the map, the better able they are to understand the meaning of the sign. This can be likened to reading text written by Shakespeare. As we gain familiarity with an older form of language, such as that used by Shakespeare, the words or phrases slowly become recognisable, and we no longer need to look up their meaning in dictionaries. Comprehension of a map sign's meaning is affected by the map user's experience and previous learning (Keates, 1996). With map reading experience and practice, coupled with use of the clues presented by the map, a map user can gain a thorough understanding of the code for map signs. Thus, we can say that maps have a well-developed system of signs which convey meaning to the user.

2.3.2 - The basic units of cartography

One major problem found with the language analogy is that maps do not use standardised units (Robinson & Petchenik, 1976). As an example, on one map a black dot may be used to show a town of five thousand people, while on another map the same black dot may represent the location of a train station. Robinson and Petchenik consider

this lack of a fixed, consistent alphabet of conventionally understood meaning for maps confusing. Head (1984) suggests that in any language, including maps, the specific meaning of a symbol is often taken from its context. For example, the letters 'sh' have different sounds in the two words 'bishop' and 'mishap'. The word 'read' also has two different meanings, and pronunciations, in the following phrases: "That book was read to the class yesterday", and "The fortune teller will now read your mind". The words lead, wind and wound can similarly be pronounced differently depending upon their context (examples from Smith, 1978). For any language, different users can also establish different meanings or connotations for various words and symbols. For instance, the word 'bad' has been used to mean good, and words such as 'pornography' can hold very diverse meanings for different users. It is only when the context of the letters and words is considered that the true meaning can be determined. Similarly, the problem of the duality of the black dot fades when the context of the map signs are taken into account. The legend, title and surrounding signs can all be used, as mentioned earlier, to glean the meaning of the cartographic sign.

Natural languages have a well established hierarchical form. This form, as well as the corresponding hierarchy proposed for the cartographic language, is outlined in Table 2.1. In the written English language, distinctive features combine to produce the letters of the alphabet. The alphabet is considered to be the basic signs, or graphemes, of the language. These, in turn, combine to create morphemes, then words and finally syntagmes and text. There is some debate as to what the basic or standard signs are in cartography, which has shed some doubt on the language analogy. Bertin's small units - the seven basic graphic

variables of location, size, value, texture, hue, orientation, and shape - have been widely accepted in the cartographic community as key units of graphic communication. Some people have incorporated these into what they term a cartographic alphabet (Ratajski, 1975; Pravda, 1978). Wood (1968) believes that points, lines, areas and names are the basic alphabet of the graphic language. Ratajski (1975), as previously mentioned, feels that the cartographic alphabet is the fifteen graphic variables created when points, lines and areas are differentiated by their shape, size, direction, value and colour.

Head (1984) compares the form of the cartographic language to that of a natural language. He proposed that the graphic variables are comparable to the distinctive features of a natural language. One difference is that he states there is no cartographic equivalence to graphemes. This, he feels, does not nullify the language analogy. He explains that the grapheme level is also missing from other languages such as Chinese. In Chinese, like cartography, readers are simply required to understand more individual or basic symbols, as opposed to the 26 letters of the English alphabet.

Table 2.1: The Hierarchical Components of a Language

Size of features	NATURAL LANGUAGE	DEFINITION	CARTOGRAPHIC LANGUAGE EQUIVALENT	
			HEAD	EASTMAN
SMALL	Distinctive features -lines, angles, dots	*Minimal elements which are combined to create units of language*	Graphic variables - size, value, saturation, texture, hue, orientation, shape	--
	Phonemes/ graphemes - the letters of the alphabet	*Small basic units of language, not carrying meaning, constructed from distinctive features Graphemes - written Phonemes - spoken*	--	Graphic variables - size, value, saturation, texture, hue, orientation, shape
	Morphemes - for example, 'dis', 'un' or 'ism'	*Smallest identifiable grammatical units of language that carry meaning, combinations of phonemes*	Map symbols	Graphic signs -created by linking a meaning or content to a graphic variable
	Words - for example, 'unhappy'	*Combinations of morphemes*	Combination of map symbols to represent geographic features	Graphic symbols - compound graphic signs
LARGE	Syntagmes and text - sentences	*Constructed from words*	More elaborate combinations of map symbols create geographic landscapes	Graphic syntax - established when form and content are linked to produce graphic signs Structure - arises due to the relationships between the map symbols

Source: Adapted from Head (1984, 1998); Eastman (1987).

Eastman, in his article *Graphic Syntax and expert systems for map design* (1987), proposes that the graphic variables are the cartographic equivalent of *phonemes*. Although they are not discrete, he feels that they are analogous to phonemes, as they are "the material from which graphic signs are created." (90). He also distinguishes between

graphic signs, which he feels are equivalent to morphemes, and *graphic symbols*, equivalent to words. Graphic signs are created by linking a meaning or content to a graphic form. For instance, when a legend shows that blue represents water, the blue portions of the map become a graphic sign. They have a graphic form (blue) and a content (water). Graphic signs are typically the features represented in a legend. They represent the attributes of a feature rather than the feature itself. Graphic symbols are "compound graphic signs" (Eastman, 1987, 90) which represent distinct geographic phenomena. They generally contain a meaningful position as well as some non-locational attribute. Graphic symbols represent geographic "features which are localised in space and which possess certain attributes." (91). For instance, Lake Ontario on a map would be a graphic symbol. Eastman goes on to explain the graphic syntax and the graphic structure. The graphic syntax is "concerned with the surface structure of map representations - the complex of visual relationships between the various elements on the map." The graphic structure arises through the relationship between the map symbols.

Schlichtmann (1994, as explained in Head, 1998) proposes an alternative naming system, deeming the *topeme* as the smallest complete unit on a map. The topeme, like any map sign, is composed of a content and an expression. The content consists of the concept of the object. The expression of the topeme contains a locator which conveys the object's location. Signs higher in the language hierarchy are termed *focus units*. These are more content-based, and are usually a complex of topemes.

Although there is no universal cartographic alphabet (Meine, 1977), cartography does have a unique system of symbols which is very similar to those used in any language. In

the cartographic language, we can identify a hierarchy, or "units, relations among these units, and construction patterns according to which units are combined to units of higher order"(Schlichtmann, 1989, 4). The map language uses its signs in a uniquely spatial way to impart meaning. In general, the map reader must consider the points, lines and area symbols that are used on maps in context with one another, using both their attribute content and their location, to accurately understand the message that they communicate.

2.3.3 - Map Grammar

Goodman (1986, 13) explains that "grammar is the system of language. It includes the limited number of rules necessary to produce an almost infinite number of utterances that will be understood by speakers of a specific language." To become an efficient communication process, the combination of language signs into expressions, words or sentences must follow the grammatical rules of the given language (Ratajski, 1975). This grammar needs to be known by both the sender and receiver of the message. Gerber (1981, 104) outlines how Chomsky defined language competence as "the understanding of the grammar of the language which provides the base for creative linguistic behaviour." Since then, the definition of competence has been widened. However, a knowledge of the rules of the language, or the grammar, still plays an important part. In cartographic research, there has been a lesser focus on the grammar of the map language than on other aspects of map using and making (Castner, 1983).

Schlichtmann (1985) feels that there is a set of rules for forming and transforming cartographic expressions. Map signs, like other language signs, can be combined in various ways. He uses the term *local syntax* to refer to the internal structure of the

localised sign. He describes the integration and arrangement of map signs into map texts as what he terms the *supralocal syntax*. This arrangement is governed by the spatial relationships of what is being mapped. Youngmann (1978, as cited by Head, 1998) proposed that the map grammar is comprised of two parts: an information portion plus a reference portion. The information portion includes the signs, legends and titles which represent the geographic phenomenon. The reference portion is the geographic base and the mathematical grid upon which the map is fixed. Various rules do govern the combination of 'objects' or basic units on maps. For instance, the preferred location of a place name is to the right and slightly above the symbol representing that place (Belbin, 1996). Countless other cartographic conventions and rules exist. As such, there seems to be a general acceptance that there is some form of grammar for the map language. As Blaut (1987, 29) states, "ordinary maps have a definite set of ordering rules which are syntactical and bear close resemblance to the syntax of written language". The rules of this map grammar, however, are still inadequately understood and documented. As Keller and Wood (1996, 279) explain, the "rules of the cartographic language do not form absolute law and ... some of the rules are still poorly understood. Indeed, it would appear that questioning, re-examination and unintentional or deliberate violation of established rules is part of what keeps the cartographic language dynamic." For the purposes of comparing cartography to a language, there is sufficient support for the existence of a grammar system acting for the map language.

2.3.4 - Visual ordering

A second major fault that has been found with the cartographic language theory is the

lack of visual order in cartography (Robinson & Petchenik, 1976). Written languages are generally processed sequentially. Wood explains (1968, 58) that "unlike writing and speech, which are sequential, a whole map is visible at once and there is no obvious order in its reading." The ordering of map symbols is multi-directional (Dacey, 1970). Studies examining the patterns of eye movement found those for reading a text tend to be strictly linear, while those for reading cartographic texts are highly varied, and unpredictable (Robinson & Petchenik, 1975). Robinson and Petchenik (1976) feel that maps are a continuous graphic image and that it is impossible to recognise or isolate the smallest independent symbols. They feel that the observation of variable eye movement patterns lend support to their idea that a map is taken in as a whole, rather than in small units or pieces. Head (1984) explains that because of the limited nature of our foveal vision, we are only capable of processing the whole picture of the map in small pieces. It seems, then, that we must successively piece together the message of the map from smaller 'units'.

Robinson and Petchenik go on to say that a lack of pre-determined reading sequence leaves maps with "no 'word' order comparable to that considered under the linguistic concept of 'syntax'" (MacEachren, 1995, 236). The order or structure of the map language has been described as non-linear, and simultaneous on the entire map (Ratajski, 1975; Robinson & Petchenik, 1975). However, as mentioned previously, the location of cartographic signs is logical, and relates directly to the arrangement of their referents in reality. According to Eastman (1985; 1987), the location of map signs can actually give order to the map and help to establish a map syntax. He says (1985, 99) that "the order of

reading is unimportant here since order does not form the basis for syntactical relationships. Syntax is embedded within the symbols themselves". The order for reading map symbols is seen as less important than the message that the symbols portray. As MacEachren (1995, 236) explains, "while most maps do not have a syntax in the narrow sense of structured reading order, they do have a carefully structured syntactics in terms of the interrelationships among signs they are composed of." It should be noted that while word order is mentioned as an important aspect of language, it is actually not always important for determining the meaning of a language. For instance, the two phrases 'Jane ate dinner after the meeting' and 'After the meeting, Jane ate dinner' have exactly the same meaning despite having different word orders. Also, for some languages, such as Latin, the case and not the word order determines the meaning of the sentence (Skidmore, 1999).

Although the arrangement of map symbols is not necessarily linear, and maps are not read in the same linear fashion as most text, they do have their own inherent order and are capable of communicating additional spatial information within two-dimensional space. The 'order' of language cannot be used to eliminate cartography from the language category.

2.3.5 - A spoken form

One other aspect of the cartographic language debate which has rarely been addressed is the fact that cartography has no unique spoken form. It is a visual language. Some linguists would feel that this itself would exclude cartography from being considered a language. For instance, Theodore Huebener (1965, in Woodsworth, 1973, 76) states that

"the basis of all language is sound" and that "words are merely combinations of sounds and the printed page is a graphic representation of sound sequences." In general, linguists have tended to be more concerned with the spoken form of languages (Woodsworth, 1973). This is likely due to the longer history and greater predominance of spoken languages in the world. For example, Hammerly (1982) estimated that out of three thousand world wide languages, only a few hundred are normally written down.

Goodman (1986) provides support for the idea that languages do not have to be verbal. He uses the example of sign language, which is a well-developed non-verbal language. He also speaks of Morse code, Braille and semaphore flags, which are non-verbal systems that have been developed to represent language. Other written languages, such as Chinese, also use their written words as symbols for ideas but not for specific sounds or words (Smith, 1978). Each of these language systems has been developed for specific reasons and are more effective than verbal communication. Cartography can fit in to this category of representative languages. Its specific function is to communicate spatial information and it is capable of doing this more effectively than any other language.

Cartography, although it is not a verbal language, has recently experimented with the use of sound in computer mapping. Differences in sound location, loudness, pitch, register, timbre, duration or order can be used as variables for certain types of animated of dynamic maps (MacEachren, 1995). Perhaps further work and experimentation with cartographic sound will find further parallels between verbal language and cartography.

2.3.6- Culture

Being familiar with the cultural aspects of a language are an important part of gaining

competence in that language. As such, it is worth discussing whether cartography has a parallel concept. As Hammerly (1982, 43) explains, "culture and language are inseparably intertwined... Knowledge of a language must entail, to be functionally adequate, knowledge of the cultural connotations of words, the gestures, and the appropriate verbal and non-verbal behaviour for the various situations in which the language is used in the second culture." Certain words have cultural connotations, as do certain body movements that accompany speech. For instance, eye contact, considered polite and important in North America, is considered rude in Japan. Also, head nodding, an obvious 'yes' for many cultures, means 'no' in Greek and in some Inuit languages (Hammerly, 1982). Understanding the cultural implications of a language can be an important aspect of that language (McKeon, 1994; Hammerly, 1982).

On the surface, it may seem that cartography does not have this same notion of culture associated with it. There may not be a uniquely cartographic culture. However, Wood and Fels (1986) describe maps as cultural artefacts. They explain that the creation of a map is the result of an accumulation of choices which reflect cultural values and slants. There are many aspects of the map and its maker that give us additional information about that map. For instance, it is important while examining maps to learn who made the map, their values, why they made it and under which conditions it was made. It is also important to note that maps are made differently for different purposes and users, such as the differences between military-purpose topographic maps versus a tourist hiking route map. An awareness of cartographic standards is important, as is a knowledge of the place being mapped, and the values of the people in that place. This additional map knowledge

can be considered valuable in the same way that cultural knowledge of a language is.

A *natural language* has been defined as "a language which is, or once was, somebody's mother tongue and which possesses all of the universal properties of human language" (Trask, 1999, 200-201). As it is unlikely that cartography could ever be a person's mother tongue, cartography should not technically be termed a natural language. There are other definitions, such as Huebener's (described on page 24), or those which specify spoken aspects, which would also exclude cartography from the language category. Although the idea of the cartographic language has met with some resistance, this section has shown that cartography can be described as possessing the major components of a language. Cartography, as a representative language system, works as a language to impart spatial information to the map reader. As such, we can define the *cartographic language*, simply as a systematic means for communicating meaning or ideas through use of the set of cartographic symbols which have understood meanings (adapted from Brown, 1987). With this definition, we can move to further explore the theories behind the reading and teaching of languages in order to apply them to cartography.

2.4 - THE COGNITIVE PROCESS OF MAP READING

Reading, of both maps and written texts, is a complex perceptual and cognitive process. There has been an extensive amount of research done on how people read and comprehend written text, although this still remains incompletely understood (MacEachren, 1995). This research has spanned the disciplines of cognitive psychology,

communication studies, semiotics and linguistics. Map reading, considered in its language terms, can be examined in much the same way as the reading of written texts. It involves visual processing, identification, recognition, and interpretation as the information presented on the map is processed and stored in the map reader's memory. Dobson (1977, 40) explains that "the activity that hopefully occurs during map reading is a cognitive continuum composed of sensation, perception, memory and thought." By exploring the cognitive process of map reading, we can gain insight into how people understand maps. This can be useful when we move to consider improving map literacy.

2.4.1 - Visual processing

According to Wood (1968), the act of seeing has three stages:

1. Physical: Light reflected from the map is received by the eye.

2. Physiological: The eye nerves react to the stimulus.

3. Psychological: The brain is able to receive and interpret the retinal pattern.

All vision takes place during the *fixation process*, which is the process of sensing information. The light that is reflected from the map gets absorbed by the 125 million receptors lining the retina of the eye (Dobson, 1979; Keates, 1996). There are different types of receptors in our eyes, known as rods and cones. Rods and cones react differently to light, rods responding to changes in intensity, and cones differentiating between colours and fine detail (MacEachren, 1995). The greatest number of these receptors are packed in the centre of our eyes, and as a result the centre of our foveal vision has the clearest vision (Wood, 1972). Due to the limited size of the fovea, the eye can only focus on a very small area at any one time. In general, however, once the receptors are stimulated by light, all

receptors generate an electro-chemical response (Dobson, 1979). This electrical signal from the receptors gets transmitted to individual ganglion cells, and then along optic nerve fibres to the brain. By this reaction, the message of vision is transported from the eye to the brain cells (Dobson, 1979; Keates, 1996). The exact length of time that is needed to focus on an object actually depends on the nature of the graphic image being studied (Wood, 1972).

2.4.2 - Storing ideas in our memory

It is generally accepted that there are three basic types of memory: a pre-perceptual store, short term memory, and long term memory (Wood, 1972; Head, 1984). The pre-perceptual store, also known as the brief visual, iconic or sensory memory, holds all characteristics of the stimulus that are being processed by the eye, although it is limited by a very short (somewhere between 200 milliseconds and two seconds) retention time (Dobson, 1979; Head, 1984; Keates, 1996; Wade & Travis, 1998). Items in the pre-perceptual store are analysed for recognisable features, such as lines, angles, and dots, to match items in the long term memory (Head, 1984). The recognition that takes place is a complex process (Neisser, 1967) and is not yet fully understood. Once recognised, the features can then be combined into new categorised items, such as letters in the case of reading texts, or contour lines in the case of map reading.

The new items are then transferred to the short term memory, also known as the working memory (Anderson & Bower, 1973; Head, 1984; Wade & Travis, 1998). According to Dobson (1979, 16), the short term memory "retains the information until it can be evaluated and used to generate a response." It is seen as a storage place, as well as

a working area. Short term memory is in constant use during a visual search (Wood, 1972). The short term memory is known to have a limited capacity which has been well established as only 7 ± 2 items (Miller, 1956, as stated in Head, 1984; Eastman, 1985). This limitation is due to the rate at which our brains are able to process information (Smith, 1978). Material in the short term memory is easily displaced as new things are sensed unless we consciously do something to keep it there (Wade & Travis, 1998).

People are capable of re-coding items in the short term memory into larger items, known as *chunks* (Wood, 1972; Eastman, 1985). These chunks are defined as "meaningful structures, stored in long-term memory which can subsequently be referred to or stored by a single label in the short-term memory"(Chase and Simon, 1973, 250, as quoted in Eastman, 1985). The ability to chunk pieces of information enables people to retain and remember more information, as they can store seven chunks in their short term memory as easily as they could store seven individual items.

The long term memory is a network or structure of knowledge (Smith, 1978). Transferring items from our short term memory to our long term memory requires manipulation and concentration (Head, 1984). Rules concerning spelling, grammar, meaning and context from the long term memory are used to build larger items, such as words and syllables from letters or a slope from a grouping of contour lines (Head, 1984). The meanings of these larger concepts can then be stored in the long term memory. Although the capacity of the long term memory may be unlimited, retrieval of items can be difficult (Smith, 1978; Head, 1984). The information in the long term memory must be organised and indexed (Wade & Travis, 1998), and as Smith (1978, 44) says "it is only

through organisation that information can become established in the long term memory, and it is only through organisation that it can be retrieved again."

A model of the human memory systems is depicted in Figure 2.2. Wade and Travis (1998) conclude that this three-box model of memory, despite not explaining all the research findings on memory, is still the dominant model used after thirty years of work.

Figure 2.2: A Model of Human Memory
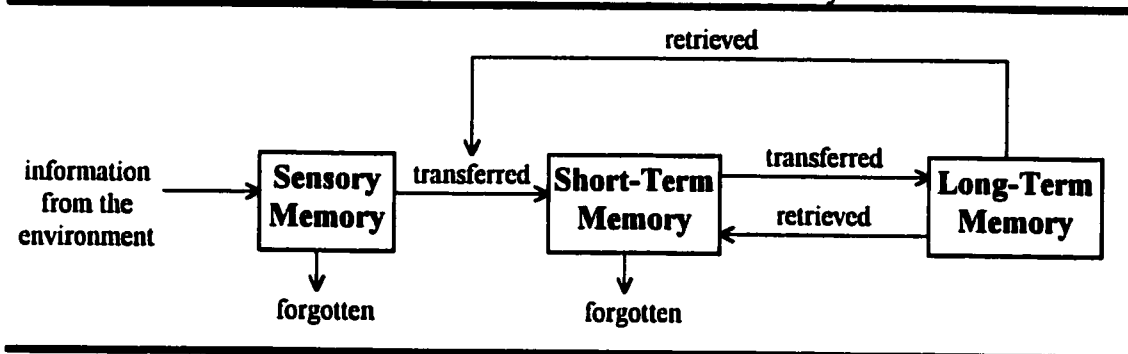
Source: Wade and Travis (1998, 350).

There have been several important proposed ideas for how sentences, or series of words, are actually encoded into our long term memories. The first major idea is that sentences are stored as a set of propositions which encode the linguistic meaning of the sentence. Anderson and Bower (1973) were supporters of this view. They felt that propositions, containing the context and fact of an idea, were stored in a tree-like structure in our long term memories. The model of a proposition is depicted in Figure 2.3. As Lloyd (1982, 540) explains, "propositions are statements or assertions about the nature of the world, e.g., the tree is green; or Texas is large." The second major idea is that only the underlying meaning of the sentence is stored, as opposed to the propositions within it (Stevenson, 1993). For this view, people need to supplement the language information

with inferences from their minds for understanding. Some combination of these two concepts is felt to be closer to the truth, although it is still uncertain exactly how the brain stores information (Wade & Travis, 1998).

Figure 2.3: The Model of the Proposition

Proposition

fact   context

subject   predicate   time   place
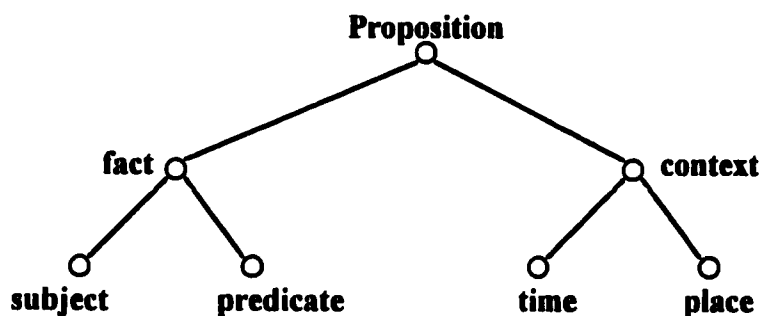
Source: Head (1984, 18).

In her book, *Language, Thought and Representation*, Stevenson (1993) explains her preferred explanation for the comprehension of the meaning of sentences. She feels that when we read or hear sentences, we form *mental models* whenever possible, and generally forget the exact wording or patterning of the sentence. A mental model is an internal model of the situation described by the sentence. In thinking, we perform operations on these models. Johnson-Laird (1983, in Stevenson, 1993) suggests that a propositional representation of the sentence is first necessary for the construction of a mental model. The propositional representation encodes the meaning of the text, while the mental model encodes the state of affairs described by the text. Stevenson suggests that the ability to create mental models will vary with the specific task, the text (or map), and the reader's expertise.

Phillips (1989) proposes that the graphical forms of maps themselves help us to

remember map information. He believes that "when the information is spread out in front of us on a map or in a diagram, there is no longer any need to store the raw information inside our heads... The graphical image itself becomes a kind of memory store for as long as our eyes continue to look at it"(1989, 25). Pictures can actually assist people in the creation of mental models in their minds, as the structure of the picture is often the same as the structure of the mental model (Glenberg & Langston, 1992).

In order to be able to perform these operations, however, map readers must use the structures or *schemata* (also referred to as frames or scripts [MacEachren, 1995]) that exist in their mind (Head, 1991). The idea of the schemata comes from psychologist Ulric Neisser. He feels that the schemata are "plans for finding out about objects and events, for obtaining more information to fill in the format"(Neisser, 1976 in Head, 1984). The schemata that we hold in our long term memories gives us a strategy for searching a picture or text. What we see is at least partially governed by what we are looking for, and the rules that we have learned (Head, 1984). This is true for reading texts, as well as for map reading. The level of experience that one has will affect their retrieval processes (Kulhavy, Pridemore & Stock, 1992). O'Malley and Chamot (1990, 64) report on research which suggests that "retrieval processes among individuals who are more proficient in a language are based on meaning, whereas individuals at the beginning level of proficiency process language based on sound similarities among words." This suggests that greater experience in a language will permit more efficient memory retrieval. Children, or less experienced map readers, will likely have map schemata that are quite different from adults. These schemata will change as children gain experience and become

more familiar with the concepts of space, scale and representation (MacEachren, 1995). Greater experience will permit map readers to better visualise the geographic landscapes and concepts being portrayed by the map. Thus, the case for early and frequent education in map reading is made stronger.

2.4.3 - Map reading

Visually identifying the map signs is the first stage in map reading, as it is for reading texts. However, there is more to map reading than just physically seeing the marks on the map. As Keates (1996, 53) explains, "Presumably a person can 'read' a completely unknown language by correctly identifying the letters which form the words, but this is hardly what most people would regard as 'reading'." There is an important difference between the identification and the comprehension of cartographic signs. Gerber (1981) terms the identification of the sign, based on its distinctive features, the *primary recognition* stage. *Secondary recognition* involves comprehending what is meant by the sign. Gerber (1981, 106) provides the following example: If an individual were to observe a river on a map, primary recognition would be recognising that it is a river. Secondary recognition would involve connecting the characteristics of rivers that are held in our long term memory (such as a winding, narrow body of water with a source and a mouth) to that particular river. Keates (1996) also distinguishes between identifying map symbols and gaining a deeper understanding. He describes detection, discrimination and identification as the initial steps of map reading. Once identified, the meaning of the map symbols can be understood. After that, further interpretation and inferring is possible. It is at this stage that true map 'reading' can actually occur. The process of map reading

involves not only detecting or seeing the map symbols that are present, but also understanding what is meant by those signs. The message of the map needs to be transferred to a person's memory. Understanding the process whereby people understand and remember the information on a map is useful to keep in mind as we move to consider map instruction.

2.5 - SUMMARY

Cartography has been shown to possess basic linguistic concepts, such as sign, expression, grammar and syntax (Dacey, 1970), although the form of some features, such as the 'alphabet' and grammar, are not yet completely agreed upon for all map users and creators. Map reading can also be described as using similar cognitive processes as does text reading. There are many parallels between cartography and language, and a definition of the cartographic language has been provided. It is valid and useful to treat cartography like a language when examining it. As Blaut (1987, 30) explains:

> "I cannot think of any other form of sign-behaviour and sign-system in human culture which comes as close to the generality of natural language - and the universality, and the primitivity, and the historicity - as does geographic mapping. In other words, if on the one hand one says that mapping is a limited-purpose linguistic system, much more restricted than natural language, on the other hand one has to point out that every *other* language-like system that culture has created is vastly *less* like the natural language than is mapping."

In examining how to teach map comprehension, it is useful to explore how other languages are typically taught, as well as how maps have been taught in the past. These topics are the focus of the next two chapters. The methods for teaching languages could prove very useful for exploring and improving map education.

CHAPTER THREE

LEARNING AND TEACHING SECOND LANGUAGES

3.1 - INTRODUCTION

Language, which guides our interaction and communication with others, is a central human activity (Stevenson, 1993). This chapter provides a deeper look at languages, particularly second languages, and how they are thought about, acquired and taught. It is quite obvious that human beings, even those of a young age, have a unique ability to learn languages. The questions of how we learn them, and how to make this learning easier, are still being explored. There are five major fields that overlap, and have important bearings on language teaching: the history of language teaching; linguistics; socio-linguistics; psycho-linguistics; and educational theory (Stern, 1992). Each of these topics has a wide and extensive research base. This chapter can by no means be completely exhaustive, but will attempt to provide a summary of language research and effective second language teaching. It begins with a look at language and learning, their meanings, and some of the common terms and definitions that accompany language learning research. It then looks at what is involved in learning first languages. It also looks into the various factors that affect language learning. Next, it examines second language acquisition and gives a summary of past and current research trends, approaches and methodologies. It finishes with some general guidelines for teaching second languages effectively, and a look to how this may affect teaching map comprehension using second language techniques.

3.2 - LANGUAGE AND LEARNING

In examining languages, one first needs to establish the difference between first or natural languages and second languages. First language acquisition is what occurs as young children gain an awareness of the communication around them and eventually start to communicate on their own - typically in the language of their caregivers. This language is the child's mother tongue, and can be considered to be a natural language. Second language acquisition is defined as learning another language, often within the culture of that language (Brown, 1987). This could occur formally, as in a classroom situation, or more 'naturally', if a person is immersed in the culture of that language. In thinking of cartography as a language, we are most interested in second languages. Cartography is not going to be a person's first language, and so it therefore should not technically be considered a natural language, as already detailed. We should therefore be interested in second language research with regards to cartography.

3.2.1 - Acquisition versus learning

The difference between acquisition and learning can also be explained. Acquisition of a language is something that occurs automatically and subconsciously as people engage in meaningful, genuine and natural communication. Krashen (1978, in Stern, 1981, 140) describes acquisition as "the unconscious absorption of language in real use". Acquirers are generally less concerned with the form of the language, and more concerned with the meaning (Krashen, 1981b; Ellis, 1986; McLaughlin, 1987; Stevick, 1991). Children are thought to acquire their first language. Learning a language, on the other hand, is described as a conscious process that tends to focus more on the form of the language

(Brown, 1987; McLaughlin, 1987). It is learning that often occurs in classrooms (McLaughlin, 1987; Stevick, 1991). The ideal situation for language instruction would be to allow a greater focus on language acquisition rather than language learning.

3.2.2 - Competence, Performance and the Teaching of Languages

There are typically four parts of language: speaking, reading, listening and writing (Woodsworth, 1973; Krashen, 1981b; and Terrell, Egasse and Voge, 1982). Society, and especially schools, have tended to focus on the written word more than the spoken or heard word (Woodsworth, 1973). Performance of a language can be distinguished from the competence in a language (Bialystok & Hakuta, 1994). Competence in a language is, according to Noam Chomsky, akin to the internalisation of the rules of the language, or an underlying knowledge of the language system (in Ellis, 1986; Brown 1987). A person's competence is hard to directly observe or measure (Canale & Swain, 1980; Stevick, 1991), but it contributes to their performance. Performance is the actual comprehension and production of a language (Ellis, 1986; Brown, 1987). Performance can be readily observed, although it can be difficult, time consuming and judgmental to measure a person's listening and speaking performance. This is likely part of the reason schools have tended to focus upon reading and writing. All four portions of language are important, but require different methods and techniques to learn.

3.2.3 - The Role of the Brain in Language Learning

The human brain is made up of two hemispheres: the left and the right. For most people, the two sides of the brain perform different functions (Krashen, 1981b). The right hemisphere tends to be responsible for activities related to emotional and social needs,

such as laughing, crying, touching or looking (Asher, 1981a & b; Brown, 1987). It also

deals with synthesis, spatial relations and music (Asher, 1981a & b; Brown, 1987; Trask,

1999). The left hemisphere is generally responsible for intellectual, logical and analytical

functions, such as talking, discussing and clarifying, as well as dealing with the concepts of

language and time (Asher, 1981a & b; Krashen, 1981b; Brown, 1987).

Language and language learning have been believed to be controlled mainly by the left

hemisphere, although there is some conflicting evidence related to this belief (Brown,

1987). Research has found that damage to the left hemisphere tends to cause language

production difficulties, while right hemisphere damage does not affect a person's language

(Maratsos, 1989; Bialystok & Hakuta, 1994). The brain's right hemisphere seemingly

processes information which it is then able to express outwardly, by touching or pointing,

but it is unable produce spoken words (Asher, 1981a; Stevick, 1991). In most cases, it is

the left hemisphere that is responsible for the production of words (Stevick, 1991). Two

specific areas, known as *Wernicke's* area and *Broca's* area, both in the left hemisphere of

most people, are thought to play a critical role in language use (Trask, 1999). Trask

(1999, 148) provides the following description:

> "During listening, speech signals are passed by the ears to the auditory part of the
> brain, which processes the sounds and sends the results to Wernicke's area for
> interpretation. During speech, Wernicke's area provides the ordinary vocabulary, via
> the *arcuate fasciculus* [a J-shaped bundle of fibres connecting Wernicke's area to
> Broca's area] to Broca's area, which embeds this vocabulary into the required
> grammatical structure and then sends its instructions to the organs of speech."

Although language production is facilitated by the left hemisphere, language *learning*

relies at least partially on both hemispheres. The skills required for reading, writing,

speaking and listening to a language are actually the result of the interaction of many different basic functions, and therefore cannot be assigned to just one hemisphere (Brown, 1987; Weininger & Daniel, 1992).

It is believed that as the brain matures, it develops this cerebral dominance, where each side of the cortex maintains separate and important functions (Krashen, 1981b; Brown, 1987). Before this lateralisation occurs, it is believed that language acquisition is easier, as functions can be fairly easily re-localised (Brown, 1987). Although there are signs that some specialisation is present at birth (Krashen 1981b), it is not certain when the brain loses its plasticity. Krashen (1981b) feels it may be as early as age five, while others such as Brown (1987) maintain that it is a slow process not complete until puberty. This has led people to suggest that there may be a critical period, before the brain becomes lateralised, during which language learning is optimal (Brown, 1987; Wade & Travis, 1998). There are still, however, questions as to how the brain is lateralised, and exactly when this lateralisation takes place. The critical period is something to be aware of, but may not be a completely limiting factor in language learning. Bialystok and Hakuta (1994) actually suggest that this critical period may be due to social and psychological factors as much as the brain.

Traditional educational methods have tended to focus on the left hemisphere (Stevick, 1991). It has been suggested, however, that infants learn to understand their first language through a stimulation of the brain's right hemisphere (Asher, 1981a & b). This poses interesting challenges for language education (and all education), as perhaps there should be a greater emphasis on the right hemisphere of the brain.

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3.2.4 - The Uncertainties inherent in Language Learning Research

For each language learning situation, there are a huge number of factors that influence the success of learning and teaching. The learning or teaching techniques, as well as the students, materials and teachers, that comprise the learning situation will all affect the language output (Blair, 1982a). People also use different strategies, in different situations, to learn different languages. Consider the following situations: the Japanese business-man who has just moved to Canada and is speaking English at work, versus the child who speaks Hungarian at home and English at school, versus the student who is learning Latin at university to fulfil a language requirement. Although language learning can occur in each situation, these are very different circumstances. Some of the specific "learner" factors that affect the success of language learning will be described and further discussed later in this chapter. It is important to realise that there are countless factors to be considered when considering language instruction.

Language and language learning are highly complicated subjects. As Blair (1982b, 12) explains, "Language is incredibly complex, intangible stuff. Its 'substance' is of the brain and the psyche; at the same time language is a social thing shared with a community of users, each differing from the other in linguistic and other ways." Language is not something that can be easily researched and 'discovered'. There are many things that are uncertain or unresolved when it comes to languages and particularly language learning. This needs to be understood as we move to look at first and second language acquisition. Krashen (1981b, 3) also alludes to the uncertainty and complexity of language research: "Syntacticians freely admit that they have only analysed 'fragments' of natural languages,

applied linguists concede that they have mastered only part of the theoretical literature in grammar, language teachers usually do not have the time to fully study the descriptive work of all applied linguists, and even the best language students do not usually master all the rules presented to them." Language research is fraught with uncertainty and there seems to be no perfect way or solution for teaching or learning languages. By examining the research that has been done on languages, it is important to look not for the perfect method, but rather the useful or helpful techniques and guidelines that contribute to successful language learning.

3.3 - FIRST LANGUAGE ACQUISITION

To examine second language learning, many researchers first turn to the acquisition of first languages. As Fillmore (1989, 311) explains, "Any human language can be learned by any normal child quite naturally, which is to say, *without special help from others,*" generally within the first five or six years of their lives. There are several different ideas and theories about just how that acquisition takes place. Brown (1987) divides the first language research into three major approaches: behaviourist approaches, the nativist or mentalist approach, and functional approaches.

3.3.1 - Behaviourist approaches

The term 'behaviourism' was coined in 1913 by John B. Watson, who felt human actions and behaviour should be studied objectively (Brown, 1987). Behavioural scientists, who gained prominence from the 1930s until the 1960s, felt that all human knowledge is based on experience (Bialystok & Hakuta, 1994). This view was adopted by

American linguists, who proposed that language is learned as a person is exposed to language. During this exposure, habits form as responses to particular stimuli are reinforced or rewarded (Ellis, 1986; Brown, 1987). An example of this is when a child repeats something his or her parent has said, and then is rewarded or praised for doing so (Ellis, 1986). Behaviourist learning is seen as a formation of these habits, and is thought to be a reaction to external stimuli, or environmental factors, and not a result of internal, mental factors (Ellis, 1986; Bialystok & Hakuta, 1994). Children were thought to learn the language which they are exposed to and nothing more. A major criticism of this view is that it is virtually impossible to tell what the stimulus is for any given speaker response in language. As well, people are capable of creating new sentences that they have never heard or produced before (Ellis, 1986). These observations suggest that language learning is not dependent only on habit formation. Fillmore (1989) summarised the situation by stating that the input children receive while learning languages does not completely determine their learning of the language. The language input and external environmental stimuli may play an important part in language learning, but they are not the only determinants of language development.

3.3.2 - Nativist or Mentalist approaches

The Mentalist view, also described as the nativist view, gained popularity during the late 1950s and 1960s and was a response to the earlier Behaviourist ideas. It was fuelled by the ideas of Noam Chomsky and Eric Lennenberg (Ellis, 1986; Brown, 1987). Chomsky believed that language acquisition is innate, or that people are born with a unique ability to learn (human) languages (Brown, 1987; Bowerman, 1989). He

proposed that people possess a *Language Acquisition Device* (LAD) which "directs the process of acquisition, and contains information about the possible form that the grammar of any language can take" (Ellis, 1986, 292). The LAD, according to McNeil (1966, in Brown, 1987), consisted of four intrinsic linguistic properties: 1)   the ability to differentiate speech sounds from other environmental sounds;   2)   the ability to organise linguistic events into various classes which can later be refined;   3)   knowledge that only a certain kind of linguistic system is possible;   and 4)   the ability to constantly evaluate that developing linguistic system.

The LAD was believed to contain a *Universal Grammar* (Wade & Travis, 1998). The Universal Grammar was a set of general principles about the form of languages (Ellis, 1986; McLaughlin, 1987). Mentalist thinking saw the child playing an active role in language acquisition, and the role of the linguistic input or external stimuli was reduced. Language input served to activate the LAD, which in turn shaped the process of acquisition (Ellis, 1986). The LAD was thought to contain the *deep structure*, or the intrinsic meaning, of the language, which was in contrast to the *surface structure* that was actually uttered (Woodsworth, 1973; Ellis, 1986; Brown, 1987).

The child's actual process of acquisition was believed to take place through hypothesis testing (Ellis, 1986; Hakuta & Bialystok, 1994). Ellis (1986) outlines the process that occurs: children test, either consciously or subconsciously, a series of hypotheses that they have about the nature and rule system of the language they are learning. They could do this by speech or by comprehension (Brown, 1987). For instance, they could make deliberate errors in the language and then consider the response they are given. They

could also consult a teacher or a native speaker. In some cases, they could analyse the language input that they receive and compare their hypotheses. Over time, children's hypotheses get clarified, revised or abandoned. This leads to modifications in their language, and as this occurs children go through a series of steps as they approach true or authentic language use. Research which examined tape-recorded samples of mother-child speech found there was a pattern to first language learning. It found that the length of children's utterances gradually increased, and that their knowledge of the grammar system was built up in a predictable order (Ellis, 1986; Bialystok & Hakuta, 1994).

The mentalist approach puts forth that children learn languages because they are predisposed to acquire this type of knowledge system. According to this view, the input that children receive plays an insignificant role in language learning. All children, despite their home environment, are able to acquire language. As Fillmore (1989, 312) states, "there is little that parents can do to 'botch' language learning altogether." This approach, stating that language learning must be genetically pre-determined, has been attacked by authors such as Lieberman (1989). Lieberman, who is a cognitive and linguistic scientist, felt that if the LAD or Universal Grammar was genetically predetermined then we should observe some genetic variability in language learning. He states that "in short, genetically transmitted aspects of the morphology of living organisms *always vary* (202)". According to Lieberman (223), "a detailed genetically transmitted Universal Grammar that is identical for every human on the planet is outside the range of biological plausibility." As such, he dismisses the possibility of a LAD or Universal Grammar. No other authors support this extreme view. The research does seem to be

reluctant to state either extreme: that language learning is solely determined by the learner; or that language learning is solely determined by a child's linguistic experience. Fillmore (1989, 312) explains that although "it can be argued that the environment influences language development, the environment does not determine language development." Some combination of these two possibilities, considering both the language input and the child's mental capabilities, seems more likely to be the truth.

3.3.3 - Functional approaches

By the beginning of the 1970s, research into first language acquisition was beginning to turn in another slightly different direction. Researchers, such as J. R. Firth, were viewing language as "interactive and interpersonal" (Brown, 1987, 202), and there was a new emphasis on the *function* of language. According to the functionalists, language was used for communication, and the communicative function of language needed to be explored in new and different ways (Brown, 1987). It was stressed that language learners could learn words, grammar, syntax and structure of a language, but if they did not understand the function of what they were trying to say, it was useless. Brown (1987, 202) explains that "while forms are the manifestation of language, functions are the realisation of those forms."

Bialystok and Hakuta (1994, 39) describe the common metaphor of functionalists as "language as a tool", a tool which is ultimately shaped by its users. They go on to say that "the tools of language are shaped for whatever is required for each new cognitive or social purpose" (41). The importance of both the human mind and the context of the communication were considered. Language learning was seen as understanding how to

use linguistic forms to achieve the necessary functions of language (Brown 1987). Bowerman (1989, 134) maintains that:

"A critical foundation for language learning is laid during the pre-linguistic period, as the infant builds up an understanding of such basic notions as objects, actions, causality, and spatial relations. As children begin to want to communicate, they search for the linguistic forms (content words, grammatical morphemes, word order or intonation patterns, etc.) that will allow them to encode their ideas."

This readiness to talk comes only after hundreds of hours of listening and comprehension on the part of the child (Asher, 1981a).

Although early language research was greatly shaped by both the behaviourist and mentalist theories of learning, the present-day opinion accepts that language learning is dependent on *both* biological readiness and social experiences (Wade & Travis, 1998). Aspects of all three approaches, behaviourism, mentalism and functionalism, can be considered important for language learning. The function of the language, as well as the experiences of the learner and their mental development, all play a role in language learning.

3.3.4 - The Role of First Language acquisition in Second Language acquisition

Research on first language acquisition has directly affected the research on second language acquisition. Early research suggested that second language learning was highly dependent upon the first language. According to Ellis (1986, 6), "it was assumed that where there were differences between the L1 [first language] and L2 [second language], the learner's L1 knowledge would interfere with the L2, and where the L1 and L2 were similar, the L1 would actively aid L2 learning." The procedure of *Contrastive Analysis*

was developed to attempt to establish the differences between the learner's first and second languages (Woodsworth, 1973; Ellis, 1986; Brown, 1987; Bialystok & Hakuta, 1994). By doing this, it was believed that the problems a learner would encounter could be predicted (Ellis, 1986). The procedure of Contrastive Analysis generally followed four steps: 1) Description (i.e. a formal description of the two languages); 2) Selection (i.e. a selection of the subsystems or areas of the languages to be examined); 3) Comparison (i.e. identifying areas of similarity and difference between the two languages); and 4) Prediction (i.e. predicting which parts of the language are most likely to cause errors) (Ellis, 1986). Ellis (1986, 26) outlines the various features a comparison may reveal:

- No difference between a feature of the first and second language.
  e.g. The contracted form 'J'ai' in French is mirrored by the contracted form 'I've' in English.
- 'Convergent phenomena' (i.e. two items in the first language become coalesced into one in the second language [L2]).
  e.g. Where the L2 is English, German 'kennen' and 'wissen' coalesce into 'know'.
- An item in the first language is absent in the target language.
  e.g. In German, subordinate clauses require a different word order from main clauses, whereas in English the word order is the same in both clause types.
- An item in the first language has a different distribution from the equivalent item in the target language.
  e.g. In many African languages, the sound in singer occurs at the beginning of the word, while in English it only occurs in the middle or at the end, like thing.
- No similarity between first language feature and target language feature.
  e.g. In Spanish, negation is pre-verbal ('No se'), whereas in English it is post-verbal ('I don't know').
- 'Divergent phenomena' (i.e. one item in the first language becomes two items in the target language)
  e.g. Where the L2 is French, English 'the' diverges into 'le' and 'la'.

The Contrastive Analysis hypothesis has been criticised in many ways, and Ellis (1986) outlines three major types of criticisms. First, there are doubts concerning whether Contrastive Analysis could accurately predict errors. For instance, what do the differences mean, and how do they determine subsequent errors? Secondly, there have been

theoretical criticisms as to whether you could feasibly compare different languages. Translation equivalence between languages is often difficult. As well, it is nearly impossible to account for learner variability. Lastly, there have been practical concerns about whether Contrastive Analysis could offer anything useful to language teaching. The question that remains is how will knowing the possible errors a language learner may make actually help in language learning? Due to these criticisms, the idea of Contrastive Analysis lost popularity in the late 1960s (Ellis, 1986).

Later research, which supported Chomsky's idea of a Universal Grammar, began to suggest that this Universal Grammar was common to all languages (Ellis, 1986; Brown, 1987; McLaughlin, 1987). Language learning, including second languages, was thought to be genetically determined (McLaughlin, 1987). Acquiring a second language occurred as learners encountered more input from the second language, and were then able to fix the specific rules of the new grammar in their mind (McLaughlin, 1987). Researchers also looked into the 'natural' route of language development, which was found to be predictable for first languages (Ellis, 1986; Bialystok & Hakuta, 1994). They could not, however, find as predictable a sequence for second language learning (Ellis, 1986).

Recent research indicates that it remains uncertain how first languages affect second language learning (Ellis, 1986). For instance, it is now evident that the first language is not the source or major cause for grammatical errors in second language acquisition (Ellis, 1986). Although first language likely plays some role in second language acquisition, second language research should look beyond it. Rice (1989, 355) contends that there are three major dimensions of language teaching that should be recognised by researchers:

"the language skills to be developed, the child's intellectual and social resources, and the provision of a setting and instructional design that maximally aligns the first two dimensions." These should be considered when considering approaches for teaching second languages.

3.4 - FACTORS AFFECTING SECOND LANGUAGE LEARNING

Second language research, in particular, has examined the different factors that affect the ability of a student to learn. Different people have their own individual motivating factors for learning a language, and for trying to improve. Ellis (1986) suggests that factors such as a person's age, learning style, aptitude, motivation and personality, will all play a part in the rate and success of second language acquisition. By discussing these factors, we can better determine the ideal learning situation for languages.

3.4.1 - Age

The age of a learner has already been touched upon in the discussion of a critical period for first language learning above. It is believed that children's brains retain at least some of their plasticity until about age ten to twelve (Ellis, 1986; Brown, 1987). During this time, they can acquire languages more naturally and with less effort. Ellis (1986) outlines the differences between old versus young language learners.

Young children are considered to be more 'open' to learning a new language, as at their level of cognitive development they are not even aware that they are acquiring a language. Children learn language in more relaxed situations. They can have a longer exposure period to language, as they begin at a young age. Children also tend to be more

motivated by the need to be accepted by their peer groups in speaking the new language. In their learning, they tend to be able to achieve a more native-like pronunciation.

Adults, on the other hand, are aware of the language learning process. They can also hold strong social attitudes towards the use of the target language. This can actually inhibit 'natural' or spontaneous learning of a language. It can, however, lead to alternate, more efficient ways of learning. Adults tend to reach higher levels of proficiency than young children do.

Teenagers have the advantage of a greater exposure period than adults, a growing awareness of the language system, and the motivation to achieve proficiency to be accepted by their peers. They tend to learn languages more rapidly than adults or children.

According to Ellis (1986, 105), "it would appear that although age improves language learning capacity, performance may peak in the teens, after which performance declines." The age at which to best begin learning languages is uncertain. Ideally, the more time spent learning a language, the better (Titone, 1981). There seems to be no reason to not introduce language learning at a young age, in order to provide exposure to the language, and to promote greater language self-confidence in the learners of the language (Weininger & Daniel, 1992). In fact, there are many books that focus exclusively on teaching languages to young children (see for instance Weininger & Daniel, 1992 or Genesee, 1994).

3.4.2 - Cognitive Style

Individual people have their own unique way of processing information. Ellis (1986) uses the term *cognitive style* to refer to the way people perceive, process, store and

retrieve information. The manner in which people do this should affect their rate and success of second language acquisition. For instance, some research has explored whether analytical thinking is more effective for learning second language than is holistic thinking (what Ellis [1986, 114] calls "two poles on a continuum"). However, the types of research that have been done do not conclusively show that our thinking style is a major factor affecting our ability to learn languages (Ellis, 1986). It is useful, however, to be aware of the different styles of learning, and the way they may affect the learning process. An effective classroom would attempt to cater to all types of learners (O'Malley & Chamot, 1990).

3.4.3 - Aptitude

A person's *aptitude* has been proposed as an important factor in learning languages (Krashen, 1981b). Aptitude refers to the rate of learning, or the special abilities involved in language learning (Krashen, 1981b; Ellis, 1986). Aptitude affects the amount of conscious learning, and the rate at which that learning can occur (Krashen, 1982). O'Malley and Chamot (1990) suggest that students with a special aptitude for learning languages may simply be those who have found their own effective strategies. They claim that aptitude, as this kind of strategic skill, can therefore be learned.

3.4.4 - Attitude and Motivation

Krashen (1981b) suggests that attitude may also play a vital role, as it will affect the amount of acquisition that can actually take place. A person's attitudes and motivation for learning are internal, personal feelings and therefore cannot be directly observed (Ellis, 1986). They can, however, be recounted by language learners in personal diaries. Ellis

(1986) describes attitude as a social factor, which includes a person's opinion of the culture and language they are learning. A person's attitude toward the language, as well as towards the teacher, the course materials, and learning in general will all affect their learning. Motivation is an affective factor, which Brown (1987, 114) describes as "an inner drive, impulse, emotion or desire that moves one to a particular action." A person needs to be to open to learning for it to happen. The differences and links between attitudes and motivation are hard to define, and have been debated by various researchers, as outlined by Ellis (1986). Ellis (1986, 118) does summarise by saying that "motivation and attitudes are important factors, which help to determine the level of proficiency achieved by different learners." Students need to want to learn, and to be interested in the learning process, to be most effective learners.

3.4.5 - Personality

There are a number of factors that combine to determine a person's personality. Ellis (1986) suggests three major personality traits that should affect language learning: extroversion versus introversion; social skills; and inhibition. *Extroversion* versus *introversion* has been suggested as one of many determining factors in a person's language learning success. Extroverted learners are expected to be more successful, as they will be able to make more social contacts than introverted learners, and as such be exposed to more language input (Ellis, 1986). *Social skills*, particularly those which enable people to be in situations where they can hear more input, are suggested to contribute to increased language learning (Ellis, 1986). As well, how people respond to being part of a group can also affect language learning ability (Ellis, 1986). *Inhibition*, which is closely linked to self

esteem and defensiveness, tends to prevent the risk-taking that is needed to progress in language learning (Ellis, 1986; Brown, 1987).

In general, Ellis (1986) describes that the available research does not clearly show how personality affects language learning, or whether it affects communicative competence or linguistic ability differently. He suggests that some traits, such as 'quickness to grasp new concepts' and perfectionist tendencies may promote linguistic abilities. Other traits, such as sociability, may promote communicative competence. Traits such as readiness to be experimental may be important for both.

Figure 3.1: Factors affecting Second Language Acquisition

Personal Factors
- group dynamics
- attitudes towards teacher and course materials
- individual learning techniques

General Factors
- age
- aptitude
- cognitive style
- motivation
- personality

SECOND LANGUAGE PROFICENCY
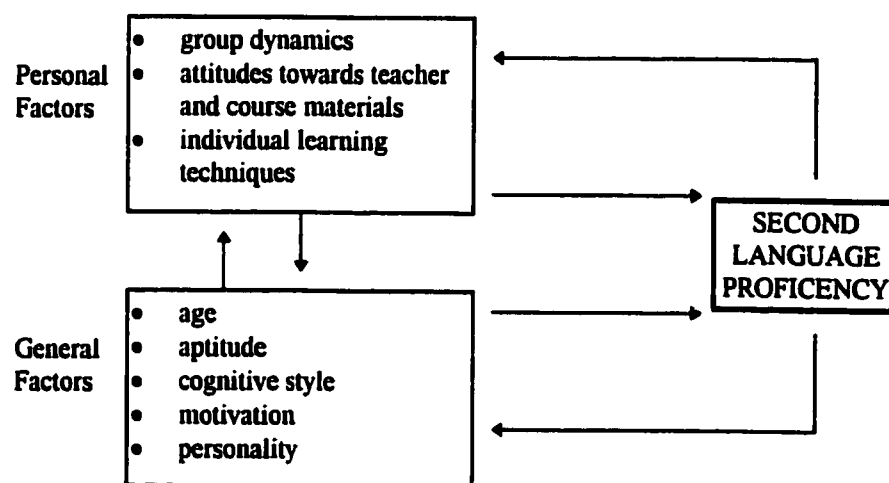
Source: Adapted from Ellis (1986, 124).

Each of these variables will affect a person's ability to learn. However, the individual learner variables are quite difficult to pinpoint, and to research, and their effect on second language learning has been difficult to determine (Ellis, 1986). Many of these factors are

interrelated, and affect one another in a feedback kind of loop. Figure 3.1 provides a very simple model to show the complex role of learner factors.

3.5 - PAST APPROACHES FOR TEACHING SECOND LANGUAGES

There have been a vast number of books written about teaching second languages. There are nearly as many different ideas about teaching as there are teachers or researchers looking into language. Over time, the specific teaching methods used in classrooms have been shaped and varied according to the research occurring at the time. In many cases, new methods have simply been a re-working and re-vitalisation of an older one. This section of the thesis will outline the major methods or techniques that have been put forward for second language instruction. They have been grouped, according to similar theoretical ideas, into the following sections or approaches[1]: 1) Early approaches; 2) Comprehension approaches; 3) Human-focused approaches; and 4) Communication approaches. The theory underlying these broad approaches will be described, and then a description of the specific classroom methods, with examples where possible, is provided. Although the methods have been grouped for the purposes of this thesis, it should be noted that the divisions are not completely rigid. Several of the methods overlap each other in some way.

3.5.1 - Early approaches for teaching second languages

The earliest traditional approach to language instruction, which has been referred to as the **Grammar-Translation method**, focused particularly on translation and the

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[1] The word *approach* is used here to describe a way of directing activities that has been determined by theory, and that shares general assumptions or principles. *Methods*, on the other hand, are the specific applications or techniques of the approaches.

grammatical rules of language (Brown, 1987; Thomas, 1988; Stern, 1992). At the time when the Grammar-Translation method was being used, language learning was generally a scholarly activity (Greek or Latin) and was not intended to create conversationally literate people. Classes were taught in the mother tongue with very little active use of the target language. Grammatical rules were stressed only as an aid to translation. Reading of classical texts was begun early to provide translation practice. Students were expected to memorise long lists of grammar rules and vocabulary and to provide perfect translations. This approach had no real theoretical base, and did nothing to enhance a person's communicative ability. As such, it has virtually no present day advocates for teaching a person to communicate. (description from Brown, 1987). It is, however, still utilised to teach classical languages, where translation rather than communication is the aim.

The twentieth century saw an explosion of research on learning languages. Language teaching activities were designed to support the 'new' behaviourist theory, and were apt to stimulate the left hemisphere of the brain (Asher, 1981b). The core of the new language instruction included repetitious activities, drills and memorisation in the learning, as it was believed that increased practice would help the learner (Brown, 1987). The aim was to make language production a habit for the students. Up until the 1960s, the **Direct method** and the **Audio-lingual method** dominated second language learning.

3.5.1.1 - The Direct Method

The **Direct method**, which dates back to the late 1800s, was developed to focus on teaching language rather than teaching *about* language (Thomas, 1988). This method had little or no analysis of the rules of the language, which was a major departure from the

teaching that had occurred for centuries (Thomas, 1988). According to Stern (1992, 6), this method "emphasised oral practice and dispensed with translation."

The Direct method is more of an approach, as it is not very unified (Brown, 1987). There are some general characteristics: Classroom instruction using the Direct method was entirely in the target language (Brown, 1987; Thomas, 1988; Stern, 1992). This was in the hope of creating an authentic second language environment. Everyday vocabulary was introduced through demonstration, sentences, showing pictures or objects and associating ideas. For example, a teacher may go through the stages of saying and demonstrating "I am closing the door; I am walking to the desk; I am picking up the book; etc." (Stevick, 1991). Questions and answers between teachers and students were sequenced and organised to help build up the student's oral communication skills. These questions needed to be so simple (for comprehension) that very little 'real' communication took place in the classroom for the first several weeks (Terrell, 1982). The grammatical rules of the language were rarely analysed, and were taught predominantly through practice (Thomas, 1988). Utilising the correct grammar and pronunciation was an important part of this method (Brown, 1987).

The Direct method required teachers who were native speakers of the target language and small class sizes to work effectively. As a result it did not work well in the public education system (Brown, 1987). Coupling this with its revolutionary character and weak theoretical foundations led to a decline in popularity in the Direct Method around the time of World War I (Brown, 1987). The Direct Method has continued to influence language instruction, and some portions of this method were revitalised and re-worked into other

methods, such as the Audio-lingual method, which will be discussed below.

3.5.1.2 - The Audio-lingual method

One of the next most prevalent methods was the **Audio-lingual method**. By the time of World War II, the ability to speak a foreign language was becoming more important, particularly for those serving overseas in the war (Brown, 1987). The United States military developed special, intensive language courses which later evolved into the Audio-lingual method (Brown, 1987). This method was rooted in linguistic and psychological theory (Brown, 1987). It focused first and foremost on oral activity. Listening and speaking were the primary focus, followed by reading and then writing (Woodsworth, 1973; Blair, 1982a; Stevick, 1991). Listening was considered important as it was held that a student will learn what they hear, and the aim was to make correct language production a habit (Postovsky, 1982; Ellis, 1986).

The activities of the Audio-lingual classroom were based on rote learning, repetition, imitation, memorisation and pattern practice (Stern, 1992). These activities were mechanical and automatic in order to form habits (Stern, 1992). Teachers, who were firmly in command, spoke predominantly in the target language, and provided words, phrases and sentences for their class to repeat (Brown, 1987). For instance, teachers could start by reading a simple dialogue, or an example of how language is used. Students repeated portions of this dialogue until they had memorised it and were able to automatically produce it (Stevick, 1991). Most often, the teacher began with choral repetition (the entire class) and then moved to group and individual student repetition (Stevick, 1980). Listening to the difference between similar, yet structurally different

words (such as *ship* and *sheep*) was another type of activity common in the Audio-lingual classroom (Brown, 1987; Stevick, 1991). The activities were sequenced to illustrate structural patterns in the language and to assist students in a progression towards understanding the language (O'Malley & Chamot, 1990). Correcting the students' pronunciation was a very important part of this method and students were expected to speak without errors (Brown, 1987; O'Malley & Chamot, 1990). There was little direct focus on the grammar, although students were also expected to produce grammatically correct phrases (O'Malley & Chamot, 1990).

This method made extensive use of tapes, visual aids and language labs to give students practice in listening and speaking (Brown, 1987). Being aware of the meaning was not considered necessary, as the content of the language was seen as less important than the correct form (Littlewood, 1981; Brown, 1987). As Diller (1981) explains, this method helped students to master speech patterns, but not to gain actual long-term proficiency in the language. Students were also highly bored with the repetition and memorisation, the lack of real communication, and the dearth of writing (Thomas, 1988). The theory of this method crashed by the late 1960s (Bialystok & Hakuta, 1994). Some practical aspects of this method, such as drills and language tapes, are still used today.

3.5.2 - Comprehension Approaches to Second Language instruction

The 1970s found researchers submitting comprehension as the key to language acquisition (Politzer, 1981). A focus on comprehension while teaching second languages stresses acquiring a fundamental understanding of the meaning or deep structure of the language (Winitz, 1981). It was believed the since language is used to convey meaning,

learning a language should involve learning the meaning rather than learning a set of behaviours (Swaffar & Stephens, 1981). Comprehension-based classes avoided any formal recitation, pattern drills or choral response techniques (Swaffar & Stephens, 1981), as speaking perfectly and knowing the rules were not considered the important aspects of language learning. It was felt that students should be exposed to language before they are expected to perform it, and as a result comprehension classes were conducted almost entirely in the target language (Swaffar & Stephens, 1981). There was new interest in stimulating the right hemisphere of the brain, as it was proposed that active experiences could enable people to understand and attach meaning to the language (Asher, 1981a & b). There are some downfalls to comprehension-based classes, such as delaying students' language production and being slow teaching methods (Newmark, 1981). However, some novel and interesting classroom techniques, such as the **Total Physical Response method** or the **Natural Approach**, were suggested in response to the comprehension research.

3.5.2.1 - The Total Physical Response method

The **Total Physical Response (TPR) method** was developed by James Asher in the late 1960s, based on the research of how children acquire their first language (Brown, 1987). Asher (in Brown, 1987, 163) noted that "children, in learning their first language, appear to do a lot of listening before they speak, and that their listening is accompanied by physical responses." At the same time, the 'trace theory' of learning, developed by psychologists, stated "that memory is increased if it is stimulated, or 'traced', through association with motor activity" (Brown, 1987, 163). The TPR method, in response to this research, was designed so that language students would be able to do a lot of listening

and acting together. The new language is gradually learned as the students act out

commands in that target language (Asher, 1977).

Table 3.1 - Lesson outline for the Total Physical Response method
(for 4 3-hour classes, teaching students aged 18-69)

		LANGUAGE INTRODUCED THROUGH DEMONSTRATION
Lesson 1	COMMANDS	• Stand up, Sit down, Walk, Stop, Turn, Jump
	EXPANSION	• Point to the door, Point to the chair, Point to the table
		Point to the door/chair/table, Walk to the door, Touch the door.
	NOVELTY	• Eduardo, point to a chair. *Jump to the chair.
		Maria, stand up. Walk to the table. Point to the table. *Sit on the table.
	NEW VOCAB.	• Window, light, ceiling, floor, wall, chalkboard
Lesson 2	REVIEW	• Stand up, Sit down, Stand up, Walk. Stop, Turn, Jump, Sit down.
		Walk to the window/chair, Touch the window/chair.
	COMMANDS	• Touch the pencil/book/paper, Pick up the pencil, Put down the pencil.
		Pick up the pencil and the book. Put down the pencil only. Now put down the book...
	NOVELTY	• Jaime, stand up. Walk to the table. Pick up the paper and the pencil. *Walk to the window and put the pencil on the floor. *Put the paper on your chair.
	NEW VOCABULARY	• Name, address, on, under, numbers 1-10, head, mouth, ear(s), eye(s), hand(s), arm(s), leg(s) [lexical items]
		Elaine, touch one of your eyes. Ramiro, touch both of Antonio's arms. Touch your nose with the pencil.
Lesson 3	REVIEW	• Use 2-4 commands to review all that has been learned previously
	NEW	• Hit, throw, give, take, turn off, turn on [verbs]
	VOCABULARY	• Flower(s), magazine(s), chalk, colours, numbers [nouns]
		Maria, pick up the blue pencil and throw it to Juan. Put the magazine on the flower. Pablo, take the chalk and write your name on the chalkboard.
Lesson 4	REVIEW	• Ramiro, throw the book to me, hit Consuelo on the arm and draw a funny picture of Consuelo on the chalkboard
	NEW	• Draw, laugh, cut, run, show, push, pull, scream [verbs]
	VOCABULARY	• Straight line, crooked line, circle, square, cat, shoulder(s), knee(s), foot (feet), hair, wrist, wristwatch, between, next to, around [lexical items]
		Elaine, put your book next to Ramiro's shoulder. On your paper, write the number of feet the Jaime has.
	READING	• A list outlining all of the learned vocabulary is handed out, and the teacher reads and acts out each one.

Source: Adapted from Asher (1977, 55-66).

In the TPR classroom, the teacher speaks in the target language and directs the class

(Asher, 1977). The first class begins with a series of simple commands which the teacher

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and students act out together. Gradually, after practice, students are encouraged to act out the commands on their own. The commands and vocabulary that Asher (1977) recommends introducing in the first four lessons are outlined in Table 3.1. By keeping students actively involved, they are able to stay motivated and to increase their confidence in their language learning. By introducing novel ideas and commands, the lesson is highly flexible. Students are only expected to speak when they are comfortable and ready (Asher, 1977). This method is somewhat reminiscent of the Direct method (Thomas, 1988). Brown (1987) notes that this method may be quite useful during the early stages of learning a language, but may become less effective as competence in the language increases. The method also does not encourage any spontaneity in the language, as all the language used is rehearsed (Brown, 1987).

3.5.2.2 - The Natural Approach

The **Natural Approach** was developed by Tracey Terrell and Stephen Krashen in the late 1970s (Ellis, 1984; Brown, 1987). Much like TPR, it proposes that students' speech production should be delayed until it naturally emerges (Brown, 1987). Students should focus on listening and comprehension to gain an appreciation of the language (Terrell, 1982). Language should be learned through real communication and acquisition rather than analysis (Brown, 1987). The aim of the natural approach is to impart basic communication skills in the learners (Brown, 1987).

The early lessons in a Natural approach classroom may closely resemble those in the TPR classroom (Brown, 1987). The teacher, speaking in the target language, attempts to model comprehensible and meaningful input by communicating common ideas and

vocabulary. They may achieve this through using commands (as in TPR), as well as gestures, diagrams, visual aids, skits or other techniques (Terrell, 1982; Brown, 1987; Thomas, 1988). Drills and exercises are practised outside the classroom as homework activities (Terrell, 1982). Ideally, students will understand what their teacher is saying. Students are free to respond in the classroom in either their native language, the target language or a combination of the two (Terrell, 1982). With any speaking, the focus is on meaning rather than form, and as such errors are rarely corrected (Terrell, 1982). As students are not expected to speak perfectly, language learning can be more enjoyable and less stressful (Nord, 1981).

An example of an early activity would be asking students to think of things that they see in their homes everyday. As students respond, with items such as a table, the teacher translates these items and uses them in a sentence (Terrell, 1982). As they build up their repertoire of common words, students will be able to understand and use more and more of the language. At that point, classroom activities can move on to more complex games, role play and open ended dialogue (Brown, 1987). Real, or natural, communication remains the primary focus within the classroom.

Brown (1987) explains that there are some limitations to this approach. Teachers have a hard time adopting this method. It is difficult to determine what 'comprehensible input' is. There is little specific guidance, from Krashen and Terrell, as to whether communication should be guided by topic, by structure, or in some other way. Also, by waiting until students are 'ready' to speak, and not correcting any errors, teachers are left with a classroom of students at varying levels of language competence. This method can

be difficult for teachers.

3.5.3 - An Increased Focus on the Human Aspect of Learning

Also throughout the 1970s, there was a new emphasis on the "human aspect of language teaching and learning" (Stern, 1992, 7). New methods, inspired or designed by psychologists and psychotherapists, mirrored findings in the field of psychology (Hammerly, 1982). The importance of the learner was stressed, as was the interaction between the teacher and the student (Stern, 1992). There was a move away from teacher-centred classrooms towards novel classroom methods (Stern, 1992). Comprehension was still important for many of these methods, but the learner's social or affective needs came first. Three methods that were dominant during this period were **Community Language Learning, the Silent Way, and Suggestopedia.**

3.5.3.1 - Community Language Learning

Community Language Learning was first suggested by Charles Curran in the early 1970s, and it placed a significant emphasis on the students' feelings and their need for belonging (Curran, 1982). It was believed that the problems encountered while learning a new language were similar to the problems one would face in a personal counselling process (Curran, 1982). As such, language learning was approached in a supportive, encouraging, low-stress environment which valued and prized each individual (Brown, 1987). Thomas (1988, 371) explains that this method "fosters self-trust, low anxiety and warm personal contacts" for the student. The word 'community' was used to illustrate that the classroom power was evenly distributed between the learners and the teacher (Stevick, 1980). According to Curran (1982), trained 'counsellors' act as teacher in this

method of language learning.

No two lessons in Community Language Learning will ever be exactly the same. However, a description of the general pattern can be given (compiled from accounts by Dutra, 1980; Stevick, 1980; Curran, 1982; and Brown, 1987). Students are typically arranged in a tight circle, with one or more teachers or counsellors on the outside. In the beginning stages, students speak in the native language on any topic they like, and the teacher(s) translate for them into the target language. Care is taken to translate slowly and in a warm, accepting tone. Students repeat this translation to the best of their abilities. A recording is made of the student speaking in the target language. The conversation proceeds, with translations being provided for each student. After approximately ten minutes, the conversation on tape is listened to and students recall the meaning of their utterances. Students could also attempt to transcribe the conversation as they listen a third or fourth time. A group feedback session, in the native language, always concludes the learning. During this time, students and teachers can share their personal feelings and emotions about learning the language.

As language learning progresses, students begin to speak about less superficial topics, and actually start to share their feelings in the target language. They also begin to feel comfortable in speaking the language on their own. They move through a series of stages as they gain autonomy and independence in the language. These stages are outlined in Table 3.2. Students move on to the next stage only when they are ready to.

Table 3.2 - An outline of stages that the student goes through in Community Language Learning, from Counselor dependency to Independence

STAGE 1
The student is completely dependent upon the language teacher.
1. First, he/she expresses only to the counsellor and *in the native language(L1)* what he/she wishes to say to the group. Each group member overhears this L1 exchange, but is not involved in it.
2. The counsellor then reflects these ideas back to the student *in the foreign language (L2)* in simple language in phrases of five or six words.
3. The student turns to the group and presents his/her ideas *in the L2*. He/she has the counsellor's aid if he/she mispronounces or hesitates on a word or phrase. This is the stage of maximum security.
STAGE 2
1. Same as above.
2. The student turns and begins to speak the *L2* directly to the group.
3. The teacher helps only if the student hesitates or turns for help. These small independent steps are signs of positive confidence and hope.
STAGE 3
1. The student now speaks directly to the group in the L2. This presumes that the group has now acquired the ability to understand his/her simple phrases.
2. Same as 3 above. This presumes the student's greater confidence, independence and insight into the relationship of phrases, grammar and ideas. Translation is given only when a group member desires.
STAGE 4
1. The student is now speaking freely and complexly in the foreign language. Presumes a groups' understanding.
2. The teacher directly intervenes in grammatical error, mispronunciation, or where aid in complex expression is needed. The student is sufficiently secure to take correction.
STAGE 5
1. Same as stage 4.
2. The teacher intervenes not only to offer correction but to add idioms and more elegant constructions.
3. At this stage the student can become teacher to members of the group in stages 1, 2 and 3.

Source: Curran (1982, 123).

Curran (1982, 133) felt that in this type of learning, "language became a means of sharing and belonging between persons." Although this method has interesting aspects, Brown (1987) outlines some of its limitations. The method lacks a plan or direction, which may be quite stressful for some students. It may also take months or years to actually achieve fluency using this method, which can seem too time consuming and discouraging. Lastly, this method is highly dependent upon the teacher's ability to translate for its success. It would be nearly impossible to incorporate this into the public

education system.

3.5.3.2 - The Silent Way

The **Silent Way**, put forth by Caleb Gattegno, focuses on the sensory-motor abilities of students (Asher, 1981b). It is called the Silent Way as the teacher remains silent for most of the time (Brown, 1987). Students must perceive and take responsibility for their own independent learning. It is based on the idea that learning is facilitated if the learner is able to discover, or create, rather than remember, and repeat, what is to be learned (Brown, 1987). Learning is a process of discovery, through looking at, grasping and manipulating objects (Asher, 1981b) and through relating the linguistic signs to that which is perceived by the senses (Stevick, 1980). Stevick (1980) outlines three typical phases that illustrate the basic techniques used by the Silent Way:

In the first phase, the teacher begins by pointing at symbols on a wall chart. These symbols stand for the possible syllables or sounds of the spoken target language. Ideally, these syllables would be written in the alphabet of the students' native language, to facilitate reading of them. Symbols that are pronounced in similar ways are coloured alike. In this way, students can initially ignore the actual symbols and focus on the colours and new sounds. Students, guided by the teacher's gestures, practice pronunciation of the symbols. The teacher remains silent, except where introducing a new sound not in the native language.

The second phase is centred on a set of wall charts containing a selection of common words in the target language, including the words for numerals. Students are able to pronounce the sounds of the language, and can now piece them together to create words.

The third phase makes use of a set of coloured rods of varying lengths. Using the charts and rods, along with gestures and perhaps a few spoken words, the teacher guides the student and introduces them to new vocabulary. They begin with numbers and colours, using the rods to demonstrate, and then can move on to relative locations and any other grammatical structures. For instance, students may progress from statements such as 'one rod' to 'two blue rods', and then later on to 'take the red rod from underneath the two yellow rods and place it behind the green rod' (Gattegno, 1982). Due to the teacher's silence, students must infer what is being demonstrated. Problems are solved as students are able to look at, grasp and manipulate the rods (Asher, 1981b). According to Gattegno (1976, 203):

"Working with situations made with the rods brings to the classroom the naturalness found by babies in the home. The meanings come from the situations, not from words, and students seem ready to ask for the proper forms in the new language to fill in an expectation that somehow one thinks should be sayable in this language".

It is up to the students to refine their understanding and pronunciation together as a group (Brown, 1987). They are in control of their learning process (Stevick, 1980). There is very little positive feedback from the teacher, but mistakes are worked with until they are correct (Stevick, 1980). The students are free to take initiative in the class, and to be creative in their learning. Between sessions, students may be allowed to talk about the experience or ask some questions in the native language. The role of the teacher and learner are outlined in Table 3.3.

This method is unique and unusual and provides an interesting learning experience. However, it has received some criticism. First, there is very little guidance or feedback for

the students, which can be uncomfortable for some (Brown, 1987). Also, learning with

the rods and charts tends to wear thin after a couple of lessons (Brown, 1987).

Table 3.3 - Principles of the Silent Way, along with the roles of student and teacher

Principle	Learner	Teacher
• LEARNING IS WORK FOR THE PURPOSE OF ADJUSTING TO THE OUTSIDE WORLD	In meeting a new challenge,	The teacher provides challenges
• INDEPENDENCE	I use resources from within myself	relative to the student's present resources
• RESPONSIBILITY	in order to decide for myself	but remains silent, non-interfering,
• AUTONOMY	among the choices	while the student works to choose
• INDEPENDENCE	offered by the resources within myself (for no other resources are available).	among the resources that we have guided him/her in developing.
• REMEMBERING (" LEARNING" ?)	The result of this work	This kind of teaching
• RETENTION (" ACQUISITION" ?)	may become a part of myself.	frees the student.

Source: Stevick (1980, 51).

3.5.3.3 - Suggestopedia

Suggestopedia, or **suggestology**, is a technique that was developed by Georgi

Lozanov, and which attempts to tap the reserve capacities of the human mind and body

(Lozanov, 1982). Lozanov believed that "the human brain could process great quantities

of material if simply given the right conditions for learning" (Brown, 1987, 140). This

method has reported outstanding results for language learning (Stevick, 1980). It is called

suggestology because all parts of the learning and teaching process are designed to

'suggest' to the students that learning will be a positive, enjoyable and rewarding situation.

For instance, high demands are placed upon the students, which 'suggests' confidence in

the learner (Stevick, 1980). Stevick (1980, 230), describes Suggestopedia as being founded on three assumptions: 1) That learning involves both the unconscious and conscious functions of the learner; 2) That people are able to learn much faster than they usually do; and 3) That learning tends to be held back by societal norms and by the lack of a relaxed, harmonious working together of all parts of the learner. The conditions for learning are considered very important in this method, and it aims to achieve a conscious and unconscious state of relaxation for all the students (Brown, 1987).

In the suggestopedia classroom, the teacher is in complete control (Brown, 1987). The suggestopedia teacher exudes competence in their tone, body language and control of the class (Stevick, 1980). They send out 'good vibes' or positive messages for the students and are a comforting source of authority (Stevick, 1980; Thomas, 1988). They learn to do this by completing a two month training course with Dr. Lozanov.

Students, upon entering the classroom, are provided with a new name and identity (Stevick, 1980). For instance, someone in an English course may become "Robert Fox", a "doctor from Oxford", or "Shirley Burton", a "journalist from Birmingham" (Stevick, 1980, 231). On the unconscious level, students receive positive, pleasant associations about this new identity and feel good about themselves (Stevick, 1980). They are able, by adopting a new identity and leaving their real life outside, to leave behind some of the embarrassments and anxieties that often accompany language learning (Stevick, 1980). In this way, the classroom consists of 'real' characters that are able to take part in meaningful communication (Stevick, 1980).

The classroom itself is typically furnished with comfortable chairs and decorated with

flowers, soft lighting and comfortable rugs (Thomas, 1988). Three phases are outlined by Lozanov (1982) for typical lessons.

The pre-session phase is fifteen to twenty minutes long and students are made familiar with key topics. The teacher outlines a great deal of new material briefly, taking care to foster a positive attitude towards the learning. Much of the material is memorised by the students.

The session phase lasts forty-five minutes and can be adapted for various ages. In the first part, students listen to emotional Classical or early Romantic music. In the second part, they listen to Baroque music of a more philosophical nature. A long dialogue, consisting of the new material, is read by the teacher during each type of music. There is a focus on the whole sentence and the communication, while pronunciation, vocabulary and grammar are considered secondary. Students are urged to understand as much as they can.

The final post-session phase works on various elaborations of the dialogue. Reading, translating, singing songs, playing games and role playing take place naturally as the students progress in their understanding of the language.

The whole effect for the student is supposed to be one of joy and relaxation, where learning can occur without mental fatigue (Lozanov, 1982). The expected results for a foreign language course using this method are outlined in Table 3.4.

Although the benefits in Table 3.4 have been shown to exist, the difficulty with Suggestopedia is that is it a total sensory experience. It should not be used only in part. Teachers need to be extensively trained and all aspects of the classroom need to be geared towards the language learning experience. As such, it cannot be implemented very easily

or practically into classrooms. Although there has been a great deal of interest in the ideas

set forth by suggestopedia, it has also created a great deal of controversy in its wake

(Stern, 1992).

Table 3.4 - Expected results for a Suggestopedia Language Course

Student results, based on a 24 day foreign language course with four academic hours a day, either no homework or only some informative reading allowed for 15 minutes in the evening and in the morning:
• The students assimilate on the average more than 90 % of the vocabulary, which comprises 2000 lexical units per course.
• More than 60 % of the new vocabulary is used actively and fluently in everyday conversation and the rest of the vocabulary is known at translation level.
• The students speak within the framework of the whole essential grammar.
• Previously unseen texts can be read.
• The students make some mistakes in speaking, but these mistakes do not hinder the communication.
• Pronunciation is satisfactory.
• The students are not afraid of talking to foreigners who speak the same language.
• The students are eager to continue studying the same foreign language.

Source: Lozanov (1982, 159).

3.5.4 - Language instruction with the aim of communication

A communicative approach to language instruction has grown out of the language

learning research of the past century (Brown, 1987). It has been developed in the hopes

of offering a wider perspective on learning languages and teaching communication

(Littlewood, 1981). **Communicative language teaching** began as an approach, but has

since evolved into more specific ideas and methods for classroom teaching. Although

there are some similarities to past methods, such as the Natural approach or Community

Language learning, communicative language teaching plays down the role of grammar,

and further increases the role of communication. Canale and Swain (1980) explain that

the aim of this approach is communicative competence, which refers to a knowledge of

the rules of the grammar of the language (grammatical competence) as well as a

knowledge of the rules of language use (socio-linguistic or contextual competence)

Brown, (1987, 213) provides a definition of communicative language teaching:

- "Classroom goals are focused on all of the components of communicative competence and not restricted to grammatical or linguistic competence.
- *Form* is not the primary framework for organising and sequencing lessons. *Function* is the framework through which forms are taught.
- Accuracy is secondary to conveying a message. Fluency may take on more importance than accuracy. The ultimate criterion for communicative success is the actual transmission and receiving of intended meaning.
- In the communicative classroom, students ultimately have to *use* the language, productively and receptively, in *unrehearsed* contexts."

Not only must students learn how to understand the second language in all its forms, but they must also learn how to use it appropriately.

Originally, the communicative approach was strictly oral and was thus criticised for not providing students with a knowledge of the written language. Many instructors have shifted over to a more contextual or meaning-based form of communicative instruction, which is not exclusively oral. In the classroom, the aim is to involve the learners in 'real' communication in the target language. A great deal of research has focused on the types of activities used for learning rather than on the style of teaching. A range of activities have been developed to help students to produce correct language and to communicate meaningful language intelligibly (Littlewood, 1981). The teacher acts as a monitor and a guide in the classroom, helping students and communicating with them (Littlewood, 1981). Activities can be divided into listening activities, functional activities and social interaction activities.

Listening activities force students to pay careful attention to the linguistic signals that they hear and to interpret the meaning of these signals (Littlewood, 1981). Students must

use their knowledge of the new language to decode the spoken text. They may be listening to the teacher or to a recording. Littlewood (1981) groups these types of activities based on three types of response: performing physical tasks; transferring information; or reformulating and evaluating information. Examples of these are outlined in Table 3.5. Activities can easily be altered to make them more or less difficult, to involve students individually or in groups, or to be more relevant to students' interests.

Table 3.5 - Listening activities for communicative language teaching

PERFORMING PHYSICAL TASKS:	
• Identification and selection	- Identify a stolen car as described by a radio message - Decide which of two taped conversations took place in a particular setting
• Sequencing	- After listening to conversations from a group of tourists, identify which sites they saw
• Locating	- Follow a route (spoken) on a map - Listen to a conversation between people placing furniture in a room and then draw the floor plan
• Drawing and constructing	- Listeners draw the scene that is described
TRANSFERRING INFORMATION:	
• Information is transferred to some other form, such as a table, chart of diagram	- Filling in a chart of train arrivals and departures after hearing station announcements - Fill in an application form after listening to an interview
REFORMULATING AND EVALUATING INFORMATION:	
• Need to evaluate the information heard	- Have a debate on the basis of a read statement - Role play the result of a situation heard on a tape

Source: Littlewood (1981, 65-75).

Functional activities are designed so that students need to solve a problem or overcome an information gap. Students need to use communication for meaningful activities, and they need to work towards a solution. They can do this by using language to share information, or being using language to discuss or evaluate information. Table

3.6 outlines examples of activities that can be used. The advantage of these activities, as with listening activities, is that the content, complexity and creativity can be easily varied.

Table 3.6 - Functional activities for communicative language teaching.

SHARING INFORMATION (*goal is to share factual information*):	
• Identifying pictures	-Two learners need to select the same picture from their own sets, by discussing and comparing the features on the pictures (pictures could be of anything from bedroom to restaurant to amusement park)
• Discovering identical pairs	- Learners must circulate, asking questions of their classmates, to find someone in the class who holds the same card as them (for instance depicting animals)
• Discovering sequences or locations	- Two learners each have a map. The second learner must learn where the first learner's objects are so he/she can place objects in the same place
• Discovering missing information	- Students have to fill in a questionnaire by asking other students who have been given certain information (for instance, about recreational activities)
• Discovering 'secrets'	- For example, Twenty Questions
• Communicating patterns, pictures and models	- Learner A makes a model out of Lego, and then describes to Learner B how to replicate it
• Following directions	- Learner A must direct Learner B to a certain location (like buried treasure) on a map
SHARING AND PROCESSING INFORMATION (*learners share information and discuss/evaluate*):	
• Reconstructing story sequences	- Each learner is given one picture, paragraph or sentence. As a group, they need to put them in a logical order
• Pooling information to solve problems	- Plan an itinerary of sight seeing if individual students each have bus schedule, train schedule, hours of operations, map
PROCESSING INFORMATION (*stimulus for communication comes from need to discuss/evaluate facts*)	
• Argue, justify	- Plan (from a list) what your group is taking on a three day mountain trip, knowing that each person can only carry a limited weight. Be prepared to discuss with the rest of the class

Source: Littlewood (1981, 22-42)

Social interaction activities encourage students to think not just about the functional meaning of their communication, but also the social meaning. Students must attempt to conform to social conventions while carrying on their conversations. Role playing and simulation are the most common types of social interaction activities in the classroom. The students' involvement and creativity can vary from performing a short, memorised dialogue up to improvising a scene, depending upon their level of competency. Table 3.7

outlines some specific examples of these activities.

Table 3.7 - Social interaction activities for communicative language teaching

• Basing dialogue and role plays on school experience	
• Role playing through cues and information	- Students can act out a conversation following cues such as 'Greet A', or 'Suggest somewhere to go together'. They need to listen to one another before responding - Students can act out a scene, such as where one person is trying to find a hotel for the night. Student A is the guest and he/she is given questions to find out about, while Student B is the manager and is given information about the hotel
• Role playing controlled through situation and goals (gives learner greater responsibility)	- Students are detective and 5 suspects. The suspects have information relating to their roles, knowledge, map of the crime scene (and one person knows he/she is guilty). The detective tries to discover the guilty party
• Role playing in the form of a debate/discussion (about a real issue)	- Students are at a Public meeting, and they need to decide how to spend money in a small town. Each student is given a character card.
• Large-scale simulation activities (help with decision-making and can discuss other topics)	- Students need to clean up an oil spill in a local pond. Each student has certain roles (i.e. reporter, president of oil company, animals)
• Improvisation (less control from teacher - can be dramatic or ordinary)	- Act out any given scene, such as a group of children at Walt Disney World

Source: Littlewood (1981, 43-64).

The communicative approach places high value on contact with target language speakers, access to various target language settings and opportunity for authentic language use (Stern, 1992). 'Authentic' materials are used whenever possible (Thomas, 1988), so that topics can be kept interesting and relevant. The activities can be easily adapted for any classroom, and they can dovetail with the activities of most other methods. As such, the communicative approach is important to keep in mind, particularly when examining cartography.

3.5.4.1 - Immersion programs

Canadian experiments in French **Immersion programs** were some of the early applications of the communicative approach (Stern, 1992). Immersion classrooms were organised to teach second languages through a medium of second language (Ellis, 1986). According to Stern (1992, 12), an immersion class focuses on "substantive, non-language content, and on experiencing the language in actual use." Teachers and students speak only in the target language and all instructions, interactions and games are carried out in this target language (Weininger & Daniel, 1992). The children learn the language, as well as the subjects being taught in this language (Littlewood, 1981). The emphasis is on using the language for learning other subjects, rather than acquiring grammar within the language (Stern, 1992). Formal instruction in the target language, covering grammar and structure, comes long after it has already been used as a medium of communication and instruction (Stern, 1981). Immersion is one specific usage of communicative language teaching, which stresses an experiential or active approach to learning (Stern, 1992). The utilisation of Immersion programs in schools had created some controversy and continues to be debated. The details of this debate are, unfortunately, beyond the scope of this thesis. At this point, Immersion programs are still being used in schools.

Ten different classroom methods have been outlined for teaching second languages. Table 3.8 presents the main characteristics of these methods for comparison. The similarities of some of the methods, as well as the trends in language teaching methods, can be observed.

Table 3.8 - A comparison of the main characteristics of the Second Language Methods outlined in this thesis

METHOD	Grammar-Translation	Direct Method	Audio-lingual method	Total Physical Response	Natural approach	Community Language Learning	Silent Way	Suggestology	Communicative language teaching	Immersion
Language spoken by teacher	L1	L2	mostly L2	L2	L2	L2 and L1	Silent most of the time	L2	L2	L2
Role of teacher	Controls class; Helps with translation; Demands perfection	Native speakers; Controls class; Demonstrate vocabulary and ask questions	In control; Has students repeat dialogues, phrases	In control; directs students through commands	Models comprehensible input	Translates students ideas; Corrects grammar and pronunciation	Guides learning; Remains silent as much as possible; Pushes students to think on their own	In control; Send out good vibes; Reads dialogues to music	Guides, not controls; Provides activities	Teach other subjects using the target language
Language spoken by student	L1 in translation	L2 only	L2 only	L2	L2, L1 or mixed	L1 and L2	L2	L2	L2	L2
Delayed speech production?	No speech production	No	No	Yes	Yes	No	No	Not specifically	Not specifically	No
Spontaneity in speech encouraged?	No	No	No	No	Yes	Yes	Yes	Yes (as new identities)	Yes	Expected
Error correction?	Yes	Yes	Yes	No	No	Yes, in later stages	Yes	Secondary to communication	No	Not mentioned
What is predominantly taught	Translation, grammar rules, vocabulary via bilingual word lists	Vocabulary (object-centred), pronunciation by imitation	Pronunciation by imitation, structure of language	Vocabulary through actions, listening comprehension	Vocabulary through demonstration	Vocabulary, translated from what students want to say, sharing feelings	Symbols, words, problem solving by students	Vocabulary through memorisation	Function of language, meaning in speech acts	Communication through listening

METHOD	Grammar-Translation	Direct Method	Audio-lingual method	Total Physical Response	Natural approach	Community Language Learning	Silent Way	Suggestology	Communicative language teaching	Immersion
Dominant classroom activities	Grammar, drills, translation	Meaningful communication and questions and answers	Drills, dialogues and response	Acting out commands	Meaningful communication	Meaningful communication and discussions	Manipulating objects and discovering how to describe them	Relaxation, listening and then role playing, games	Listening activities, functional activities and social interaction activities	Learning other topics through language
Special classroom requirements	Classical texts in L2	Small classes	Audio tapes, visual aids, language labs	None	None	Small class	Charts and coloured rods	Comfortable chairs, rugs, flowers, music	Authentic materials	None
Skill emphasis	Reading, translation	Listening, speaking	Speaking, listening first	Listening, speaking and reading	Focus on listening and then speaking (reading, writing later)	Speaking and listening, reading and writing later	Speaking, understanding	Listening, reading, speaking and writing	Communication - speaking and writing	Listening and speaking first
Vocabulary	Controlled and emphasised	Controlled and emphasised	Controlled, de-emphasised in favour of structure	Controlled and emphasised	Emphasised and free (according to class needs and desires)	Class determines importance and what is said	Guided by teacher initially, but then controlled by students	Common words guided by teacher; Secondary to whole sentence	Meaningful; relevant to students	As needed for other subjects, not emphasised
Pattern drills?	No	Yes	Yes	No	Only in language labs	No	No	No	No	No
Written grammar exercises?	In class and for homework	Not used	Restricted use	None	Assigned as homework	No	No	No	No	Not at beginning - grammar not addressed till later

METHOD	Grammar-Translation	Direct Method	Audio-lingual method	Total Physical Response	Natural approach	Community Language Learning	Silent Way	Suggestology	Communicative language teaching	Immersion
Theoretical base	No real theoretical base	Weak theoretical base	Behaviourist learning theory - belief that language production is a habit	Mirroring first language acquisition	Communication and relaxed, delayed speech production will encourage acquisition	Learning a new language is like dealing with a problem - learner's needs must be addressed	Learning is facilitated if learners can create and discover	Whole brain should participate in learning, Analysis and synthesis should happen together, Learning is conscious and unconscious	There is a need for communicative competence - get students using real communication	Communicative competence will follow real exposure to language
Unique characteristics	Focus on reading and translating	Attempt to create a L2 environment to model correct speech production	Focus on perfect speech production	Use of commands and actions to learn language	Students listen and have meaningful discussions	Student conversation is translated; Support for each person	Students discover and create their learning	Whole sensory experience; relaxation	Learning is more important than teaching	Teach other subjects using target language
Major goal	Grammar and translation	Communication and accuracy	Structural accuracy	Comprehension and production of real language	Communication fluency and range of expression	Low stress, learn to speak and understand	Get students to think about what they want to say and how to say it	Tap reserve part of brain for more efficient, joyful learning	Meaningful communication	Communication and comprehension
Drawbacks	No theory, and does not enhance communication abilities	Need small classes and native speaking teachers; weak theoretical foundations; Revolutionary in its time	No long term proficiency; Boring; No real communication used for a long time	Not effective for higher levels; Speech production is too rehearsed	Hard on teachers; very little specific guidance; students are at varying levels	No real plan or direction; Fluency takes a long time; Highly dependent on translation abilities of teacher	Little guidance for students, which can be overwhelming; Rods and charts wear thin	Teachers need extensive training; Need whole classroom to be geared to this method	Little guidance is provided for teaching early classes	Stressful situation for young children

In examining Table 3.8, *use* of the second language, both by teachers and students, can be seen as an important part of most language teaching methods. It can also be observed that grammar, vocabulary and meaning have been key components of language education over time. As well, meaningful communication can be seen to be an increasingly important aspect of language teaching.

3.6 - GUIDELINES FOR TEACHING SECOND LANGUAGES

Language learning, as it has been shown, is a complex and varied topic. The "right" way to teach languages is not an absolute, as language learning varies with the learner, the language, the teacher and the situation. Although ten different methods have been outlined in the previous section, current thought is moving away from one absolute method for language teaching (Stern, 1992). Every proposed method can be useful in some ways, but they also have drawbacks and limitations. Stern (1992, 277) states that it is very important that "we learn to operate with flexible sets of concepts which embody any useful lessons we can draw from the history of language teaching but which do not perpetuate the rigidities and dogmatic narrowness of the earlier methods." The actual method, itself, can be less important than the classroom situation. Certainly the most appropriate method will depend upon the students, the teacher and the resources that are available.

Rather than attempt to describe the best way to teach languages, this section will provide some general guidelines, based on the available research, that should help to make second language teaching and learning most successful. It is a suggestion of important

things to keep in mind when designing a second language program, based on the trials and errors of the methods that have been outlined. This section goes past the specific methods that have been recommended and looks more closely at the learning situation. It is divided into the topics of input, learner, teacher, and classroom and materials.

3.6.1 - The Input

Krashen (1981a) outlines four important characteristics of optimal input for second language learning. The first is comprehensibility. According to Krashen (1981a) it is impossible to acquire when we do not understand the message encoded in the language. He claims language must be comprehensible to enable acquisition. Ellis, Tanaka and Yamazaki (1994, 481) modify this by arguing that "it is not comprehensible input but comprehended input that is important." They go on to say that "interaction provides the means by which learners can successfully strive to comprehend." The second language classroom can be an effective place to learn. In a classroom, the input can be catered towards students and this environment can allow them to interact with the language input so that they comprehend it.

Krashen's second characteristic is that the input should be interesting and relevant in order for its meaning to be processed. This is particularly important, as it suggests that second language classrooms should focus on 'real' and whole communication, as opposed to meaningless drills and exercises. This belief is evident in the approaches to second language teaching, as repetitious drills and exercises have tended to be gradually replaced with more meaningful communicative activities. Students will be motivated to learn if language learning focuses on subjects they are interested in.

The third characteristic is that language should not necessarily be grammatically sequenced. Research has not been able to show the 'correct' order for the acquisition of grammatical structures. In addition, individual students are at highly varying levels of learning. They each need their own amount of time on a given topic. By sticking to a grammatical sequence, some students will be ahead of or behind the given level, and the focus cannot be on real communication. As Krashen (1981a, 104) says, "the answer is using language to communicate real ideas." Again, the decline of grammar-focused exercises is evident in the teaching methods outlined above.

Finally, Krashen (1981a) feels that sufficient quantity is an important characteristic. The new language should be used whenever possible in the classroom. This does not necessarily mean that the native language is excluded from the classroom, or that instruction is solely in the target language. It just suggests that students be exposed to as much of the target language, in various contexts and situations, as possible.

3.6.2 - The Learner

Each learner brings unique qualities to the classroom. Ellis (1986, 122) has come up with a summary of qualities of the 'good language learner', based on his own and other research:

The good language learner will:
- Be able to comfortably deal with the group dynamics of a classroom learning situation, and not develop negative anxiety and inhibitions.
- Seek out additional opportunities to use the target language as much as possible.
- Use all possible opportunities to practise listening to and responding in the second language, with attention given to meaning as opposed to form.
- Identify and use various study techniques which help them to learn.
- Be an adolescent, ideally, in order to best grasp the early stages of grammatical development.
- Possess sufficient analytical skills to perceive, categorise and store the linguistic

features of the new language.
- Have a strong reason or desire to learn the second language.
- Be prepared to experiment and take risks in the learning process.
- Be able to adapt to different learning conditions.

A good learner should be open to learning a new language and to the language learning

process itself.

3.6.3 - The Teachers

Teachers should be well educated in the way that people learn. They should be

dedicated to providing a classroom situation that meets the needs of their students, and to

selectively choosing portions of different second language techniques that work best.

They should also be committed to providing or supplementing the input required for

learning in a meaningful and interesting way. They should focus on the meaning of

language. They should also be prepared to act as a facilitator of learning, taking control in

some situations, and letting learning occur spontaneously and naturally in others

(Littlewood, 1981). This is no small task for today's teachers, and simply represents the

ideal situation. In fact, Horwitz (1986, 684) explains that "many teachers feel frustrated

and overwhelmed, not only by the sheer number of research studies, but by their confusing

and sometimes contradictory results." Strategies for teacher training may need to be

investigated and re-evaluated, in light of the current research (Canale & Swain, 1980;

O'Malley & Chamot, 1990).

3.6.4 - The Classroom and Extra Resources

The second language classroom should be an active place where the language comes

alive. It should be a supportive environment for all stages of learning, and one that makes

students eager to learn. The focus in the classroom should be on frequent and varied exposure to the language, rather than on specific instruction (Ellis, 1984). Classroom language, and the resources used, should focus on all of writing, listening, reading and speaking (Swaffar & Stephens, 1981). Resources used within a classroom should go beyond just a textbook, and could include such materials as wall charts, flash cards, video tapes, wall maps, audio recordings, pictures, games, song books, dictionaries, computer programs, conversation books and poetry collections (Stern, 1992). All of these materials should be used to promote communication in the classroom (Ellis, 1984).

3.7 - SUMMARY

Language learning and teaching are complicated subjects. They are closely linked to psychological, linguistic and educational research. The research cannot be easily summarised, and does not necessarily point in any one direction. As Blair (1982c, 13) states:

> "Like the stars, the essence of language may be forever beyond our reach. We probe it only indirectly and tentatively with crude instruments - much like astronomers dealing with light emanations from stars. And if language if complex and intangible, so is learning and instruction. We may approach the study of learning and instruction through scientific methods, but it seems doubtful that they will ever be reduced to laws of formulas that will render them predictable."

While this makes the prospects for teaching languages seem overwhelming and rather hopeless, Bialystok and Hakuta (1994) point out that there are no absolute barriers to second language acquisition. We should not feel hopeless. They go on to say that we all have the ability to learn a second language, although all people cannot learn second

languages equally. Each of the methods outlined in this chapter have worked at some point. As Stevick (1991, 2) explains, these methods can "work again for teachers who see when, how and why they fit their students' needs."

The number of choices for language teaching is still increasing (Altman, 1981). There has, however, been a general shift in the proposed approaches over the past century. There has been an increased focus on meaningful communication as part of language learning. Communication, comprehension, and the meaning of language have become more important than the rules, structure and form of language. Language learning should be real and natural, sensible, interesting, relevant, and have real purpose for the student (Goodman, 1986). Bialystok and Hakuta (1994) also claim that there is no single correct method for language teaching. No one method can accomplish all of the aims of language learning. They feel that "learners must take responsibility for acquiring a second language. And teachers, for their part, must support and guide this effort. With no single correct path, language learners and teachers become free to negotiate their own goals and to chart their own route" (210). Flexibility, for teachers, learners, and the classroom itself, is a key feature of modern language learning. The guidelines for teaching language point to increasing variety and creativity in the classroom. All aspects of language, including the vocabulary, grammar and meaning, should be considered and included in some way.

This chapter, after reviewing the second language literature, sought to determine how languages are taught, as well as what is taught. Various methods were outlined, as well as the important characteristics of teaching languages. This information can be very useful

when considering map education. The next chapter seeks to examine the ways that map comprehension, or map literacy have traditionally been taught. In a similar manner to the current chapter, it will look at the methods used to teach cartography as well as what portions of cartography have been considered important. These two chapters will then be compared in Chapter Five, in an attempt to provide some direction for map education.

CHAPTER FOUR

A REVIEW OF LEARNING AND TEACHING MAP COMPREHENSION

4.1 - INTRODUCTION

Map use is an important yet complicated task. It is, however, a task that many people are not comfortable with. To learn more about the recent methods of teaching map comprehension, it would be useful to approach it in the same way as was done for second languages, reviewing the various methods that have been used to teach cartography over time. It is difficult, however, to take a similar approach. In the last chapter, it was explained that all humans are able to learn languages. Substantial language learning research has been supported by the fact that it is difficult to survive in our world without being capable of speaking at least one language. Map comprehension, on the other hand, is something that is incredibly useful, yet easily ignored. One does not need to be literate in the language of cartography to survive. Unfortunately, this has resulted in research on teaching about maps that is not nearly as extensive or theoretical as it is for language teaching. The research is also scattered between the fields of cartography, geography, psychology and education (Blades & Spencer, 1987). Although each of these fields has been interested in map education, they have all approached it from different angles. Cartographers have tended to be interested in map design, geographers in the applied uses of maps, and educationists in the best way to teach map work in school. Psychology, on the other hand, has been mainly interested in the development of spatial awareness, and has done little specific work on the problem of map use (Spencer, Blades & Morsley,

1989). This chapter provides a look at the ideas for map education which have resulted from this disparate research, knowing that there is room for improvement for former map education. It attempts to document some of the common themes of this literature.

It begins by looking at why we should teach cartography and map reading and how they should be an important part of geographic education. It outlines the factors that affect cartographic learning, as well as when this education should happen. It then discusses past and recent examples of map education to examine how it has been taught in the past. A review of the important ideas of this teaching is provided.

4.2 - GEOGRAPHIC AND CARTOGRAPHIC LEARNING

Map reading is generally lumped under the subject of Geography in education systems. Geography is a complex, extensive and dynamic topic, and unfortunately "the research base about children's geographic learning is limited" (Hickey & Bein, 1996, 118). Although it is well established that Geography is an important topic (Casper, 1961; Boardman, 1986; Geography Education Standards Project, 1994; Hickey & Bein, 1996; Commission on Geographical Education, 1997), it is one that is often neglected, overlooked or undervalued in school systems (Freundschuh & Sharma, 1995; Anderson, 1996; Hickey & Bein, 1996). It is useful to examine why cartography is an important part of geography, and why it should be reinforced as a vital part of education.

4.2.1 - Map reading is an important part of Geography

Geography has been recognised as an important aspect of the education system. Marran (1992) notes geography's practical value. He says that geography "is immediately

and constantly usable because it connects data to real situations" (140). Mills (1988) lists graphicacy, world knowledge, international understanding and environmental awareness as the unique contributions of geographic education. In 1994, the American Geographical Society, along with the National Council for Geographic Education and the Association of American Geographers, published a book of National Geography Standards for geographic education in the United States. This is one of the few examples that exists of such standards. In most cases, geographic and cartographic education are not co-ordinated in such a large-scale fashion, but may rather be left to the discretion of the individual school boards or teachers. The aim, as stated by the Standards (1997, 34), was to create "a geographically informed person (1) who sees meaning in the arrangement of things in space; (2) who sees relations between people, places and environments; (3) who uses geographic skills; and (4) who applies spatial and ecological perspectives to life situations". The value of these skills, as stressed by the standards, indicate the importance of geography.

The National Geography Standards, which have been relatively well received by critics and teachers, divide geography into six essential elements, which are then further subdivided into eighteen standards. These are shown in Table 4.1. Maps are tools of analysis which are applicable to each of these elements and standards. In fact, using maps is the subject of the first two standards. How to read and use maps is seen, therefore, as a crucial part of geographic education.

Table 4.1: The Eighteen *Geography for Life* Standards

The World in Spatial Terms

The geographically informed person knows and understands:

1. How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective
2. How to use mental maps to organise information about people, places, and environments in a spatial context
3. How to analyse the spatial organisation of people, places, and environments on Earth's surface

Places and Regions

The geographically informed person knows and understands:

4. The physical and human characteristics of places
5. That people create regions to interpret Earth's complexity
6. How culture and experience influence people's perceptions of places and regions

Physical Systems

The geographically informed person knows and understands:

7. The physical processes that shape the patterns of Earth's surface
8. The characteristics and spatial distribution of ecosystems on Earth's surface

Human Systems

The geographically informed person knows and understands:

9. The characteristics, distribution, and migration of human populations on Earth's surface
10. The characteristics, distribution, and complexity of Earth's cultural mosaics
11. The patterns and networks of economic interdependence on Earth's surface
12. The processes, patterns, and functions of human settlement
13. How the forces of co-operation and conflict among people influence the division and control of Earth's surface

Environment and Society

The geographically informed person knows and understands:

14. How human actions modify the physical environment
15. How physical systems affect human systems
16. The changes that occur in the meaning, use, distribution, and importance of resources

The Uses of Geography

The geographically informed person knows and understands:

17. How to apply geography to interpret the past
18. How to apply geography to interpret the present and plan for the future

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Source: Geography Education Standards Project (1994, 34).

4.2.2 - Why improve Map Education?

Patrick Bailey (1984) outlines four major reasons why we should try to improve cartographic knowledge in schools. The first is that most people are not able to effectively use a map once they leave school. Maps are primarily learned about through school geography lessons, as opposed to being learned in any other forum (Board, 1981). In general, however, this education is felt to be inadequate (Bailey, 1984; Blades & Spencer, 1987; Castner, 1987) and children are not prepared to effectively use maps (Giannangelo & Frazee, 1977). Anderson (1995, 64) explains that "young elementary school children rarely perceive themselves as map users." Hopkins, Paddon and Brunanski (1981) found that two thirds of the Grade Twelve Alberta students they surveyed were unable to use a map to locate Lake Huron. Blades and Spencer (1987) also report on several studies which show that few people are able to confidently use a map, and in many cases they will avoid using one altogether, as highlighted in Chapter One. It can be inferred from the research that students and adults are not always very good at using maps.

Bailey's second reason is that maps are used often in everyday life. In school systems, maps are included not only in geography, but they can also be found in biology, history, physics, chemistry, technology and design (Bailey, 1984). Steiner (1993) points out that there is an abundance of geographical data in the world, much of it presented in cartographic form. Maps are featured in newspapers, on television, and found in shopping malls, amusement parks, universities, subway systems and large buildings. According to Blades and Spencer (1994, 161), "the rapid development of computer-based Geographical Information Systems is likely to make spatial representations even more important" for

people. Being able to use and read a map are skills that can be useful in many different disciplines and aspects of life.

The third reason Bailey gives is that map learning encourages students to give order to the spatial relationships in the environment. He feels that enabling students to develop this ability is an essential part of education. Ottosson (1988) explains that map features can be compared to real features, and the spatial attributes of these features can be examined. In doing so, a student can develop spatial awareness and reasoning. In turn, being more aware of spatial relationships in the world will also help students with their ability to use maps (Blades, Sowden & Spencer, 1995).

Bailey's final reason for improving map education is that he feels that "in order to read, much less to interpret such maps, [hard] skills have to be acquired" (62). He likens map reading to learning how to play the piano, stating that practice must occur before a person can read anything meaningful from a map. Christophel (1961, 285) states that "map-reading skills and abilities are developed gradually. Constant practice, frequent review, and re-teaching are necessary." Cartographic skills, such as knowing the cardinal directions, being familiar with grid references, or being able to recognise map signs, are best acquired with the practice, exposure and repetition that thoughtful and effective education encourages (Hayes, 1992). People rarely develop these skills on their own, and as such it is up to the school system to teach them.

These reasons, and the support for them, indicate that there is a need for more effective map education in school systems.

4.3 - FACTORS THAT AFFECT MAP LEARNING

Many of the factors that affect language learning hold true for cartography. Research looking specifically at factors affecting map reading is limited. Gerber (1984a, 205) outlines that "the map user is the most unpredictable variable in the cartographic communication process. Each map user brings varying intellectual abilities, environmental influences and experiences to the map-reading situation." Anderson (1996, 122) also explains that "little attention is paid to developing student's comprehension of a map's components and how a map functions," and so "little is known about the needs, knowledge and abilities of young map users." Several authors suggest various factors which they feel influence a person's ability to understand maps. These include: visual perception of symbols, previous experience with maps, age, education level, home environment, spatial abilities, drawing skills, attitudes towards maps, and intelligence level (Balogun, 1978 [in Gerber, 1984a]; Wood, 1972; Blaut & Stea, 1971). Many of these factors do overlap those discussed for language learning.

Gerber (1984a) conducted a study that examined these factors and their influence on children's map-reasoning level. Through a correlation study, he found that several of these factors interacted, and all of them, except for attitudes towards map characteristics (such as texture or light), played some part in children's ability to understand, interpret, draw or use maps. Gerber does not comment on this, but does feel his findings should be further confirmed. As is often the case, the factors overlap and are not independent, making it extremely difficult to determine what makes the 'good map learner.' Gerber (1984a) does stress that "children should be treated as individuals when they read and

draw maps" (211) in the map classroom, as they will each have different map abilities.

4.3.1 - When to teach map comprehension

The age at which children should or can begin to learn about maps is a topic that has been explored by many authors. This research has created a somewhat heated, yet interesting, debate. The age when children first understand a map as a representation should be an important consideration for any educational decisions (Blades, Sowden & Spencer, 1995).

Traditionally, the research surrounding map education was greatly influenced by the work of Piaget (Blaut, 1987). Piaget's theory of spatial development proposed that conceptual spatial reasoning, or the ability to consider spatial representations, is not developed until approximately the age of seven (Blades, 1991; Blades & Spencer, 1994). Blaut (1997b, 169) explains that "in Piagetian theory, only when they reach the concrete operations stage do children acquire the ability to 'project' from the earthbound perspective of ordinary experience to the overhead perspective of a map or aerial photograph; only at the age of about seven, therefore, are most children ready to begin real map work." While this view was prevalent in the educational research, there was little or no reason to begin any map-thinking education in the early grades (Sowden et al., 1996). In fact, map education was usually withheld until at least age seven, as was a great deal of the research that looked at mapping abilities (Spencer, Blades & Morsley, 1989; Blades & Spencer, 1994; Blades, Sowden & Spencer, 1995).

Since the 1960s and 1970s, however, research has begun to show that children do have mapping abilities, and that these are present by age four or five (Sowden et al.,

1996). There are numerous studies that have explored this idea. For example, Bathurst, in 1961, stated that he had "observed first grade children working with and understanding simple maps that had been made in the classroom" (26).

Blaut and Stea (1971) outline a series of studies that they performed. In their first study, they found that children (of median age six years and five months) were able to identify features on an aerial photograph, which was considered to be a map-like representation. This was later repeated, and they found that children as young as three years were also able to identify features. Blaut and Stea felt that these children, by their ability to identify, were exhibiting an understanding that the photographs represented a land area (Ottosson, 1988). A further study by Blaut and Stea (1971) includes a test of first graders. These children were able to successfully identify roads and houses on an aerial photograph, trace these shapes onto acetate, colour code these 'signs' with the aerial photograph removed, and then use their 'map' to navigate between two houses. Blaut and Stea concluded that "pre-literate children of five and six can deal with map-like representations and display immense pleasure in doing so" (393). Sowden et al. (1996) later confirmed this research as they found that four year olds were able to identify features on an aerial photograph, and those over four and a half years were able to draw an appropriate route on the photo.

Several other studies also report on children's abilities to understand map symbols. For instance, Ottosson (1988) reports that children aged four to six were able to identify and recognise some abstract symbols on a map. Spencer, Blades and Morsley (1989) indicate that "young children can appreciate a view of the world from above even when,

as in the case with a map, the view is one that is conventionalised and includes symbols" (141). All these studies indicate that children can understand the symbols that are on a map.

Another series of articles (Bluestein & Acredolo, 1979; Blades & Spencer, 1986; Blades, 1991; Pearson, 1994a) look at the navigation or way-finding abilities of young children using a map. Bluestein and Acredolo were the first to use an environment through which children could walk to test children's mapping ability (Blades & Spencer, 1994).

In their study, Bluestein and Acredolo (1979) showed simple maps of a room to children aged three to five years. The room contained four identical boxes and some simple furniture. The location of a hidden toy was shown on the map to the children, and they were then sent to find the toy in the room. Several different conditions, such as having the map in or out of the room, and rotating the map, were tried. Bluestein and Acredolo found that all the children were able to understand that the cartographic symbols represented objects in space, which is in agreement with the work mentioned above. They did find, however, that the youngest children (aged three and four) were not able to compensate for the map being mis-aligned.

Blades and Spencer (1986) performed a similar experiment, using a model of a room rather than a map. They found that children aged three to four could successfully use the model to locate the toy's hiding place, again indicating that they understood the symbolic representation of the model. In further studies to see if children could follow routes on a map, they found that children older than 4.5 years were better able to use the map than

those younger. Blades (1991) concluded that children aged three and four are able to understand some basic map tasks, and the correspondence to the environment, particularly when the maps are correctly aligned for them.

Pearson (1994a) involved five year olds with a series of map activities. She found that five year olds were able to use a map, could navigate, draw routes, follow a marked route, and understand symbols. She stated that the five year olds "understand that maps can help us to find our way, and confidently accepted the idea of symbols to represent the ground features" (33).

Studies like these, according to Ottosson (1988, 31), "consistently indicate that many children, during their fifth year of age, can understand simple maps and use them to perform easy tasks." The implication, therefore, is that map education should begin early for children, ideally at or before school-entering age (Balchin & Coleman, 1966; Blades, Sowden & Spencer, 1995; and Blaut, 1997a & b).

Blaut (1991) has even gone so far as to suggest that children may possess a 'Mapping Acquisition Device', modelled after the Language Acquisition Device (Liben & Downs, 1997). He describes mapping as a natural ability or habit, and implies that children are born with a latent map understanding or ability (Blaut, 1991). Map reading experience will serve to increase that ability, and make children more proficient in map reading (Freundschuh, 1990).

At the other end of the scale, Liben and Downs (1997; also Downs & Liben, 1997) have been referred to as having a "pessimistic view" (Blaut, 1997a, 152) when it comes to teaching children map skills. Liben and Downs feel that while they are able to recognise

some symbols, "young children are still struggling to understand" (162) all aspects of symbols and what they represent. They agree that "young children show some basic understanding of the spatial properties or maps", yet they go on to say that "children have only limited understanding of the geometric correspondences between map and space" (162). For map education, Downs and Liben "argue for early beginnings but not early mastery of map understanding" (Liben & Downs, 1997, 159). They feel that curricula should be carefully sequenced for varying levels of children's understanding.

Blades, Sowden and Spencer (1995), after consideration of some of the studies, feel that a true appreciation of how a map represents space may not be present until age four or five, unlike some of the earlier estimates of age three or even two. They found that children aged four had some difficulties using spatial relationships, such as 'next to' or 'between'. Blades and Spencer (1994) also point out that younger children do have greater difficulty locating themselves on a map, as well as distinguishing between two identical features in different locations.

Despite these limitations to very young children's mapping abilities, there still seems to be agreement that map reading education should begin as early as possible (Dekker & Saimis, 1961; Sabaroff, 1961; Blades, Sowden & Spencer, 1995; Sowden et al., 1996; Downs & Liben, 1997). Bathurst (1961, 26) described that "the skills required in reading maps should begin with children in the primary grades... Map reading, like word reading and picture reading, is a developmental continuing process." Balchin and Coleman (1966), see no reason why it cannot start very early, as map skills can progress from the very simple to the very complex. Freundschuh (1990) hopes that the early natural abilities

that do exist will not be overlooked as map education programs are developed. There is a need to develop appropriate ways to teach young children, from school-entering age, about maps (Blades, Sowden and Spencer, 1995).

4.4 - IDEAS UNDERLYING FORMER MAP EDUCATION

It has been shown above that map education is important, and that it can begin at an early age. There is still, however, little known about how to teach map comprehension, or how students learn most effectively. The research that does exist is rather scattered, both in time, and in research fields. There have been few or no agreed upon aims or standards for early map education.[2] The National Geographic Standards (Geography Education Standards Project, 1994) are a recent example of national geography educational guidelines. Although they take a step to provide guidelines for geography education, they do not address the earliest levels of education. They start by recommending what a person should be aware of by Grade Four. They establish that map use is a crucial skill, yet they do not specifically address how to teach this skill.

In language education, the ultimate aim is communication in the target language. Ideally, a person would be able to speak, read and write in the language in any situation. Language programs have identified the simple parts of the language and typically build

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[2] There is a body of literature on cartographic programs at the University level which establishes goals for this level of education. These programs, training people to become skilled cartographers, tend to deal with advanced topics of map production, including data acquisition, management of spatial data, graphics and advanced levels of measurement, statistics and map design. A well-trained cartographer should have a full understanding of each of these and could be described as being completely 'fluent' in the 'cartographic language'. As these programs focus on the highest levels of cartography, as opposed to the fundamental map reading and interpretation skills that are being discussed in this thesis, they have not been included in this discussion.

upwards from there. Map education is more nebulous. The simplest map concepts, or how to begin or order map education, are still generally unknown. As was already indicated, map education in the school systems has been considered inadequate, (Blades & Spencer, 1987; Castner, 1987) due to the poor levels of map literacy observed in students.

The research for this chapter, which reviewed more than 140 publications, revealed little cohesion in the past approaches to map education. Many articles have been written by teachers simply to address one specific classroom problem, such as students not being able to understand contour lines. These articles often have very little theoretical background, and tend to be based on the ideas and successes of the individual teacher. Several other articles review the design of children's atlases, intended as aids to map instruction, with no mention of the specifics of map education. Other works discuss what the important portions of cartography are, yet rarely examine how children can or should specifically learn them. There is little consistency, and there are no approaches or methods for teaching cartography that are well-documented, developed and understood, unlike language education. As such, to summarise these publications is a difficult task. My research found that there are no well-developed systems for teaching map comprehension, from a young age, which comprehensively address all aspects of map education from introductions to advanced levels of map use.

One observation, from the past map education research, is that several topics turn up often in the suggested map activities. The most commonly referred to topics were spatial awareness, maps as a representation, generalisation, scale, symbolisation, location and

direction. While there were no agreed upon ways to teach these topics, they appeared to be accepted (unofficially) as important aspects of map education.

What can also be summarised, from this literature review, are several relevant ideas which emerge as important from past map education. These ideas, while they do not specifically address *what* to teach in map comprehension, have guided former map education and have helped teachers to create what they believe is a conducive learning environment for students. The five most common ideas suggested are: 1) Providing exposure to maps; 2) Making map learning hands-on and experiential; 3) Making map learning interesting and relevant; 4) Moving from what is known to what is unknown; and 5) Linking maps and mapping to other topics. Each of these is outlined in the following section. Examples from the literature of how they have been used or recommended for classrooms, and the theoretical background that does exist, are provided. These ideas can still be used as relevant for map education today, as they serve to set the tone for geographic learning.

4.4.1 - Providing exposure to maps

Several authors have suggested that students should be exposed to maps and globes as early and often as possible (DeSart & Trytten, 1961; Petchenik, 1985). Greater exposure to maps will hopefully serve to increase a child's spatial awareness as well as their understanding of map representations. Kulhavy, Pridemore and Stock (1992) did a study that looked at people's map experience, and their ability to extract geographically important information from a map. They found that people with greater map experience were able to extract cartographic information more effectively, and were better able to

visualise the space being shown by the map. Saku (1990) also looked at map experience, and found "that geographic experience does have an impact on map use performance" (121). This experience could begin with map exposure for young children.

The literature has made a push for exposing students to all different kinds of maps, spatial references and geographic pictures (Petchenik, 1985; Rogers, 1997). Bailey (1984) recommended building up a school's collection of local maps and aerial photographs, including maps of various scales, types and mediums. A Maps Day, where students bring in, exchange and examine all the maps they can find, has also been suggested (Rogers, 1997).

4.4.1.1 - Playground maps

A specific example of this type of map exposure can be found in Goble (1961), David (1990), and Hickey and Bein (1996). These authors have all spoken of activities that can be carried out once a large playground map has been created. This type of map, generally painted on some portion of the school's playground, is an easy way to provide exposure to maps for the entire school. Goble (1961, 283) explains that "it's one of the simplest - yet most ingenious - training aids at the school. It teaches something of the size, shape and location of the states, even while they're playing." Students have been able to use the map to compare sizes of states by seeing how many people they can stand on each one; locate famous landmarks, such as Walt Disney World, and determine which ones are farthest from home; or play games such as 'Simon Says' or Hopscotch using certain directions or locations as limits. All three authors feel these types of maps can be a valuable learning tool where children have the opportunity to learn about several

geographic concepts just by walking over it.

4.4.1.2 - Globes

Globes have been a well-used classroom item that can be highly useful for map teaching, and another example of map exposure. Using globes in the classroom can help students to better understand the entire world (Wright, 1994). Keates (1996, 89) explains that it is often said that "the only satisfactory representation of the Earth is a globe, retaining its three-dimensional character." According to the Geography Education Standards Project (1994, 62), "as scale models, globes constitute the most accurate representation of Earth in terms of the properties of Earth's surface features - area, relative size and shape, scale and distance, and compass direction are proportionately and therefore correctly represented on globes."

Globes have been used to help to remind students of the true shape of the earth, as well as showing the location of the child's home relative to the rest of the world (Sabaroff, 1961). They are also the best way to explain to students "the true nature of latitude and longitude, the changing seasons and other aspects of earth-as-a-planet geography" (Bailey, 1986). Globes, although they can be a more advanced topic, can help children realise the spatial arrangement of the real world.

4.4.1.3 - Children's atlases

Most maps used in the classroom have typically been found within textbooks or atlases. Atlases, especially, have been widely used and deemed important for classrooms (Sandford, 1985). Sandford (1980) found that 74 percent of sampled secondary school geography students had access to an atlas at home. Because of their popularity, there has

been substantial research in the last twenty years that has examined the design of children's atlases, and attempted to provide suggestions for making them more effective. This section will attempt to provide a brief review of this research.

Children's atlases have, in the past, tended to be simplifications of adult atlases (Thake, 1976; Gerber, 1982). They are generally designed by cartographers who have little or no contact with the educational system (Keller, Hocking & Wood, 1995). The design of an atlas can also be affected by external factors, such as money and fashion, as opposed to focusing specifically on the children's needs (Petchenik, 1985). This has led to the creation of a generation of atlases that do not effectively teach students about maps and geography (Wood, 1987).

Atlases have recently evolved to include more than just maps. Text, charts, graphs, photographs, aerial photographs, remote sensing images and various graphics have also been included to supplement and enhance the information on the maps (Keller, Hocking & Wood, 1995). This can create an eye-pleasing book, but care needs to be taken to ensure that the information is presented in a useful and effective manner (Castner, 1987). Atlases are also now available in electronic format, to be read on computers. This presents new possibilities and challenges, with the advantage of technology being enticing to students. Winn (1987) outlines nine points considered important for selecting or designing a children's atlas:

- The map or graphic should facilitate comprehension and make the map easier to understand;
- Elements, patterns and sequences should be clear and unambiguous;
- Features should be represented realistically, with enough detail, yet the maps should not overburden the student's processing abilities;
- Maps and graphics should follow all normal cartographic conventions;

- Strategies for using the maps should be obvious or indicated;
- The maps or graphics should facilitate the completion of these tasks;
- The tasks should be within the repertoire of students at that stage of development;
- Attempts should be made to develop the skills that are useful and that students need.

Ideally, early mapping activities would focus on an area that students were familiar with, and should help provide meaningful education (Petchenik, 1987).

Various specific suggestions have resulted from the atlas design research[3]. For instance, Sandford (1985) has suggested placing inset globes on every map page indicating the global position of the place shown on the map. This is in an attempt to help students to comprehend the map's location, orientation and scale in relation to the rest of the world. Keller, Hocking and Wood (1995) caution about making atlases and maps too cluttered, crowded and confusing for students, while Sandford (1987) warns about over-generalisations and making maps too simplistic. Wood (1987) also cautions of sacrificing nomenclature and accurate topography in the effort to make maps more interesting to children. Dahlberg (1961) and Sandford (1985) both felt that lines of latitude and longitude should be included on every atlas map. Gerber (1982) looked specifically at text on atlas maps, and how it affected children's map perception. He made recommendations for the style and size of font so that students could find it both interesting and meaningful. For example, he found 6-point and 8-point Univers Medium and 10-point and 12-point Univers Bold Condensed were most easily understood.

It seems that there are great demands placed upon atlas and map design, yet the research into how these atlases affect children's learning has not been well established.

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[3] There is a solid body of literature which looks specifically at the design of maps in atlases. This section provides a simple overview of this literature.

Further research into the curriculum, the content and the design of atlases is needed to ensure their utility (Carswell and DeLeeuw, 1987). In doing this, the use of atlases can hopefully be used to help provide increased exposure to maps and to help children understand the information presented.

There are many different ways that children have been exposed to maps in classrooms, including playground maps, globes and atlases. This exposure can help to ensure that children learn to appreciate various map forms from an early age.

4.4.2 - Making learning hands-on and experiential

It has been suggested that map education should also be hands on, as research has found that young children can learn more effectively by doing (Palmer, Smith & Grace, 1993; Commission on Geographical Education, 1997). Classrooms, as interactive environments, have attempted to involve each student in learning (Paul, 1993; Steiner, 1993). Atkins (1983) performed a study in which he found that young children who were involved in experiential learning activities were better able to remember what they had learned than a group that learned the same information without experiential activities. His results showed better performance both immediately after learning, as well as one year after the learning had occurred. Other teachers concur that this type of learning is effective. Both Angier (1992) and Steiner (1993) suggest collaborative group activities in order to teach about map situations and include all the students. Several other authors (Hayes, 1992; Pearson, 1994a; Hickey & Bein, 1996; Kirman, 1996) have also suggested activities that involve the students and get them to learn about maps through

fun activities. In the growing computer and technology age, children need to be entertained and stimulated more than ever in the classroom.

4.4.2.1 - Making maps

Having students create their own maps appears to be a most effective cartographic activity which has actively involved students and given them the chance to creatively learn about the mapping process. Map making seems to have been a commonly used method of involving students.

More than thirty different authors have provided suggestions for activities that involve students creating maps. They suggest that by getting involved with the mapping process, and by actively recreating an environment that is familiar to them, students can gain a better understanding of what a map is (Dekker & Saimis, 1961; Blaut, 1987; Linn, 1997). By producing a map, regardless of how primitive, a student can be introduced to the ideas of representation and symbolisation (Sabaroff, 1961; Thake, 1976), as well as gaining a better understanding of location, direction, shape, and size (Goble, 1961; Thake, 1976; Palmer, Smith & Grace, 1993; Hull, 1994).

The mapping ideas that have been suggested by authors, and used in the past, range from the very simple to the very complicated. A simple suggestion, for young children, is to create a three-dimensional model map of their immediate neighbourhood, as described by Bathurst (1961) and Sabaroff (1961). Three dimensions makes it less abstract, and helps children to visualise what a map is. From this stage, the teacher can move to a more abstract level by creating a smaller paper map of the same area, with the students' help. Creating maps of imaginary countries or cities has also been suggested (Catling, 1988;

Hayes, 1992; Pearson, 1994a; Marra, 1996). This enables children to be creative, but also forces them to think about the functions of place and location, and how spatial relationships affect a place. Table 4.2 outlines some of the notable articles that have provided suggestions for map making, and the proposed benefits of each one.

In general, it is believed that letting students make their own maps can increase their awareness and understanding of other maps and of the spatial representations that exist on them. It can also keep them actively involved and having fun - a benefit for any classroom. This type of activity can be adapted and included in any classroom, from pre-school to university. Although map making can help children to understand maps, it still needs to be incorporated into a broader cartographic education system to be most effective.

Table 4.2: Examples of Map-making activities

Author	Age	Suggested Map-making Activity	Proposed Benefits
Hawkins & Larkins (1983)	Ages 4-6	• Create a map of their hands, using special symbols for fingernails, knuckles and rings	-introduction to idea of maps (compare hand to map) -introduction to the idea of symbols, or that something else can be used to represent various objects
		• Make a map of desk tops	-introduction to idea of making a map smaller than the actual area
		• Prepare a map of the classroom, including directions, doors, windows, desks, and tables	-helps children to understand direction, and where things are, while reviewing other ideas (symbols, etc.)
		• Create a map of area covered by a field trip by marking all that is remembered on to the map, and including symbols	-practice in the idea of making a map, observing spatial relationships, selecting what to represent on the map, using symbols to represent objects and understanding where things are in relation to one another
Pearson (1994a)	Ages 4-6	• Create routes on a map of gym equipment, and then follow these routes	-understanding what the map represents by using it
		• Create a 3-D village on a play-mat, and then replace buildings with symbol cards. Village map can then be used for play	-full understanding of what the symbols represent, as children actually replace objects
		• Draw maps to accompany stories, such as Little Red Riding Hood	-helps students to think spatially while having fun; helps to reinforce idea of map, and provides more practice with geographic vocabulary
		• Create their own town, and decide which buildings should be located where - and then draw a map (together) of the town	-learn about the practical locations of buildings (why things are where they are), and can be creative
Gutierrez & Sanchez (1993)	Grades 1-2	• Have children observe the area outdoors once or twice a week. Build a compass, and then create maps of all the features they can remember in each direction	-children focus on detail, and observe all aspects of the environment -explore their location, and can learn concepts of direction through use of giant compass
Trifonoff (1995)	Grade 1-2	• After examining other thematic maps, have students design and create their own to show data	-helps them to think about how spatial patterns can be represented on a map -can discuss the appropriate ways to represent this type of information on a map

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Author	Age	Suggested Map-making Activity	Proposed Benefits
Bathurst (1961)	Primary grades	• After a year of observing, children make a three-dimensional map of the community, large enough that students can walk through the streets. The same community map is re-created on a sand table in a smaller form. This can then be re-created on paper, in a reduced form, and using symbols	-hones students observation skills and encourages awareness -realise map represents a real place, as they can actually walk through map to understand it, and it becomes more realistic -can understand what happens when the map is made smaller -Children can understand what the symbols represent, and can see the abstraction that takes place as symbols replace buildings -realise where things are located relative to each other
Marra (1996)	Primary grades	• Children created their own maps of neighbourhoods that were described in storybooks, such as those near a bayou or a volcano. Real maps of these areas could then be compared to the students maps	-helps children to acquire spatial knowledge of areas, and to establish a mental picture of geographic features -also lets them have fun and use their imaginations
Rogers (1997)	Primary grades	• Children made maps of their bodies	-gives them practice in seeing a map form -lets them understand how things, such as their bodies, can be represented in other ways
Goble (1961)	Upper elementary grades	• Students paint a giant map of their country on the school playground, paying attention to scale and location	-teaches students the relative sizes of states -in the creation, students can realise the concepts of scale and ratio -see where states are in relation to each other
Angier (1992)	Upper elementary grades	• Students create their own landscapes using playdough. They then put them in a tub, and add water up to certain marked intervals. At each interval, the outline of the water is drawn onto the model. When finished, the outlines of the contours are traced from above, creating a contour map of the landscape they had created	-great introduction to the idea of contour lines -uses a concrete example to teach a complex idea -understand how contour lines are used to represent the idea of elevation on maps

Author	Age	Suggested Map-making Activity	Proposed Benefits
Hayes (1992)	Upper elementary grades	• Students create a map of their own make-believe country. Features such as a north arrow, lines of latitude, cities, developed areas, transportation, lakes, mountains, swamps, plateaux, deltas and rivers are included	-students need to inspect other maps to understand how to represent items on their maps; they also get practice in cartographic skills and are able to use their creativity
Hull (1994)	Upper elementary grades	• Students, after reading the journals of families travelling during the 1800s, map the journeys taken by the families	-gives children a better understanding of movement, transportation and location -gives a picture to history
Taketa (1996)	Upper elementary grades	• Students create accurate maps from field observations, where they measure directions and dimensions of an area	-gives students direct practice in scale and distance ideas, and let them have fun learning how to create a map
Hughes (1976)	High school and university	• Students create isopleth maps using computers. Groups create the same map, making their own decisions about how to represent information, and then they compare the look of the resulting maps	-students can understand how maps communicate information -students can see how different decisions affect the look of the map
Schulze (1996)	High school and university	• Students create choropleth maps from their own collected data, and then analyse the collection of student maps	-students can learn about map representations and geographic topics through this create activity; different decisions will yield different types of maps - by exploring their own, they can gain a better understanding of other maps

4.4.2.2 - Using maps

Because children learn best by experience, it is felt that they should do more than just view maps in the classroom. It has been believed that students of all ages can benefit from actively *using* maps (Blades & Spencer, 1987). It is only with repeated practice and map use that children can begin to understand and clarify their concepts of maps, symbols and navigation (Hayes, 1992; Pearson, 1994b; Chiodo, 1997). Maps can be utilised for class field trips, for learning about other subjects and for activities (DeSart & Trytten, 1961; Dekker & Saimis, 1961).

Young children can begin to use maps by navigating with large scale maps of areas familiar to them (Sabaroff, 1961; Board, 1984). The maps can let them compare the rise and fall of the land, plus the location of landmarks and features, to what is on paper. Field trips, to areas like parks, zoos, shopping malls, or the neighbouring community, can be an ideal time to practice navigating. Pearson (1994b) outlines an activity where she worked with five and six year olds. She created a simple orienteering course around the school, and had students find their way from one control banner to another. At each banner, the children used their maps to review which direction they should be headed for, what they were looking for, what they could follow along the way, and what they should see as they go. With practice as a class, students were able to learn how to navigate to find banners on their own. These students learned by doing, and gained confidence in the useful skill of navigating.

4.4.3 - Making learning relevant and interesting

There has been a push for exploring topics which are "relevant to the child's

perspective on life, material which affords the child some insight into what the educational task is about, and which initiates the investigatory techniques used by the age group" (Thake, 1976, 36). Several authors have felt that teachers, as well as map designers and atlas publishers, should keep the child's needs and interests in mind, and should attempt to make map work pertinent for them (Casper, 1961; Thake, 1976; Bailey, 1984). To be more engaging, map studies should be focused upon more meaningful, yet true topics (Petchenik, 1985). Children should be encouraged to observe and explore, to have fun, and hopefully their natural sense of curiosity can be sparked (DeSart & Trytten, 1961).

Traditional classroom map activities have tended to focus on the question of "Where is...?" (Sandford, 1980; Castner, 1987; Marran, 1992). Children have been typically asked to locate or find a specific place or object on a map. Left to their own devices, however, children tend to prefer to browse a map and to 'discover' (Sandford, 1980). In a study that examined what children were most interested in looking at, Sorrell (1974) found that children, when asked, wanted to know where the countries of the world were in relation to their own. Topics such as the locations of animal habitats or holiday destinations were more enticing than were capital cities, roads, railways and typical landmarks. Children can be encouraged to become excited about using maps, and can be interested in the information they are using. It is possible to teach students how to obtain information from maps, and how to search for spatial patterns, all while using novel and attractive topics.

There are several suggestions in the literature for fun activities that make use of maps. For instance, Kirman (1996) outlined a game where students play a game of tag with

markers on a street map. On their turns, they draw a movement card that tells them whether they can move north, south, east or west. Players can move three blocks on each turn, and the tagger can move three blocks in any direction. The object is to make it safely to the school without being "tagged", or caught by the tagger. This game provides practice in the idea of directions and location, as well as in planning routes and thinking spatially, while being fun. These games, while familiarising children with mapping ideas, can be more interesting and fun than a map lesson.

Another article outlines how Brodsky (1994) had his more experienced high school students collect five maps that lie. This more advanced activity forced students to think critically about maps, and to examine how maps are used to present information. It helps them understand the concept of generalisation on maps, and to think about how maps augment or diminish reality. It allowed the students to search for maps that were of interest to them. It was a fulfilling activity, both for the students and the teacher.

4.4.4 - Moving from what is known to what is unknown

In the education system, we have already established that map education should begin as early as possible. It has been suggested that young children are more capable of learning new information if it begins by being very concrete, and connected to what they already know (DeSart & Trytten, 1961; Board, 1984; Stimpson, 1991; Palmer, Smith & Grace, 1993). As Petchenik (1987, 19) explains, "to learn anything, we generally need to be able to relate some new perceptions or observations or facts to something we already know." This is even more necessary for young learners and has been used in some areas of past map education. For children in early primary school, the world that they know and

understand generally consists of the school-home community (Bathurst, 1961). Teaching about maps has often started with this familiar and observable environment. Children have easily been able to explore the spatial relationships that can be seen and are known throughout their classroom, school-yard and surrounding neighbourhood (DeSart & Trytten, 1961; Sabaroff, 1961; Bailey, 1979; Board, 1984; Ottosson, 1988). Map learning lessons, by starting with these simple areas, can progress into larger and more complicated areas as a child's knowledge and comfort increase.

4.4.5 - Linking maps and mapping to other topics

Several authors have suggested entertaining activities using maps in combination with other topics. Ideas such as linking maps with historical stories (Hull, 1994), playing computer games to learn about other countries (Svingen, 1994) and searching for differences as they compare old maps to new maps (Kelly, 1994) have been suggested. There are natural links between maps and other topics. Castner (1981) stresses the importance of placing geography and maps in a broader educational context, and highlighting "the interrelationships that exist between mapping and drawing, visual perception, geography, language, mathematics and geometry" (65). Trifonoff (1995) also speaks of the link between maps, social studies and mathematics. By incorporating maps into more facets of school life, it is believed that students can grow to value and appreciate their use. By combining maps with other parts of the education system, students can gain more exposure and a greater understanding of how they work.

4.5 - SUMMARY

Maps and cartographic learning should be seen as a vital and important part of geographic education. Teaching students how to use maps is something that, for the most part, is still poorly researched and understood. One well-established fact is that map use can begin at an early age. Young children are capable, and early map education only serves to build their mapping experience.

This chapter has looked at map education from a geographic or cartographic perspective. As can be seen, the established research on cartographic education is quite different from that for language education. The language education research has been well-developed and is more theoretically supported than the map education research. This is likely because language is more essential to human experience than are maps and cartography. Map education has not, in the past, been based on any specific theory. It has been rather scattered and sketchy, and there are few accepted conclusions about teaching map comprehension. Results from mapping ability studies also indicate that past methods have not been effective for teaching map skills. The one important aspect of the past cartographic education research is that it is typically based on what has worked for various teachers in a classroom situation. Many of the articles reviewed have been written by teachers. Although not necessarily based on theory, their suggestions for what helps students to understand map representations are still valid. Perhaps if utilised within a better developed system of teaching, improved results can be achieved for map literacy.

Five ideas, which have been important for guiding past map education, have been outlined in this chapter. They are very similar to some of the language input suggestions

provided in Chapter Three, and they can still be applied for map education today. These ideas have proposed that children need frequent exposure to different kinds of maps. As well, teachers should attempt to keep things interesting and relevant for the children, and make learning hands on in order to provide a dynamic learning environment. Lastly, moving from concrete to abstract ideas, as well as linking maps to other school topics, should help children to build up confidence in their mapping abilities. These ideas do not specifically address what should be taught for map education. They can, however, be adapted for use in a current education program which does consider what to teach.

Cartography has been established as a form of language. The language education research, which is more systematic and theoretical than the map education research, can help to provide important ideas for a system of teaching map comprehension. The next chapter will look more specifically at map instruction using applications and ideas from second language instruction. While keeping in mind the valuable aspects of the map education research, it will seek to find the ways that the techniques and ideas of second language instruction can be used to help improve map literacy.

CHAPTER FIVE

APPLYING IDEAS OF SECOND LANGUAGE INSTRUCTION TO TEACHING MAP COMPREHENSION

5.1 - INTRODUCTION

One major purpose of this thesis was to develop a framework for teaching map comprehension with the aim of improving map literacy. To accomplish this, reviews of the literature surrounding both map teaching and second language teaching were done in order to determine if and how second language teaching principles could be applied to cartography. My examination has found that the second language education research is less clear than was originally anticipated. Although there is substantial second language research, there are also many uncertainties and conflicting ideas within the literature. Language theory has undergone several radical changes over the past century. It is difficult to propose one way in which to effectively teach languages. Couple this with the scattered and inconclusive cartographic research, and it becomes a intricate feat to propose precise guidelines for more effective map education using second language approaches.

There are, however, valid points from both literatures that can be applied to teaching cartography. Second language research discusses the major components which should be part of a language education course, and how these have varied with different approaches. It also provides several approaches and methods which can be adapted, where suitable, for cartography. The cartographic research gives suggestions for effective learning about

maps, and provides support for these suggestions. Although this research has not been as theoretical as the second language research, it is based on what has worked in the classroom and as such should not be ignored.

This chapter examines how cartographic teaching can use and apply some of the findings of second language teaching. It begins by examining some important differences between teaching second languages and teaching map comprehension. Keeping these differences in mind, it then selects from the second language research certain effective aspects of teaching languages which could be applied to map education. It also places cartography firmly into a language framework to examine which aspects of cartography are important for teaching. It finishes by exploring four methods of teaching second languages to determine how their teaching techniques could be specifically adapted for teaching cartography.

5.2 - DIFFERENCES BETWEEN TEACHING SECOND LANGUAGES AND TEACHING MAP COMPREHENSION

Cartography has been compared to a language, and the differences and similarities between the two have been outlined in Chapter Two. There are, however, some differences that appear when you consider the teaching of second languages as compared to the teaching of map comprehension. These differences need to be outlined, as the two types of teaching are not directly applicable to one another.

5.2.1 - Classroom situations

Learning a new language tends to happen within classes that are geared specifically

towards that language. Many schools and educational programs offer English as a Second Language classes, or a series of classes in languages such as Spanish, French or German. The various methods that have been discussed for teaching languages, or some combination of them, tend to be used in these language classrooms. Learning the language is the primary aim of the classroom.

Cartography will likely never be taught as a separate subject, at least not within the school system. It is likely to remain a small portion of geography. This is not necessarily a negative aspect of cartographic teaching. Immersing map reading in other subjects, such as geography and social studies, can actually be a valuable way to teach and to enable students to make sense of the concepts that are shown on maps. For instance, meandering rivers, oxbow lakes, drumlins and eskers on maps take on more value once students have learned about glaciers, when they existed and the way that they shaped the land. Also, features such as old city walls or fortresses become more visible and interesting once students have learned about the history of a province or city.

5.2.2 - Pronunciation

Teaching second languages tends to deal often with language production or the pronunciation of words. Learning how to properly pronounce words, and to hear the differences between them, can be an extremely important part of learning a new language. Speaking and listening form the foundation of some second language teaching methods, such as the Audio-lingual method (Brown, 1987). In order to help language learners accurately pronounce the language, research has explored the use of voice modulation, breathing and the neuromuscular actions involved in speech production (Stern, 1992).

Language classes also make extensive use of audio tapes and recordings to assist with hearing language production. Cartography is typically a visual language, and does not have a specific spoken form. Map education, at the basic levels that we are speaking of, is also more concerned with the comprehension of maps than the production of maps.

Learning the pronunciation of words could be considered parallel to learning the basic formation and placement of map signs, just as you would learn the formation of hand signs for sign language. However, for teaching map comprehension, the language learning literature concerning reading, writing or *general* language production, is more applicable than that which focuses exclusively on speaking and pronunciation.

These differences do not invalidate the comparison between teaching cartography and teaching second languages. Rather, they indicate that not all of the second language teaching research will be pertinent for teaching cartography. We must selectively choose those ideas which are most relevant to cartography.

5.3 - LANGUAGE TEACHING - THE "BEST" METHOD

As Bialystok and Hakuta (1994, 209) explain in their final chapter, "there is no single correct method for language teaching." The "best" method depends ultimately upon the goals of teaching and learning, as "most methods have some good elements" (Hammerly, 1982, 269). The language teaching methods outlined in Chapter Three tended to be centred on one or more of the vocabulary, grammar and meaning of the language. Some second language approaches have pushed for teaching only the vocabulary and meaning of

the language, feeling that an understanding of the grammar will naturally follow (for instance, communicative language teaching or the Natural approach). Others (such as the grammar-translation method) claim that the grammar must be taught explicitly and that knowledge of the vocabulary and meaning will follow. It seems unlikely that either of these claims is true. A full grasp of a language's vocabulary would be difficult to just 'pick up', just as a knowledge of the grammar is nearly impossible to acquire simply through language use. (For support, one can ask anyone who has ever graded high school or university papers whether all students have a manageable grasp of the grammar of the language.) A focus on just vocabulary or grammar would also neglect the cultural and social aspects of the language.

Several authors have noted that different types of competence are necessary for learning a language. For instance, Hammerly (1982) discusses linguistic, communicative, and cultural competence, while Canale and Swain (1980) review grammatical, socio-linguistic and strategic competence. The establishment of these different sorts of competence suggests that to be completely competent in a language involves learning about all aspects of that language, including the vocabulary (or lexicon), the grammar *and* the meaning, as well as how they interact and fit together. A good method for teaching languages should therefore include, in varying degrees of importance, all three portions of the language. While different authors use different terminology while discussing the various portions of language, this thesis will define lexicon, grammar and meaning, as follows (definitions compiled from Trask, 1999):

Lexicon - The vocabulary of the language, or the total store of words and morphemes that can be combined and understood by a user of the language.

Grammar - The rules for constructing words and sentences in a particular language.

Meaning - The characteristic of a linguistic form which allows it to be used to pick out some aspect of the non-linguistic world. This includes the semantics, or intrinsic meaning of language, as well as the pragmatics, or how the meaning is communicated in context.

Although we can describe the lexicon, grammar and meaning of the language, one of these cannot exist without the others. The three are inextricably linked. However, a knowledge of all three components, as well as how they function together and interact to produce language, should be included in a language education program.

Hammerly (1982, 270) explains that "there are so many methods, with so many overlapping claims and counterclaims" that it can be very confusing for those looking to design a language program. He goes on to outline several characteristics that he feels a best method for teaching second languages would have:

- It would concentrate on practice in the use of language.
- It would take into account different student attitudes and varying cognitive strategies that students use while learning languages.
- It would be adaptable to needs of non-average students.
- It would not emphasise one or two procedures to the exclusion of other good procedures. The validity of the reasons for emphasising or avoiding anything should be carefully examined.
- It would be eclectic, incorporating the best from various methods and approaches, as there is something good in most methods.

All of these points are extremely important for designing a map education program. Teaching a language cannot be reduced to one simple approach.

5.4 - THE MAJOR COMPONENTS OF THE CARTOGRAPHIC LANGUAGE

For teaching languages, it was established above that a good language teaching method should include the lexicon, grammar and meaning of the language, proposed as major components of language. The geographic and cartographic literature do not propose any such major components for mapping. H. A. Sandford (1988, 191) explains that "although mapwork is without exception regarded as essential to any balanced geographical syllabus, there has been little insightful consideration of detailed objectives and of what they imply for mapwork teaching." In order to determine how to teach map comprehension, we need to first determine what the important aspects of cartography are.

To do this, we can apply the language analogy once again to cartography. From there, we can propose that map instruction should include information about the lexicon, grammar and meaning of the cartographic language. The map lexicon, the map grammar, and the meaning can be considered the most important aspects of the cartographic language for instruction purposes. Just as for language, there is overlap between all of these, as they are interconnected. Each of these, their translated meaning for cartography, and the important portions which should be included in map education, will be further outlined in turn. Just as they form they basic foundation for language learning, they can also be the important elements for map education.

5.4.1 - The Map Lexicon

The lexicon or vocabulary of the map language can be described as the signs, symbols, map elements, graphic variables, and combinations of these, that are used on a map. To be fluent in the cartographic lexicon, one must be aware of how to appropriately create

and use cartographic signs on maps, as well as how to understand already existing cartographic sign systems.

In order to teach the map lexicon to young children, the idea of symbolisation needs to be introduced. According to Ottosson (1988, 132), "the fact that symbols are used to stand for various things is something which children come into contact with quite early." The research has indicated that young children are able to understand the idea of symbolisation (Blades & Spencer, 1987; Ottosson, 1988; Spencer, Blades & Morsley, 1989), as outlined in the earlier section on when to teach map reading.

Figure 5.1 - The Basic Graphic Variables

Differences in SIZE

Differences in SHAPE

Differences in VALUE

Plan Dimensions

red
green
blue
etc.

Differences in ORIENTATION

Differences in HUE

Differences in TEXTURE or SPACING
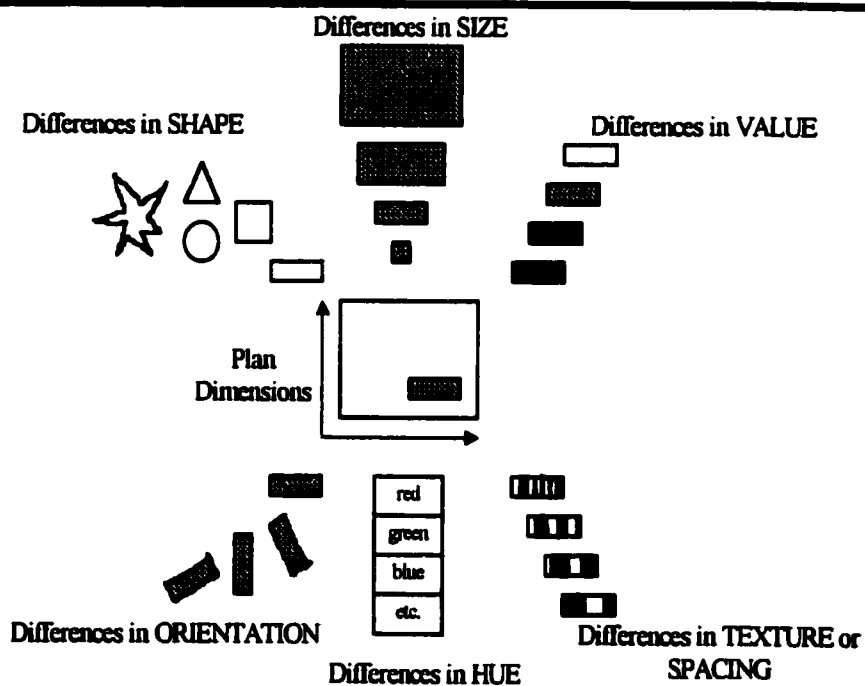
Source: Adapted from Head (1991, 240 - after Bertin, 1967, 43).

Point, line, area, word and number symbols are used on maps to depict various parts of reality (Randhawa, 1987; Boardman, 1986; Gregg, 1997). The graphic variables, as

originally proposed by Bertin, can be used to distinguish and differentiate symbols (Head, 1991). These variables are pictured in Figure 5.1. The symbols, with the graphic variables, combine in various ways to create signs. When placed in the map's spatial reference system, they become cartographic signs, which establish the existence of an object, its location, and the spatial relationship that item has amongst the other items represented on the map (Gregg, 1997). Map signs, if arranged together, can also create larger phrases and expressions (Dacey, 1970).

Map signs do not exist without meaning. However, the lexical component of the cartographic language is more concerned with the expression of the map sign, or the 'sign-vehicle', as described by MacEachren (1995). The content or meaning of the sign will be further described in the cartographic meaning section below.

The graphic or visual variables are applicable in varying degrees for expressing different kinds of information. For instance, differences in value, location, texture and size are most appropriate for expressing order, while shape differences are less appropriate (MacEachren, 1995). As computer and technological advances have influenced cartography, the list of variables has been expanded to include things such as sound, animation and change (MacEachren, 1995). If using automated or computer based maps, these variables, and the way they are used to express certain types of information, would also be part of the map lexicon.

Standard map elements, such as the title, legend, cardinal directions, scale, grid and parallels and meridians, are basic characteristics of most maps (Geography Education Standards Project, 1994). They can be likened to common words in a language, such as

'I', 'and' or 'the'. They should also be recognised and understood as part of the map lexicon. Being aware of the purpose of each of these, and how they are represented, allows for a better map understanding.

The mapped location of common places, and their relation to one another, make up larger lexical items. Students typically are weak at understanding and remembering geographic location and place knowledge (Stimpson, 1991; Hickey & Bein, 1996). Having a mental image of places which are commonly referred to, such as Canada, Ontario, Toronto and Ottawa, can be part of the cartographic vocabulary. For instance, the outline of the province of Ontario can act as a large map sign which can be recognised on other maps. Being able to recognise the shape of these places, and their location relative to one another, helps to expand the vocabulary for the map reader.

Thake (1976) points out that children are likely better able to relate to pictorial symbols than they are with text, as they are not yet able to read. However, as the area being represented on the map increases, the symbols used to represent features become more abstract and less picture-like (Thake, 1976), which may make it more difficult for children to understand them. In examining how children understand map signs, Gerber (1984b) has found that young children are better able to understand qualitative signs than quantitative signs. His research showed that quantitative line signs were among the hardest for children to distinguish between and to understand.

The cartographic signs, and the ways that they are grouped, combined and ordered, (in accordance with the map grammar), form the vocabulary for cartography. They are an important aspect of map reading and, according to the research that has been done, one

that children are generally able to grasp. Understanding the map lexicon allows people to recognise map signs. If map education enabled early introductions to conventional map signs on different kinds of maps, as well as more practice in using map signs, this could provide an important base for later map reading.

5.4.2 - The Map Grammar

The grammar of the map language has already been mentioned in Chapter Two, and comprises the rules that govern the combination of, and the relationships between, signs on maps. These rules ultimately determine what is included on a map, where items are located on a map, how they are represented and how higher-level concepts are taken from a map. The set of rules has been poorly understood in the past, although there is agreement that there is some set of rules governing the combination of signs on maps. *Syntactics* has been described as the relation between a given sign-vehicle and other sign-vehicles (Morris, 1938, as stated by MacEachren, 1995). MacEachren (1995, 235), citing Morris, outlines three kinds of sign relationships considered to be syntactics: "1) the consideration of signs and sign combinations so far as they are subject to syntactical rules; 2) the way in which signs of various classes are combined to form compound signs; and 3) the formal relations of signs to one another." For example, rules for positioning letters (Board, 1981) or rules about combining signs, such as a group of contour lines (MacEachren, 1995) could be considered part of the map syntactics. With this explanation, the syntactics of a map can be considered a part of the map grammar.

The map grammar is concerned, at a basic level, with the specific standards and conventions that exist for both the placement and characteristics of map signs and map

design. These concern the arrangement and location of signs, as well as the combination of signs and symbols to create larger, meaningful graphic expressions. This combining is done by both the producer and comprehender of the cartographic representation. This can be compared to the rules that govern word and sentence formation in the language.

Youngmann (1978, in Head, 1998) refers to the information and reference portions of the map grammar. The information portion includes "the representation of the graphic phenomenon, the symbols, legends and titles." By this definition, the selection and arrangement of map signs to represent concepts or objects is considered part of the map grammar. The information portion of the map grammar will be affected by the generalisation and scale of the map. The scale chosen for the map dictates the size of the area represented and the amount of generalising that needs to take place.

The reference portion is "comprised of the geographical base and the implied or explicit grid." The actual physical position and arrangement in space of the objects whose attributes are being mapped will affect the arrangement and organisation of map signs. Systems, such as grid reference systems or lines of latitude and longitude, have been developed to help establish exact location and position on maps. These systems serve to direct the position of map signs.

The map grammar is concerned with a large number of ideas and rules which guide the organisation of map signs and the relationships between them. Understanding the map grammar enables people to realise the relationships represented between and among map signs. There is a need, however, for the actual grammatical rules of the cartographic language to be compiled and documented.

5.4.3 - The Meaning of the map

The map meaning is completely dependent upon the cartographic signs and their arrangement and resulting relationships. The map meaning involves understanding the meaning or inherent message of individual map signs (i.e. "what does it represent?"). It also includes the message that is ultimately being conveyed by the arrangement of map signs, in context with one another.

People learning to read maps need to move beyond understanding and perceiving the existence of map symbols and attempt to understand the concept or meaning behind the specific symbols (Boardman, 1986). They need to understand that the marking of a symbol does not necessarily represent that exact object in reality. For instance, Ontario road maps use a trillium symbol to represent major tourist attractions. A new map reader needs to realise that the trillium represents an attraction, and not necessarily a giant trillium garden. Experienced map readers are able to see the map symbols and immediately interpret them into their meaning, what they represent, and the spatial relationships that are implied by the map (Sabaroff, 1961).

Anderson (1996, 121) states that "for successful communication of map information it is essential that the meaning attached to a symbol by the map designer is the same as that interpreted by the map user." Children should be taught what common map symbols mean. The features of concepts they depict should be discussed and illustrated (Bailey, 1984). The map key or legend can be a major aid to understanding the meaning behind symbols and should be consulted (Gregg, 1997). As such, legends should be included in educational maps, and children should become familiar with their purpose.

Understanding the meaning of a map is what allows us to relate what we see on a map to the real world. In looking at a map, children should realise that it is more than just a picture or plan and that maps are a real representation of some part of the world around them (Randhawa, 1987; Downs & Liben, 1991; Blades, Sowden & Spencer, 1995). According to Bathurst (1961, 26) a "reader of a map must know that it [a map] is a 'bird's eye view', drawn with lines, of a given area of section of the earth. This may be a relatively small area, or it may include the entire surface of the earth." The literature indicates that children need to realise this connection between the map and reality to understand the message being presented on maps. Blades and Spencer (1994) use the term 'recognition of correspondence' to refer to the understanding that one set of spatial information (such as that which is on a map) has a direct relationship to another set of spatial information (that in the environment). Anderson (1996) explains that, at present, little attention is given to developing this knowledge, of how a map represents space, in the education system.

A map reader should recognise that a map sign, in addition to conveying information, also designate the spatial location and spatial relationship of the referent to other items on the map. Understanding the map meaning will enable the map reader to grasp the message presented on the map and to link the information on the map to reality.

5.4.4 - Other information that assists in Map Comprehension

There are other pieces of information that are not specifically part of the cartographic language, but which will assist in map understanding. For instance, one of the first additional things young students need to know are the general terms that are related to

location, space and direction. Several authors (Dekker & Saimis, 1961; DeSart & Trytten, 1961; Sabaroff, 1961; Thake, 1976; Gutierrez & Sanchez, 1993) speak of the importance of clarifying direction and location terms early in children's map reading experience. The ideas and terminology used to describe relative location, direction, closeness, distance, proximity and relative size need to be learned before students can relate these ideas to the information on a map. If they are unable to describe the location of an item in the classroom, they will be unable to describe positions and locations on a map. Using directional vocabulary, such as 'near to' or 'far', regularly in early childhood situations can help to teach children what these terms mean (Catling, 1988). The fact that 'up' and 'down' are away from and towards the centre of the earth, and not northwards on a map, also needs to be explained for children (Dekker & Saimis, 1961; Sabaroff, 1961).

Students should also realise the importance of using definite directions, such as North and South (Anderson, 1995) and the link between these directions in reality to directions on the map. Anderson explains that the term north is actually a complex concept. It permits us to state location and direction independent of our individual location. The directions north, south, east and west should be included, discussed, and labelled in the classroom (Dekker & Saimis, 1961; Sabaroff, 1961), as well as the neighbouring landscape (Gutierrez & Sanchez, 1993). Relating these directions to examples in the world, such as the North pole, or birds flying south for the winter, can help to clarify these directions (DeSart & Trytten, 1961). The sun, wind and weather movements can also be used to help students observe and remember the cardinal directions (Dekker & Saimis,

1961; Sabaroff, 1961; DeSart & Trytten, 1961; Johnson & Gondesen, 1991). By understanding the directional terms and what they represent, they can then be related to maps.

Understanding 'what is where' provides us with the frame of reference that we need to make sense of the world around us (Catling, 1988). Anderson (1995, 68) describes that "being able to describe 'what is where' in a meaningful manner, in an environment to which they can relate, is essential for working with larger-scale maps, and forms the basis for more complex tasks of map analysis, interpretation and use." Once these ideas are understood, they can then be related to maps.

Understanding the mathematical concept of a grid can also simplify later map understanding. Various games, including Battleship, can help to clarify the concept of locations on a grid and to get children accustomed to using gridded systems (Thake, 1976; Kirman, 1990).

Geographic knowledge can also be considered beneficial for map comprehension. A student should be able, through geographic and social studies classes, to build up their knowledge of the processes that shape the earth, the way that water and air move around the planet, settlement patterns, natural resource utilisation, and the ways that humans have modified the planet. This information can allow a person to recognise more map features, and to provide supplemental information about those features. For instance, once a student has learned how volcanoes are formed, they can start to locate and recognise features such as volcanic island chains, craters and volcanic plugs on maps.

Map education should not just focus on the signs and their arrangement on the map. It

should also investigate information such as who made the map, why it was made, when it was made, how it was made and who uses the map, akin to the 'culture' of the cartographic language. Exploring what else you can learn from a map is a valuable part of becoming more comfortable with the cartographic language. Just as a well-read person will be able to provide a more interesting and comprehensive review of a book, a more experienced map reader will be able to more critically review the information on maps.

The hope is that by including what has been explained as the cartographic lexicon, grammar and meaning, plus additional knowledge, as major foundations of map education, students will be able to develop a more effective grasp of the messages being communicated by maps.

5.5 - APPLYING LANGUAGE TEACHING TO CARTOGRAPHIC TEACHING

After establishing the important elements of cartographic teaching (i.e. *what* can be taught), we can now explore the specific methods of teaching second languages to see which aspects can be applied to teaching cartography (i.e. *how* to teach). As already established, no one method on its own is perfect, and so cartography should choose aspects from several different methods. The ten methods outlined in Chapter Three will be considered in the next section, with the aim of choosing portions of the few methods that are most useful and applicable for developing cartographic instruction guidelines.

5.5.1 - Which second language teaching methods can be useful for cartography?

The traditional grammar-translation method is one of the few methods that specifically

addresses grammar. It has, however, been considered "unacceptable as a method of teaching second languages" (Hammerly, 1982, 222), as it only teaches about the language but not about how to use it. This, and its weak theoretical foundations, make grammar-translation a poor choice to apply to cartographic instruction.

The Direct method was considered an extreme approach in reaction to the grammar-translation method (Hammerly, 1982). It has been re-worked and updated into other methods, and so it too will be eliminated from our examination of cartographic instruction. The later, re-vitalised methods are more appropriate.

A large portion of the audio-lingual method focuses predominantly on speaking and hearing the language (Hammerly, 1982). As already explained, cartography is not a vocal language. However, the audio-lingual approach does aim to teach the structure, pattern and (through induction) grammar of the language (Brown, 1987), which many of the later methods tend to ignore. This focus on grammar and language structure may be useful for exploring the structure or grammar of the cartographic language, and will be examined further below.

The Total Physical Response method and the Natural Approach are two very similar methods. In fact, the Natural Approach often uses many aspects of TPR in its early stages (Brown, 1987). These methods are based on comprehension and on understanding the meaning behind the language. These are important for cartography, as it is understanding the meaning that will permit map users to visualise the concepts being portrayed by the map. The Natural approach will be further examined below.

Community language learning, the Silent Way and Suggestopedia are three of the less

conventional approaches for teaching second languages. These were designed by psychologists and focus on student-centred classrooms where the 'community' of students works together to learn (Hammerly, 1982). While focusing on students' needs is important for teaching, these methods are geared very specifically towards teaching spoken languages, and were not meant to be isolated or used in part, according to those who developed them. As such, it would be very difficult to adapt these methods to be part of any other learning situation. The results of these methods are also slightly questionable (Hammerly, 1982). For these reasons, none of these methods will be significantly explored for use with cartography. However, the theory behind them, considering the learner's affective and social needs for more effective learning, will be explored.

Communicative language teaching is perhaps the most applicable of the methods for teaching cartography. It places a great deal of importance on the function of the language rather than the form or grammar (Brown, 1987). The aim of 'real' communication and comprehension, as well as the wide range of activities that have been developed, can provide very useful guidance for cartography. This will be further examined in a later section. Immersion, as a distinct example of communicative language teaching, will not be specifically addressed.

5.5.2 - Specific language applications for cartography

Four different language teaching approaches or methods will be explored in this section to see how they can be specifically applied to cartographic teaching. These methods are the grammar/structure portions of the Audio-lingual method, the Natural Approach, the affective considerations of the human-focused approaches and the

Communicative approach.

5.5.2.1 - The Audio-lingual approach

The Audio-lingual approach focuses mainly upon language production, although it also teaches grammar and vocabulary. In many cases, a dialogue is used at the beginning of each unit to introduce new grammatical ideas, lexical variations and vocabulary items (Hammerly, 1982). Students are able to observe how the grammatical patterns work together and to hear the vocabulary being used in context. In order to teach the grammar of the language, drills, such as mimicry and choral repetition, are used to practice the grammatical rules (Hammerly, 1982). Pattern practice and repetition are thought to help students understand how the language works and to form habits in language production (Stern, 1992). Simple 'generalisations' can be used to sum up what has already been practised (Stern, 1992).

To apply this to cartography, particularly at beginning levels, simple maps can be introduced (as are the dialogues for language instruction) to depict some of the cartographic conventions, mapping rules and elements of a map. For instance, a map of a school could depict items (such as a park, a store, or houses) located on a grid surrounding the school in order to practice describing directions and spatial relationships and using grid references. Likewise, different types of maps can be used to show how colours or graduated symbols should be appropriately used on a map. Various rules and conventions can be conveyed to the students as they see and use the maps, without giving explicit explanations. For example, through simple discussions or drills, students can begin to understand that 'blue' generally represents water or that the size of symbols can

be used to suggest order on a map. Also at early stages, teachers can have their entire class create a simple map step-by-step, with each student following the same series of steps. This is likened to the choral repetition of the audio-lingual approach. By being told to place elements such as a north arrow and title on every map they create, it can become habit before students fully understand what purpose they serve. Teachers should ensure that students are correctly symbolising and placing elements correctly on maps, as they would ensure that students are pronouncing words properly.

5.5.2.2 - The Natural approach

The Natural approach focuses mainly on the meaning of language and the exchange of ideas rather than the form (Terrell, 1982). Students are introduced to the language by learning what it means, and are not expected to perform in the language in the beginning stages. Brown (1987) outlines three stages for this approach: a pre-production stage, early production and expanding production. At the pre-production stage, the teachers begin by communicating as many common ideas and vocabulary to the students as they can. The teachers act out vocabulary, or use gestures, diagrams, visual aids or skits to help students start to understand the meaning of the words. As students get more comfortable with the meaning of the language, they can move into early and expanding production and start to produce language on their own.

This can be directly applied to cartography. The vocabulary of cartography, which is quite extensive, is the various map signs (and combinations of these) that are on maps. The actual map expressions (marks on the map) can be shown to students, and then their content or meaning can be conveyed to students through diagrams, photographs,

miniature models, or by going out to actually see some similar features in the neighbouring area. On a very simple level, a map depicting a lake can be examined, and then pictures and aerial photographs of a lake can be shown to the students to teach them the meaning of the map representation. Teachers do not necessarily need to talk much, or describe what the students see. Just coupling the map representation with a depiction of its real life referent should help students to link the expression with the content. Another example would be building a model of a hill or slope represented by contour lines to depict what the lines on a map represent. The model, coupled with diagrams or photographs of hills, can be shown along with the map contour lines. As students begin to learn more of the basic vocabulary (such as those items depicted in the legend), more complicated features such as lake and river systems, mountain chains or trends of human population could be examined. As students get more comfortable with the cartographic topics and features being represented, they can join in more advanced discussions of what is depicted. For instance, a beginner student may be expected to recognise that there is a lake, while a more advanced student would be able to describe that there is a lake with four islands, and rivers leading in to and out of the lake on the east and south-west sides. Clusters of cottages exist on the northern and western shores of the lake.

5.5.2.3 - The Human-focused approaches

Suggestopedia attempts to make learning a positive, enjoyable and rewarding situation. Students are relaxed, and language learning is presented as a pleasant, easy and natural activity (Hammerly, 1982). Community language learning emphasises the students need for belonging, and aims to provide a supportive, encouraging learning environment.

According to Thomas (1988, 371), "it fosters self-trust, low anxiety and warm personal contacts as the main conditions for effective learning." Learning is seen as a sharing process, and students are encouraged to slowly become acquainted and comfortable with using the language. The Silent Way encourages students to discover, problem solve and learn independently as they see and use the language (Brown, 1987). The focus on student needs suggested by each of these methods can be applied, in turn, to cartographic teaching. These suggestions affect how to teach, as opposed to what to teach or specific teaching methods.

In order to adapt and follow the psychological considerations of the above methods, students should not be anxious about reading or using maps. Map use should be introduced as a useful, simple activity as opposed to something that students are intimidated by. If early activities are centred around fun topics, such as using a map to find the buried treasure, or designing their own creative map of the classroom and school, students can learn to enjoy the information that maps provide. Success in map reading also helps to build up people's confidence in their mapping abilities (Pearson, 1994b). This type of success should begin while children are still young. Early map exercises should be geared towards success, and should be aimed towards helping children gain an understanding of how maps work and how useful they are. Testing for or about maps should be delayed until students reach a higher level of map reading to further reduce the stress of learning. To enable students to learn on their own, as they do in the Silent Way, they should be given mapping exercises where they need to collaborate as a group to determine what the map is communicating. Again, allowing for *early success* can help to

increase student's enthusiasm and confidence.

5.5.2.4 - The Communicative approach

The communicative approach attempts to involve learners in 'real', unrehearsed communication in the classroom (Brown, 1987). The function of the language and the communicative needs of students are seen as far more important than the form or the grammar behind the language (Hammerly, 1982; Brown, 1987). This approach is centred around a series of activities which try to get students using the language while being involved in fun activities (Littlewood, 1981). Listening activities force students to hear information and transfer that information in some way. Functional activities are activities that encourage problem solving in the language. Social interaction activities allow students to think about the social meaning behind the language. While functional activities may be most applicable to cartographic instruction, each of these types of activities can be applied to a cartographic setting.

For cartography, a focus on function rather than form can be quite beneficial. This can be likened to exploring the reality that is being represented by the map, are opposed to the individual map signs and elements. Immersing students in activities that show how useful maps can be, as well as how to use them effectively, can equip them with a valuable knowledge of maps. The activities suggested by the communicative approach can be adapted to illustrate the function of maps.

Listening activities are designed to enable students to actively listen for meanings in the language, and to use the clues that the language provides to make sense of the message (Littlewood, 1981). Several similar activities can be used to have students

listening to map information and reacting to this information: Students can follow, on a map, verbal directions. This could progress from very simple, such as 'turn *west* or left at Queen Street', to more complicated, such as 'turn west at the highest point in the road and proceed until you reach the road that runs from Lake Charles to Smithsville. Here, turn uphill and go towards the nearest fire tower.' They could also plan a route on a map, after hearing a set of sights that someone wanted to visit. Or, they can guess where on a map a person is after hearing the sights and landmarks that person can see. Students could also draw sketch maps of an area after hearing a description of it. The accuracy of these maps and directions would be less important than getting the students to think spatially.

Functional activities are intended to have students working towards a definite solution or decision (Littlewood, 1981). They actually use the language by sharing, discussing or evaluating information. These can be adapted to cartographic instruction. In fact, several of the second language functional activities already suggest using a map to solve problems or have students discuss information. At a simple level, a map could be cut up into equal squares to make a challenging jigsaw puzzle. Small groups of students would need to put the map together and agree that pieces fit with one another. Alternatively, each student could be given a simple map. Then, by asking questions to one another about the features on the map, they need to find the student in the class with an identical matching map. Another activity could have students in pairs. One student, given a simple map, tries to describe the map to the partner in enough detail so that it can be reconstructed on a blank piece of paper. Or, students could be given a series of historical maps of a city, and be told to reconstruct the temporal order of the maps as best they can and justify their

decisions. A more advanced activity can have students planning a route and itinerary for a fictional school trip. They would need to consider the mode of transportation, alternate routes, travel time, cost of travel, sights to see, and what they will learn from the trip. Each group will need to present their trip, on a map, to the rest of the class, justifying why they have chosen that particular route and what the trip will entail. Although the discussions encouraged by these activities are in the students native language (and not the target language, as if the case for second language teaching), they do enable students to talk about the 'map language', and what messages are being presented on maps.

The last group of activities are social interaction activities. For second language learning, these activities encourage learners to let social *and* functional considerations affect their choice of language (Littlewood, 1981). In the language classroom, these tend to involve role playing and improvisation. For cartography, these types of activities can be adapted to illustrate the different levels of accuracy and detail a map needs, depending upon its purpose. Several different maps can be displayed, such as a sketch map to get to the corner store, a military map, a nautical chart of a lake and a road map of Canada. Students will need to decide which maps are appropriate for certain uses and users. Acting out some situations, such as the houseboat owner who is trying to get to a secluded bay, or the family who is trying to drive across British Columbia, can add an element of fun to the classroom. The class could also randomly choose a map, and then attempt to discover who the intended audience of the map is, and what makes this map different from other maps for other users. Also, comparing maps of one city from various sources can be useful. One city can appear very differently in a road atlas, a subway route

map, an environmental land use map or a map advertising the location of certain businesses. These differences can be discussed to help students understand how maps can communicate different messages.

As many 'real' maps as possible should be used in the classroom. These types of activities should enable students to see the purpose that maps can serve, as well as learn how to use them more effectively.

5.6 - SUMMARY

This chapter has explored the idea of teaching map comprehension using aspects of second language teaching. It has considered both the second language research, as well as the cartographic research, in order to determine the important aspects of teaching map comprehension from a language point of view, as well as some specific methods of teaching it.

The differences between teaching map comprehension and teaching languages were outlined in this chapter, as all portions of language teaching are not directly applicable to map teaching. The differences illustrated that we need to selectively choose the aspects of language teaching which most apply to map education. The language research also suggests that carefully using a variety of techniques to build an educational program is more effective than using just one of the past language instruction methods.

Keeping in mind the differences and similarities of the cartographic language analogy, the relevant language ideas were applied to map education. Three major components of language were proposed for language education. The cartographic lexicon, grammar and

meaning were then subsequently developed for education concerning the cartographic language. The cartographic lexicon, grammar and meaning were all explored and expanded upon. This chapter also looked specifically at four language instruction methods to examine how their classroom techniques could be specifically applied to cartography.

This chapter provides the background for the final chapter of this thesis, which provides specific guidelines for teaching children about maps. The next chapter uses the proposed language framework to suggest a sequence of what students should understand and know for map education, as well as activities which could enable this learning.

CHAPTER SIX

GUIDELINES FOR TEACHING MAP COMPREHENSION AND GENERAL CONCLUSIONS

6.1 - INTRODUCTION

It has been established that former map education can be improved. This chapter applies the suggestions and the findings of the research to provide a set of guidelines for teaching cartography. The aim is to provide a logical framework, based on the language and cartographic research, for teaching cartography from beginning introductory levels to more advanced map literacy. The hope is to be able to educate students to be competent in the cartographic language.

The remaining sections of this chapter address the general objectives of the map education proposed by this thesis. The basic guidelines, which outline the things that students should learn plus some suggestions for how to teach them, are provided and then discussed. Directions for further research, based upon the work of this thesis, are discussed. The final section considers the general conclusions of this work.

6.2 - GENERAL MAP EDUCATION OBJECTIVES

The goal of any map education should be to enable students to understand the message on maps and to effectively use maps, both in and out of school (Sandford, 1988). Map use, in itself, can be a highly variable task. Olson (1976, 152) was the first well-documented author to distinguish between varying levels of map use skills. Other authors

(Board, 1978; Morrison, 1978; Head, 1984) also speak of different levels of map use. In Olson's three-tiered classification, *Level One* map reading involves comparing the characteristics of individual symbols, such as the shape or relative size. For instance, determining what a specific colour means on a map would be considered a Level One task. *Level Two* entails recognising properties of symbol groups on the map as a whole. At this stage, abstract symbols are still being considered. Relationships within or among sets of symbols are observed, such as whether a point distribution is scattered or clustered. An example of a Level Two task would be to determine where the highest points of land, or the steepest slopes, occur. At *Level Three*, the map user is able to use the map as a decision-making device through the integration of the symbols with other information. The symbols themselves are seen to represent phenomena as well as their spatial characteristics. Level Three map reading goes beyond identifying individual map signs and starts to look at what they represent. It requires the use of appropriate schemata in our minds. An example of a Level Three task would be recognising an area as a flood plain, or determining what the cross section of an area would look like. Education should be geared towards getting students to be able to use maps for Level Three type tasks.

Dorothy Sylvester, (1952, 59, in Board, 1978), explains that "the final test of map reading is the visualisation of landscape from a map." Board (1978, 2) goes on to describe how visualisation is a complex task which calls upon a reader "to synthesise and relate to one another the forms and pattern of individual features." Understanding the lexicon, grammar and meaning behind the map should enable map readers to recognise the signs on the map, what they represent, and how to connect them to the additional

knowledge or information that goes along with them. In this way, they should be able to construct an accurate mental image of the area being portrayed.

6.3 - GUIDELINES FOR TEACHING CARTOGRAPHY

In order to improve map literacy, and enable students to use maps for Level Three map tasks, specific guidelines should be established based upon the research findings of this thesis. Table 6.1 outlines the suggestions and results that have been provided thus far, highlighting the results and ideas from the second language and cartographic research.

In order to teach cartography more effectively, all of the suggestions from Table 6.1 should be considered as important. Based upon these suggestions, this section moves to supply a basic outline of guidelines and suggested activities for teaching cartography in classrooms. The guidelines were developed with several objectives in mind:

• A program should be designed to be flexible and adaptable to both varying student needs and the needs of different education programs. The hope is that these could be adapted and expanded for use in any educational setting. They are also simple, to allow for further development and additions if applicable.

• There should be a focus on a broad range of ideas, techniques and activities, rather than focusing too narrowly on one area of the cartographic language or education research.

• All aspects of the cartographic language should be included, as these are each dependent upon one another. In particular, the cartographic signs, the rules governing their location and combination on maps, and how these signs, and relationships among signs, convey meaning, form an important basis for map education.

Table 6.1 - A summary of suggestions that have been given for teaching cartography, based upon the cartographic and second language research

How to teach (based upon suggestions from the) cartographic research, as well as the guidelines for teaching languages	• START EARLY	• PROVIDE FREQUENT EXPOSURE TO MAPS	• MAKE MAP LEARNING INTERESTING AND RELEVANT	• MAKE MAP LEARNING HANDS ON	• MOVE FROM THE KNOWN TO THE UNKNOWN	• LINK MAPS TO OTHER TOPICS
	-children are capable of using maps from a young age, and should be exposed to maps -by beginning early, they will be able to gain more practice in the use of the language	-children need a 'sufficient quantity' of map input -they should be exposed to different kinds of comprehensible, real maps to increase spatial awareness and show how useful maps can be -helps students to create mental images and enables them to organise maps and map reading in their memories	-allow for fun and discovery, and use maps in interesting ways in order to reduce anxiety and instil map interest -also increases motivation -if topics are interesting, children want to understand the message on the map	-have students directly involved in making and using maps to help them understand the various ways maps can be used -maps should be seen as active learning, not boring or dull -include less teaching *about* maps, and more teaching *with* maps	-allow children's success to grow as they relate what they are learning to things they already know -sequence lessons to increase knowledge -the order should be dictated by student's interest, rather than the rules or vocabulary	-make cartographic learning interdisciplinary in order to increase map use and understanding -also helps to keep map learning interesting -increases geographic understanding

	LEXICON	GRAMMAR	MEANING	OTHER INFORMATION
What to teach (based upon the major components of language)	-the signs, symbols, map elements, graphic variables (and combinations of these) of the map	-the rules of the map which govern the combination and relationships between signs -includes conventions and 'rules' -affected by generalisation, scale, locational systems	-understanding the inherent message of the individual map signs plus message being conveyed by the arrangement of signs on the map -includes the meaning of individual symbols, as well as their locational meaning, and the implied spatial relationships of these symbols	-such as general locational and directional terminology -includes additional geographic knowledge -also involves understanding the who, what, when, where and why's of map production
Specific examples of how to teach (based upon applying the language teaching methods to cartography, and recommendations from the cartographic literature)	-make maps in order to understand the ideas of representation and symbolisation -use maps often to associate symbols with their real life referents	-use simple maps to gradually introduce cartographic conventions and mapping rules -create simple maps step-by-step to form the habit of adding map elements	-depict map sign meaning by using diagrams, photos, models, etc. -have students involved in activities where they have to make decisions about cartographic information -use maps to demonstrate that students understand meaning, such as navigation or problem solving	-activities which get students discussing map uses and purposes

- Classrooms should focus on real use of maps and the cartographic language. This is in the hope of providing positive map exposure, practice and experience.

- The expectations of the students should be geared to gradually build up the students' knowledge. The aim was to move from simple to more complex ideas, considering children's cognitive and developmental abilities. For instance, complex topics such as scale and latitude and longitude (Meyer, 1975; Johnson & Gondeson, 1991), were reserved for higher levels.

The guidelines have been divided into five different levels. They provide a suggested order of teaching about maps, and a list of the specific things that students should be able to do after the completion of each level. As already described, cartographic instruction should begin as early as possible. The ideal situation would see Level One introduced to children in Kindergarten and Grade One. The remaining levels could then be spread between Grade Two and Grade Nine, each level covering two years. After Grade Nine, geography courses are typically optional for students, and they tend to focus on more specific aspects of geography or cartography. The hope is to develop students' map comprehension by the time they finish Grade Nine Geography. These levels, and the activities suggested, have been developed with these ages in mind. By incorporating map education into all grades of education, children will have more opportunity to be exposed to maps and to practice the map skills they learn. It is recommended that teachers and school boards work to include map education in all grades. However, it is the progression of learning which is important, along with the practice and use of maps. These levels could be started at any age and progress, with minor modifications of the activities. The

suggested activities that are provided for each level are intended to help students grasp the skills of that level. They have been modelled after the language and cartographic activities that were discussed throughout this thesis. While these activities can provide suggestions or starting points for teaching, educators should not be limited by these activities. Table 6.2 provides an overview of the five levels. Each level, along with the proposed activities, will be discussed in further detail below.

Table 6.2 - Guidelines for teaching cartography

	Expectations of Students
Level One Awareness and Appreciation	• Understand what the term 'map' means • Be introduced to idea of symbolisation • Be introduced to basic map elements and the identification of simple map features • Be able to make and use simple maps of familiar areas • Be introduced to the concepts of direction and location • Develop a spatial awareness of the things around them • Gain practice in the use of spatial and directional terms • Understand that maps can be used in different ways
Level Two Early map use and understanding	• Develop an understanding of what common map signs mean • Be aware of differences between different map signs • Be able to use a legend and understand what it represents • Understand the idea that a map is a generalisation, and that not everything can be shown • Be able to create a simple map of an area, making use of symbols and map elements • Be able to use a map for simple navigation • Use simple maps in other topics, and be aware of their use for a variety of purposes • Understand the cardinal directions and how they relate to maps, classroom • Start to link photographs and other graphics to the map signs

	Expectations of Students
Level Three Exploring and practising map skills	• Build up a larger repertoire of map symbols and meaning • Be introduced to concept of map scale • Be introduced to lines of latitude and longitude • Be able to create accurate (scale) maps of simple areas • Be able to use maps for basic measurement, orienteering, navigation and simple problem solving • Start to be aware of patterns in map symbols • Be introduced to visualisation of maps by discussing what can be seen in various directions
Level Four Expanding understanding of the map meaning	• Be able to make more advanced maps in order to present and organise information - utilise topics and areas of interest • Use maps for planning routes, orienteering, decision making, describing aspects of other subjects • Start to recognise the spatial characteristics and not just the location of map phenomena • Be comfortable with using grid references, lines of latitude and longitude, and locational information • Begin to link additional information with what is being shown on the map
Level Five Developing Map Proficiency	• Have a suitable knowledge of the lexicon, grammar, and meaning of map, as well as how these interact to communicate information and represent reality • Be able to use a map to give or take detailed instructions, using location, local references, etc., as well as more advanced problem solving, decision making, orienteering and navigation • Be aware of the meaning behind the map symbols • Be able to give descriptions of the processes and information being represented on maps • Understand what contour lines represent • Create realistic models of mapped areas (demonstrating visualisation) • Be introduced and develop initial awareness of cartographic standards for more advanced cartographic design • Be introduced to idea of map projections • Be aware of the links between maps, photographs, satellite imagery, text, graphs, etc. and be able to integrate other information with that on the map

6.2.1 - Level One - Awareness and Appreciation

This level, recommended for Kindergarten and Grade One, focuses on introducing simple cartographic ideas to children, and developing an early awareness of map forms and mapping ideas. Teaching is centred around using simple map signs and introducing basic map knowledge, while more specific meaning and grammar ideas are left until students are a little older, when they are better able to understand them. At this level, students are not necessarily expected to produce their own maps. They should gain an appreciation of what maps are, what they can do, and how they can be used.

Students are expected to:

1. Understand what the term 'map' means
2. Be introduced to idea of symbolisation
3. Be introduced to basic map elements and the identification of simple map features
4. Be able to make and use simple maps of familiar areas as a class
5. Develop a spatial awareness of the things around them
6. Be introduced to the concepts of direction and location
7. Gain practice in the use of spatial and directional terms
8. Understand that maps can be used in different ways

Specific activities suggested to promote these skills are:

• Be introduced to ideas of 'map' and 'symbols' by making very simple maps, such as Hawkins and Larkins (1985) suggestion of making a map of their hands, and then progressing to a map of their desks.

• Spatial awareness is something that needs to be taught, as it is not always adequately acquired through regular development (Chiodo, 1997). Gutierrez and Sanchez (1993) explain that, particularly for young children, their world is a self-centred one. For many young students, they are just beginning to realise their own place in space. Having students observe the spatial relationships that exist around them can help them to appreciate the environment and to gain their own perception of distance, direction and scale (Bailey, 1979; Gutierrez & Sanchez, 1993; Taketa, 1996).

• Involve students in observation activities to develop their understanding of direction, place and spatial awareness. For instance, students could observe the street outside their school, and learn the ideas of near, far, left, right, together, beside, up, down. They could also discuss ideas of change, differences, staying the same.

• Read storybooks that have spatial terms in them to further help students become comfortable with these ideas (modelled after Catling, 1988).

• To practice using directions, students could describe to others where objects are hidden in the classroom.

• Further observation activities could have the students counting the number of doors, windows, stairs, or classrooms that there are in their school or home. This information can be presented on tables or diagrams.

• Students, as a class, could create a model of the school playground, based on what they have observed. This can involve building, positioning, thinking about size, relative location, details. This type of project should be on-going for several weeks to allow students to work on their observation.

• Students could also build a model of their classroom together. After they are comfortable with the model, the information can be transferred to a map by the teacher, using simple symbols instead of pictures (as suggested by Sabaroff, 1961; Bathurst, 1961).

• As a drill type of exercise, students could then have to make their own copy of the school map by gluing elements on to a base map. They will not have to draw, or fully understand, the elements (such as north arrow or scale), but they will need to place them on a map. This is in the hopes of forming habits of what belongs on a map (after the Audio-lingual approach).

• To get students thinking and communicating about spatial information, they could attempt to draw a 'map' of their bedroom at home, or their backyard. At a young age, these maps may be more of a picture, but it still gets students thinking spatially.

• Several different kinds of maps, globes, should be brought in to the classroom to discuss where students have seen them before, who might use them, where they may be. At this stage, maps should be interesting for the children, such as a 'Winnie the Pooh' map of the One Hundred Acre Woods, a map of the zoo, or a map from a computer program.

• By looking at different maps, students should try to look for things in common on all of them, such as words, lines, colours, titles, legends, scales, north arrows.

● After reading stories of other places, cities or countries, these should be located on the globe, or a provincial map. In doing this, the students' HOME should always be located first.

These activities are basic introductions to many of the ideas important for map comprehension. They lay the foundation for further, more advanced map work for students.

6.2.2 - Level Two - Early Map Use and Understanding

This level is recommended for Grade Two and Three classes. It introduces students to using real maps, and helps them to develop basic understandings of map representations. Teaching addresses all aspects of the cartographic language and helps students to gain awareness of the concepts involved in mapping. At a Grade Two and Three level, students are able to read and write in their own language, and so can develop a deeper understanding of what is represented on maps. They are also introduced to how to make their own simple maps.

Students are expected to:

1. Develop an understanding of what common map signs mean
2. Be aware of differences between different map signs
3. Be able to use a legend and understand what it represents
4. Understand the idea that a map is a generalisation , and that not everything can be shown
5. Be able to create a simple map of an area, making use of symbols and map elements
6. Be able to use a map for simple navigation
7. Use simple maps in other topics, and be aware of their use for a variety of purposes
8. Understand the cardinal directions and how they relate to maps, classroom
9. Start to link photographs and other graphics to the map signs

Specific activities suggested to promote these skills are:

• In order to gain an appreciation of the cardinal directions, students should go outside and observe the shadows produced by the sun. After keeping track of the sun's movement, students can be introduced to the unique names that are given to the directions. By using a phrase such as 'Never eat shredded wheat', they can start to remember North, East, South and West. These directions should then be labelled in the classroom, and the school yard. In this way, students can begin to answer questions about what lies north of the school, who sits at the south end of the classroom, etc. (after Dekker & Saimis, 1961; Sabaroff, 1961; DeSart & Trytten, 1961; and Johnson & Gondeson, 1992).

• Once cardinal directions have been established, north should be pointed out on every

subsequent map, and the map should be aligned, using the north arrow, to the classroom north. This is a drill to remind students of the directions. (modelled after the Audio-lingual approach)

• Games which use directions should be played. For example, Simon Says. 'Simon says face west', 'Simon says take one step to the south', 'Simon says run to the north end of the room', etc. to reinforce the directions.

• Have students draw everything that is in their house on one piece of paper to initiate a conversation about generalisation. Discuss how not everything could be shown, and how the most important things need to be picked out. Talk about other things that are too big to put on to a piece of paper, or to bring in to the classroom. (For instance, an elephant or car.) How could you represent these? Compare this to maps, and talk about putting the whole city on one piece of paper. To further this understanding, bring in small and large versions of the same toys or objects. For instance, a 5 inch stuffed Mickey Mouse doll could be compared to a 24 inch Mickey Mouse doll. The students could identify what was left out on the smaller one, or what is different about the two. All maps are generalisations. There is more on the surface of the earth than could ever be placed on a map, and map users should understand that what is on the map represents choices that have been made by the map maker (Morrison, 1974; Gregg, 1997). According to MacEachren (1986), students should begin map education with the realisation that all maps are imperfections, and that each map represents different selections. Maps can be exaggerations as well as being selective (Bailey, 1979; Brodsky, 1994). All map users should be aware of this, as taking a map representation as the absolute truth can result in some dangerous assumptions. Not only should they realise that maps are generalisations, but they should also understand that not everything needs to be or should be shown on their own created maps.

• Have students use maps to follow simple routes through the classroom or playground. Begin by doing this as a group, and discuss where the route goes next, what you should see next, what should be beside you, etc. Working first as a group will build up the students' confidence (after Pearson, 1994).

• Make up a series of treasure maps to further practice simple navigation. One map will lead students to another map, etc., until the final map leads them to the 'treasure'.

• Have students draw pictures, make models or create lists of the things that basic map symbols stand for (for instance, hospitals, cemeteries, highways). This should only happen after students have been shown photographs of these symbols and talked about them. Their list of symbols, or display of pictures can be compared to a legend. This list can also help them to remember what various signs mean (modelled after the Natural method).

• Using aerial photographs, translate the shapes into maps of the same area, utilising

symbols for roads, buildings. Work as a class, and include a legend, title, north arrow, and standard elements (after Blaut, 1991).

- Examine maps, even of imaginary spots. By referring to the symbols and legend on the map, have students draw a picture of what they think the area includes. These pictures should contain the important elements contained on the map.

- Practice drawing maps, using simple symbols, of areas discussed in story books, neighbourhood parks, amusement areas, or places visited on vacation. At this stage, including all the elements is considered more important than perfect relative size and position. More practice in map drawing will help to reinforce the need for standard map elements (after Marra, 1996).

- Use base maps (already made) to show or organise information. For instance, a symbol could be placed at each desk location to indicated the number of siblings the student has.

- Students can act out situations of people that may be in need of a map, and then attempt to select an appropriate map (modelled after the communicative approach).

- Use maps for math concepts. For instance, have students add the number of schools to the number of libraries in a city.

- Use words that students find on maps to create stories or to practice spelling.

- Have students practice making sentences about what they see on the map. For instance, 'Our school is west of Queen Street' could be an appropriate sentence.

- Use map legends to compare the sizes of cities on a map. Make a list of the largest cities down to the smallest. Discuss the possible differences between large cities and small cities.

- Students should be able to create their own version of a classroom map. They should include a north arrow, a title and a legend. Symbols should be used to designate simple facts such as where the students sit, or the doors in and out of the classroom.

This level sees students starting to use maps for a variety of purposes. They are introduced to the information that is on a map gradually, and they get lots of practice in using and drawing map shapes. Students at this level should be beginning to recognise what some of the things on maps mean, and how this information can be useful.

6.2.3 - Level Three - Exploring and practising map skills

This level would ideally be introduced to Grade Three and Four students. It is an expansion of the last level and provides more practice in map use and drawing. It expands upon the simple signs introduced and understood in the last level to let students produce more interesting and accurate maps. Topics should be shaped by the student's interests.

Students are expected to:

1. Build up a larger repertoire of map symbols and meaning
2. Be introduced to concept of map scale
3. Be introduced to lines of latitude and longitude
4. Be able to create accurate (scale) maps of simple areas
5. Be able to use maps for basic measurement, orienteering, navigation and simple problem solving
6. Start to be aware of patterns in map symbols
7. Be introduced to visualisation of maps by discussing what can be seen in various directions

Specific activities suggested to promote these skills are:

- Using maps of different scales, measure the length of certain features, such as the school, a major street, or a lake. Try to determine the length of these objects in reality. To help understand scale, Sabaroff (1961) advises having students look down on a scene from a height, and observing what happens to the objects below as students go higher. Relating this to the idea that features represented on a map get smaller as the map covers more area will help the child to better understand the concept of scale. (A trip up the CN Tower, or another large building, would help with this illustration.) Introduce the concept of scale as a way to describe how big things on the map are in real life.

- Use maps and scale to make simple measurements on a map. This can provide practice in measuring as well as in using maps. For instance, students could measure the length of King Street, the distance from the school to Walt Disney World, the length or a river. Measuring interesting things can help to clarify how scale is used on a map.

- After significant practice, introduce measurement of areas and how to translate measurements into a map scale. Start with creating simple maps of student's desks, and keeping the scale correct. Work together to measure the classroom, and then move on to the school or playground. Measurements can be made on the maps, and

then compared to real life measurements to ensure that the scale is being used correctly. Understanding the concept of scale can help a child to grasp the scope of the spatial relationships on the map, and the amount of generalising that must have taken place in making the map. As Sabaroff (1961, 187) explains, "if some sort of scale is not established, there is no way of knowing how large the area is nor the distance between features." Unfortunately, the concept of scale is one that is quite complicated and can be difficult for children to fully comprehend (Thake, 1976; Boardman, 1986; Ottosson, 1988).

• Play games such as Battleship to discuss importance of a grid providing one location (Thake, 1976; Kirman, 1992).

• See if students can find grid-type lines on maps and globes. Discuss why these lines are there. Introduce lines of latitude and longitude.

• To further reinforce the cardinal directions, teach students how to use a compass, and then have them practice finding North in various locations (on a bus, in the park). From this, students can start to practice aligning the map to the compass when outside of the classroom. Best done at a stationary location to begin with.

• Students can also be introduced to using a compass for simple orienteering tasks.

• Use atlases and maps to find places of interest to students. Let students mark on a provincial or national map with pins the places they have visited over the year.

• Create a tally of the number of times different symbols are used on a map. For instance, a list could be created of the number of provincial parks, the number of tourist attractions and the number of airports within Ontario. This tally-ing could get more advanced, and could have students comparing which parts of the city have the most parks or most schools, or describing which services various neighbourhoods are close to. For instance, they could find that Beechwood is very close to schools, parks and shopping but farther away from a hospital.

• Explore colours on maps, and make lists of what each colour gets used for on different maps.

• Compare the ways that items are represented on two different maps of the same area. By looking at different scales, or even maps made for different purposes, students could look for items that are represented the same and items that are represented differently, or items that are excluded from one of the maps.

• Using a topographic map, show photographs from a particular point and have students try to guess which direction the photographer was facing.

• Have students follow verbal or written directions, such as 'turn south on King Street' or 'Drive 5 km. on Main Street', to mark a route on a map. They should also practice making up directions (after the communicative approach).

• Involve students in creative problem solving on maps. For instance, find the hospital nearest McKellar, or find the northern-most town accessible by rail in Ontario (after the communicative approach).

• Have students put together jigsaw-type puzzles of maps. If pieces are cut in small, equal sizes (such as rectangles), it will make this more difficult and force students to look carefully at what is on the map (after the communicative approach).

• Have students pick a spot on a map randomly and then create a story about it. They should include as much information about that place as they can determine from the map. They should, within their story, describe what is and what is not in the place, such as water, parks, nearby cities, etc.

• To overlap with history lessons, students could attempt to put historical maps of one area (such as their city) in the proper temporal order, discussing the changes that have occurred.

• Science and environment classes could use maps to show habitats and locations of various phenomena (such as the largest waterfall, active volcanoes, etc.)

This level of map instruction is intended to let students become familiar with many of the basic map concepts and symbols. They should feel comfortable using and drawing maps for different purposes. This level provides them with additional practice in map skills. It also begins to build upon some of the simple concepts introduced earlier.

6.2.4 - Level Four - Expanding understanding of the map meaning

This level of map instruction would ideally be directed towards Grade Six and Seven students. Students at this stage should be quite familiar with maps and mapping. This level is geared towards furthering map understanding, and getting students to realise the message of the map. It should involve the students in real, interesting map exercises. It focuses on using maps for a variety of purposes.

Students are expected to:

1. Be able to make more advanced maps in order to present and organise information - utilise topics and areas of interest
2. Use maps for planning routes, orienteering, decision making, describing aspects of other subjects
3. Start to recognise the spatial characteristics and not just the location of map phenomena
4. Be comfortable with using grid references, lines of latitude and longitude, and locational information
5. Begin to link additional information with what is being shown on the map

Specific activities suggested to promote these skills are:

• Have students make a list of the '___-est' parts of the province. For instance, they could find the largest city, the largest island, the longest highway, the furthest north city, etc.

• To provide practice for grid references on maps, use drill type exercises. For instance, students should 'find the object at 321654', or 'give the name of the lake at 456123.'

• To further practice finding places on maps, have a map representing places in the news, interesting stories, natural disasters, or whatever interests the students.

• To drill location, have students label map of Canada and neighbouring countries.

• Discuss what the climate patterns and seasons tend to be like at various levels of latitude. The class could have Theme Days for the Tropics, or the Arctic, to discuss what the weather would be like, and what differences there are between where they live and there.

• Use atlases and maps that include lines of latitude and longitude. Both Dahlberg

(1961) and Sandford (1985) criticise children's atlases for not including lines of latitude and longitude. Discuss what you can know about a place's seasons, climate, time, length of day and likely activities just by knowing its lat./long. position. Kirman (1990) explains that understanding latitude and longitude is something that is easily forgotten, and should be reviewed often.

• Have students plan a route for various scenarios. For instance, a family going to Temagami for a cottage weekend. Which route should they take, how long will it take them, what will they pass? (After the communicative approach)

• Hull (1994) suggests mapping the historical routes that have been taken and described by settlers. Students could even create a mini-play about the journey they had to take.

• Use maps for more advanced math problems. For instance, How long would it take a snowmobile to travel from A to B, if travelling at 12 kilometres per hour? Or, name all the provincial parks within a one hour drive of London.

• Use maps to discuss ideas of population distribution, highway networks. Compare where people tend to live in a province and in the country. Look at highway maps to try to determine which highways came first, and which ones are used the most.

• Look for symbols that are close together on maps, and try to determine why. For instance, rivers, bridges, and swamps may be located together in low-lying areas with poor drainage.

• Look at certain simple map features, and try to describe where those features are located. This will give students practice in observing patterns of symbols. For instance, they could notice that travel information centres tend to be on major highways, near the borders of provinces and near tourist regions.

• Use a map to locate interesting names of towns or lakes. Attempt to learn about the history of a name (i.e. Native origins) or make up a story about how places got named.

• Write letters to students in another city or province. Attempt to learn as much as possible about that place through maps, brochures, etc. Also, send information about your home to the pen-pals. Compare topics like the weather, the topography, the size of the city or town, etc.

This level encourages students to use maps for as many different interesting topics as possible. Few new concepts are introduced, but students are expected to become comfortable and competent with those that they have learned.

6.2.5 - Level Five - Developing Map Proficiency

This final level of map instruction would ideally be geared towards Grade Eight and Nine students. By this level, students have built up their geographic and cartographic knowledge. This added knowledge can be linked to maps and map representations. Students, once they have built up significant mapping experience and are a little older, have the ability to grasp some of the more difficult concepts involved in mapping, such as contour lines and visualisation. This level attempts to further enrich the students' mapping knowledge and their map literacy.

Students are expected to:

1. Be able to use a map to give or take detailed instructions, using location, local references, etc., as well as more advanced problem solving, decision making, orienteering and navigation
2. Be aware of the meaning behind the map symbols
3. Be able to give accurate descriptions of the processes and information being represented on maps
4. Understand what contour lines represent
5. Create realistic models of mapped areas (demonstrating visualisation)
6. Be introduced and develop initial awareness of cartographic standards for more advanced cartographic design
7. Be introduced to idea of map projections
8. Be aware of the links between maps, photographs, satellite imagery, text, graphs, etc. and be able to integrate other information with that on the map
9. Have a suitable knowledge of the lexicon, grammar, and meaning of map, as well as how these interact to communicate information and represent reality

Specific activities suggested to promote these skills are:

• Discuss the true shape of the earth, and observe globes to realise the movement of the earth. Discuss how to map the globe. Try to flatten an orange peel or a balloon to illustrate the problems inherent in mapping a round earth. The orange peel demonstrates how certain areas need to get stretched or squished in order to make it flat. This can be used as a very basic introduction to map projections. Maps of the world, with different projections, can be shown to depict the effect that different projections have.

• Students should build models of an area with contour lines. If they use one-inch sheets of Styrofoam, they can cut out each contour shape and build a three-dimensional model that represents the steps in the land. Once the relation between contour lines and elevation is understood, students can build models out of Styrofoam, or paper mâché, and then create contour maps of their models. Matching contours to models, or pictures, can provide further practice in using contour lines (after Hickey & Bein, 1996; Harnapp & King, 1991; Angier, 1992).

• Students should, as small groups, plan potential trips using maps. They need to determine where they are going, why, itinerary, timing, cost, and then present these ideas to the class. This could be done for an actual school trip, based upon the criteria of certain budgets and time constraints (after the communicative approach).

• Students should do detailed research on a particular area and then create a tourist brochure for that area, including map, information, how to get there, what you can see, photographs, diagrams.

• Using topographic maps, describe what the terrain would be like as you passed from Point A to Point B. Have others try to guess where Point B is, after hearing a description of the terrain covered (after the communicative approach).

• Students could be involved in site selection exercises. For instance, they could determine the best location for a new restaurant or corner store, based on the criteria that they feel are important.

• Find and mark the highest and lowest points on a map. Determine how this affects water flow in the area. Discover which way rivers flow, which lakes are higher and lower, where waterfalls are likely, which roads have steep sections. See if there are any unusual aspects about the water flow, and determine why this might be so.

• Learn about glaciers in class, and then see if students can discover any evidence of glaciers on maps.

• Students can choose a section of a topographic map and then create a three-dimensional model of the area represented. They should add in additional information wherever possible. Things like the direction of river flow, what the view from the highest height would include, what the land is used for, the population of the area, etc. could be included.

• Discuss different kinds of landforms and how they are created. For instance, fault lines, volcanic islands, mountain chains, etc. Locate these features on maps, and see if you can learn anything about their shape.

• Students can do a comparison of many different maps to try to determine if they can find any common techniques or conventions that tend to get used for the graphic

variables. For instance, in examining colour, students could find that most maps have water in blue, and boundaries in black while maps that showed blue land were very rare. These simple observations can lead students to start to understand the conventions that exist for map production. Students can be shown some of the interesting psychological experiments to learn about the research that has been done. For instance, they could see how different shades of grey can look darker or lighter depending on the background, or certain shapes look closed even if they are not quite closed. They should be aware of some of the conventions for mapping, and why they exist.

After this final level of instruction, students would still not be completely 'fluent' in the 'cartographic language'. Further specific cartographic training would be required for this. They should, however, be competent. They should be able to use different kinds of maps for a variety of purposes. They should also be comfortable interpreting the information presented on various maps. At this stage, they should be able to visualise (simply) the features being represented on the map. They should also be using the map to go beyond basic questions of location, and should be examining trends, patterns, and spatial relationships between items.

6.4 - BENEFITS AND LIMITATIONS TO THE PROPOSED GUIDELINES

These guidelines have been proposed after considering the language, cartographic and psychological findings that have been reported in this thesis. They attempt to provide a logical order for teaching map proficiency, based upon developmental, geographical and educational research. The tasks suggested move from simple Level One tasks to more advanced Level Three tasks of map use. Early activities are simple and guided, while later activities allow more individual and student-guided learning.

They are practical, as they give suggestions for what to teach, plus how to teach. In doing this, they are able to provide direction for educators who may not be comfortable or proficient in teaching about maps. Due to the many pressures placed upon teachers, having clear and simple guidelines in place for what and how to teach can be very helpful.

A further advantage of these guidelines is that they are flexible and adaptable. More activities can be added or different activities could be used. The activities can also be catered towards students' interests, and towards things that they want to learn about.

These goals and activities also overlap map comprehension with other topics. Map use can provide practice in reading and writing, as well as mathematical concepts. The use of maps can also help to clarify ideas in geography, history and environmental studies. In turn, as students learn more about these other topics, the maps they use can become more interesting and advanced.

Further work will be needed to objectively address the effectiveness of these guidelines. While they are rooted in the theory and research discussed, they have not yet been practically tested. This education is intended to help improve the map literacy of

students. More accurate methods of testing, and ways to measure map literacy, will need to be developed.

It is also hoped that these guidelines will be simple and straightforward for teachers to execute. However, further training may be needed for some teachers. Teaching about maps over ten years places demands on all teachers from Kindergarten to Grade Nine. These teachers will require a basic level of map proficiency and competency in order to be able to effectively teach to their students. There is, unfortunately, a growing gap between the geography departments and the education departments that train geography teachers (Bednarz & Bednarz, 1995). This has led to the creation of ill-prepared teachers in the past. Bednarz and Bednarz feel that teachers need to be educated in Geography and cartographic principles, in order to strengthen the geographical information being passed on to students.

Teachers may need to examine the adequacy and appropriateness of map and globe materials available for educational programs. As these guidelines recommend frequent exposure to many different kinds of maps, the scarcity of such resources may limit the effectiveness of teaching. Gathering enough maps for the whole class to use can be expensive and bothersome. However, it is hoped that schools will be able to build up a collection of maps from a variety of sources.

6.5 - FUTURE DIRECTIONS

These guidelines, and the findings reported throughout this thesis, give direction to cartographic education research. The comparison and application carried out in this thesis

place map education in a language framework. The next major step that should be taken is to determine whether these guidelines are able to help students to better understand and use maps. Previous work, by Head and Elgood (1988) and by Saku (1990), has indicated that teaching cartography using a language framework can be very beneficial. While it is hoped that the implementation of these new guidelines will help to improve map literacy in students, this will need to be further verified.

There are aspects of the cartographic language which will need to be further clarified to assist understanding. An extensive index or listing of the lexical items used in cartography should be developed. This could be likened to a cartographic dictionary, depicting the common elements and the typical ways that ideas can be represented cartographically. An elucidation of the map grammar and syntax also needs to be developed. An organised, systematic review of the map rules, and when they are used, can be most beneficial for teaching. Once these are established, the guidelines can be expanded to include additional language-based activities and to teach more aspects of the lexicon and grammar.

Finally, it needs to be acknowledged that cartography and map production are radically different today than they were a decade ago. The wide utilisation of GIS programs, desktop mapping and other technological components have changed the way that maps are made. The use of satellite images and GPS systems are also becoming an increasingly important aspect of cartography. (Fryman, 1996). The pervasiveness of technology should not be ignored for geographic education. While the proposed guidelines have not specifically addressed the use of technology, the hope is that they

could be adapted and expanded to add these further dimensions of cartography. Future research should explore how to most effectively use GIS programs, remote sensing, and computer mapping to assist in the teaching of geography and cartography (Nellis, 1994).

6.6 - GENERAL CONCLUSIONS

This thesis has demonstrated that there are significant parallels between cartography and languages. A comparison between cartography and language was carried out to discuss the similarities and differences between the two. Major components of natural languages were discussed in a cartographic context.

Cartography was shown to possess a well-developed sign system, which acts in a similar manner to that of a natural language, to represent things, feelings or ideas, and to convey meaning. The signs, once placed on a map, are the physical representation of the cartographer's reality. They are able to represent physical, mental or abstract ideas, plus convey locational information due to their placement on the map. The basic units of that sign system need to be considered in context with one another to determine their meaning. This is true of any language.

The idea of a map grammar was also explored to compare it to language grammar. The map grammar was described as a definite set of rules for forming and transforming cartographic expressions. As for languages, the rules of the map grammar govern the position, order and combination of signs on the map. While there is general support for the existence of a map grammar, the specific rules of this grammar need to be more adequately developed.

The visual order of maps was explored. While not a linear order, maps do have their own inherent order. The location of cartographic signs, and the interrelationships between these signs, act to create meaning and establish order on the map.

The notion of culture was also explored. Understanding the culture of a language involves an awareness and knowledge of the cultural connotations of words and meanings, as well as the values and attitudes of the language producers. This can be likened to an awareness of additional cartographic information, such as who made the map, where they made it, and the cultural connotations of symbols and words on the map. This information is invaluable for understanding the message of the map.

A spoken form for a language is considered necessary by some definitions of language. In general, cartography is not a vocal language. However, elements of sound have been introduced to some cartographic forms, which indicate that cartography can have vocal aspects. Learning the spoken form of a language can be compared to learning the physical form of cartography. In general, not all languages are verbal, and cartography can be described as a representational language.

Map reading can also be considered to use similar cognitive and perceptual processes as does text reading. The two can be considered similar, not only in visual processing of information, but in the way that information is transferred to the memory.

Based upon this discussion, significant parallels between cartography and language have been made. While cartography is not technically considered a natural language, it can definitely be considered a form of language. A definition of the cartographic language was provided. By considering cartography in terms of a language, a further exploration of

the language research could be undertaken, with the intention of applying it to map education.

Past map education has been described as inadequate at producing students who are comfortable and competent with using maps. Many people are unable to effectively read maps once they finish school. There has been a general agreement of a need for improvement in map education. It is hoped that this education can help people realise the utility of maps, and to give them practice in using them.

A review of the literature surrounding recent methods of map instruction revealed that there was little cohesion in this research. There has been no well-established system for how to teach people how to read maps. The methods used for teaching were not based on any general model or theory of cartography. They were typically narrow, and lacked theoretical grounding. Although the methods used for teaching were generally inadequate, several other aspects of this research were considered relevant and could be fitted within a language teaching framework. The research pointed towards early beginnings for map use. It also provided the following ideas for effectively teaching about maps:

- Provide extensive exposure to maps
- Make map learning hands on and experiential
- Make map learning interesting and relevant
- Move from known, concrete ideas to more abstract, unknown concepts
- Link maps to other topics

These ideas are similar to recommendations made for language teaching. While this research did not provide any significant guidance on *what* to teach in map education, it did provide some help for *how* to effectively teach about maps.

A look at the research surrounding second language learning and teaching helped to provide a relevant, theoretical basis and framework for teaching about maps. The language research, being well established and thorough, helped to provide suggestions for what to teach, as well as how to teach, for cartographic education. The "best" language method was described as teaching all aspects of the language, specifically the lexicon, grammar and meaning, as well as how these interact and work together to create language. In examining *how* to teach language, the specific techniques of several different methods were outlined. Considering, again, the "best" language teaching method, an eclectic approach was recommended, utilising the most effective aspects of several different methods. Effective language instruction will include some combination of drills, repetition, student involvement and considering the function of the language. Classes should be guided to relax, support and encourage the learner. Practice in the use of 'real' language should happen whenever possible.

These ideas from the second language research can be applied to map education. The cartographic lexicon, grammar, meaning and their interaction were examined as the basic foundations for map education. Several different types of language activities were also extended and applied to the cartographic language. The recommendations for a "best" language method were applied to cartographic instruction.

From that stage, guidelines for a sequenced approach to teaching the cartographic language were suggested. These guidelines were intended to foster map competence and map literacy. Five different levels, progressing from early exposure up to basic map proficiency, were outlined. For each level, general goals plus suggested activities have

been provided. These guidelines were based upon the cartographic and language research undertaken for this thesis.

These guidelines are a general and simple outline of topics and activities to be covered for map education. The benefits of these guidelines are that they are adaptable and flexible, and they describe a sensible sequence for learning map skills. They also provide a much needed direction for map education. In order to specifically apply them into an educational system, further work is needed to evaluate their effectiveness.

In closing, by placing cartography into a language framework, a detailed program for teaching map comprehension has been proposed. This thesis has provided further direction and a deeper understanding of the cartographic language. This can be valuable for map designers and map users. It can also be valuable, along with the guidelines discussed, for map educators as it points to new directions and possibilities for improving map literacy.

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