CULTURAL ACTIVITIES AND LEARNING: A PERSONAL AND CULTURAL EXPERIENCE OF LEARNING GEOMETRICAL SHAPES AND PATTERNS

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CERTIFICATE

Certified that the dissertation entitled "**Cultural Activities and Learning: A Personal and Cultural Experience of Learning Geometrical Shapes and Patterns**", submitted by me in partial fulfillment of the requirements for the award of the degree of **Master of Philosophy** has not been previously submitted so far, in part or in full, for any degree of this university or any other university and is my own work.

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Recommended, that the dissertation be placed before the examiners for evaluation.

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Abstract

The present study attempts to examine if participation in garment activity influences children's comprehension of elementary geometrical shapes and patterns. The underlying purpose is to examine the relationship between culture and cognition.

This is a comparative study between children of two groups (Weaver and Non-Weaver groups) in Senapati District, Manipur. The sample consists of 60 girls belonging to two cultural groups (weavers and non-weavers). One group consisted of 30 girls (15 each in class III and IV) who do weaving and the other group consisted of 30 girls (again 15 each in class III and IV) who do not weave. The average age range of children in both groups of Weavers and Non-Weavers (classes III and IV) is 8-9years respectively. The girls in the study belong to the Mao tribal community, in Senapati District of Manipur state, India. Children attending English-medium schools from three Mao villages were considered for the present study. Children who had not received formal geometrical instructions or lesson yet were kept as the norm.

The following objectives were framed

- To examine if participation in the cultural activity of garment weaving influences children's understanding of geometrical shapes and patterns in a social situation.

- To examine whether children in the Weaver group differ from children in Non-Weaver group in operating cognitive activities like spatial and abstract thinking.

The following hypotheses were tested

- Children who do weaving will differ significantly from children who do not in comprehending geometrical shapes and patterns in a social situation.

- There will be a significant difference between children in the Weaver group and Non-Weaver group in cognitive activities like spatial and abstract thinking.

The findings of the present study are:

- It is found in the study that Weaver and Non-Weaver children differ significantly in their perceptual understanding of geometrical shapes and patterns.

- It was also found that participation in the cultural activity of garment weaving triggers children's spatial thinking to a certain extent.

To assess the ability to comprehend different geometrical shapes and formulate patterns, 7(seven) items were constructed to assess children's ability to recognise different geometrical shapes and patterns, describe and identify them, categorize objects on the basis of their shapes, formulate patterns and give explanations and so on. No true standardized scheme was employed for the scoring.

It was observed that certain aspects of culture orients and acquaints the child with cognitive advantage of understanding of geometrical shapes and patterns. Frequent participation in the cultural activity of garment weaving also triggers child's ability to perform tasks related to spatial thinking. The findings are indicative of the nature of cultural influence in cognitive development.

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INTRODUCTION

1.1. Learning and cognition

Learning is generally considered to be an active, constructive process rather than a passive, reproductive process (as was the general view in the 1960's and 70's). It is a change in behaviour of human being – perceptual, motor, expressions of motives, etc are controlled or monitored by learning. Learning is an inevitable part of any activity; all that an individual do or experience, he or she inevitably acquires new impressions and attitudes, intentions and meanings, information and vocabulary, skills and abilities, pieces of wisdom and mental schemas.

Early learning theories like, Pavlov's 'classical and operant conditioning', or Thorndike's 'trial and error learning', or further still, Stimulus-Response orientation of Watson, Skinner, etc were looking at integrating how animals learn with how human beings may learn or may be taught or instructed. In their enthusiasm to see the effect of certain conditional stimulus on behaviour, learning was viewed as an outcome or desired changes and the processes involved in learning were usually sidelined. This was the dominant trend in Western psychology until apparently mid-sixties (Das, J.P. 1998). However the desire to know how people think, or solve problems, make decisions, what consciousness is, etc started to occupy the psychologists. Since these profound queries could not be addressed within the sway of strict behaviouristic psychology, there has been a shift to cognitive psychology. Rumelhart and Norman (1978) can be credited for their initial attempts to develop a cognitive concept of learning, wherein, they employed logical analysis of the nature of learning with a schema-based representational system (Shuel, J.1985).

According to Rumelhart and Norman, there are three qualitatively different kinds of learning:

- Accretion or the coding of new information in terms of existing schemata.

- Tuning or schema evolution, which involves the slow modification and reinforcement of a schema as a result of using it in different situations.
- Restructuring or schema creation, which is the process whereby new schemata are created.

Meaningful learning involves all three types, with different types of learning being most appropriate in different learning situations. Each type must be taken into account in developing an adequate understanding of cognitive structures and its relationship to learning. Learning how to solve problems or think and reason, etc occupies higher levels of cognition in Piaget's developmental stage, namely concrete and formal operational level. Vygotsky refers to these levels as 'higher psychological functions'. Learning would refer then to all the processes in the cognitive domain of acquiring knowledge, modification of behaviour, thinking, reasoning, problem solving, etc.

Generally, cognition refers to every process by which individuals abstain and utilize knowledge. It includes mental processes such as thinking, reasoning, learning, recognition, planning, etc through which people comprehend their environment and achieve successful adaptation to it (Mishra, 1997). This includes how information is acquired, processed and organised. The International Encyclopaedia of Education Research and Studies (Vol. 2) defines cognition as the act of knowing and the analysis of the act. Psychologists normally understand this to refer to the informed processes of thinking at the individual level, while anthropologists employ 'cognition' primarily to designate what people think, their collective cultural representations, 'belief systems' and the like (Jahoda and Lewis, pp.18-19). A narrow definition of cognition then, would refer only to 'awareness' but a broader view would include all higher mental processes like perception, thinking, attention, languages, reasoning, problem-solving, creativity, memory and intelligence, etc.

Cognitive development study how these processes develop in children, and how they become more efficient and effective in their understanding of the world and in their mental processes. Cognitive developmentalists lay emphasis on the interaction between individuals and the environmental factors, and thereby, try to understand how changes in the environmental realm alter individual's cognitive structure.

Piaget's theory of cognitive development: Overview

Piaget, the Swiss psychologist, is a cognitive giant, in that he left a benchmark in studying the intellectual or cognitive aspect of human development. He viewed that man, like all other biological phenomena has a characteristic internal organisation involving a structural concept called "schema". Piaget (1960) defined schemas as "essentially repeatable psychological units of intelligent action". It refers to strategies that the individual has at his/her disposal to respond to external stimuli when interacting with the environment (Paul, K, 1995). Key concepts to Piaget's approach are 'assimilation', 'accommodation' and 'equilibrium'. The individual structures his environment through accommodation to stimuli that come from the external source and modification of the environment through the process of assimilation (Halford, 2005).The combination of assimilation and accommodation amounts to a process of self-regulation that Piaget termed 'equilibrium' which means the process through which the structure and their component schemas undergo change over a period of time (Paul, 1995). Piaget felt that children do not learn unless faced with an optimum level of dissonance (Crain, 1980).

Piaget conceptualised the development of children's cognitions by a succession of distinct and coherent 'stages' of cognitive development, which reflects the direction and course of mental development. Each stage has an underlying cognitive-logical structure. The first stage is the sensorimotor (0-2years), characterised by structured coordination of sensori abilities and motor skills, wherein child comes to understand the world by seeing, touching and hearing. For babies, objects cease to exist once they are out of sight. The preoperational stage (2-6years) is characterised by the development of semiotic or symbolic functions, including play, drawing, imagery and language. The child begins to use symbols and language to represent things. Thought process at this stage usually displays a high degree of egocentrism and animism, and therefore limitations on thinking at this stage are due to inability to consider other's point of view. At the concrete operational stage (7-11 years), children begin to think logically but are unable to think in abstract terms. The underlying characteristics at this stage is the ability to perform tasks involving conservation of number, classification, relations or functions, in which thinking is governed by fundamental rules of logic. The last and highest stage is the formal operational stage (11 years and above), which is characterised by the ability to compose concrete operations into abstract thinking and deal with hypothetical testing. The child at this stage has the intellectual potential to discover solutions to problems through mental manipulation of symbols by adopting logical and systematic way known as scientific thinking and problem solving

Piaget (1952) viewed that learning is a spontaneous process that comes from the child's own effort to make sense of the world and thereby, make great intellectual leaps simply by exploring the environment, before an adult intervenes the process. In Piaget's view, real learning then comes from experiences that arouse children's curiosity and give them the chances to work out their solutions on their own. Piaget endorses problem-posing educational objectives. The child, in Piaget's view, is an intellectual explorer, making her own discoveries and formulating her own positions. Piaget acknowledged that people do have an impact on the child's thinking but only in terms of promoting development by stimulating and challenging the child's own thinking.

Piaget's stage theory provides a comprehensive account of how child interacts and develops as he interacts with his environment, and how maturation and experience determines child's cognitive growth. Owing to its highly ethnocentric approach, a sociocultural perspective, under the pioneering works of Vygotsky, the Russian psychologist, was adopted to examine the relation between culture and cognitive development.

1.2. Issue of culture

'Culture' is a term used and understood in various ways by writers of various disciplines and it is beyond the scope of this paper to discuss and analyse, at large, the different observations made. Therefore, for the purpose of our understanding and relevance of the discussion 'culture' is taken to mean the totality of socially transmitted behaviour patterns, along with the arts, institutions, and other process and products of work and thought.

Britannica Concise Encyclopaedia, (2002) defines culture as, "[It] is an integrated pattern of human knowledge, belief and behaviour that is both a result of and integral to humankind's capacity for learning and transmitting knowledge to succeeding generations". Encyclopaedia Dictionary and Directory of Education, Vol. I, (1971) describe "culture is all the manifestations of social habits of a community and all human beings as determined by these habits. It implies the mental patterns of thinking of a community as reflected in the life and work of its members."

Culture plays a crucial role in human evolution, allowing human beings to adapt the environment to their own purposes rather than solely on natural selection to achieve adaptive success. Hollins (1996) states that:

> *Culture is ... the essence of who we are and how we exist in the world. It is derived from understandings acquired by people through experience and observation (at times speculation) about how to live together as a community, how to interact with the physical environment, and knowledge or beliefs about their relationships or positions within the universe.*

Maynard and Greenfield (2003) also echo that culture is a socially interactive process of construction comprising two main components: shared activity (cultural practices) and shared meaning (cultural interpretation). Both components of cultural processes are cumulative in nature since they occur between, as well as within, generations. Meanings and activities not only accumulate but also transform over both developmental time--across a single life cycle, and historical time--between generations.

Hall (1977) as cited in Ezeife (2002) concisely described the function of culture as, "culture is man's medium; there is not one aspect of human life that is not touched and altered by culture. This means personality, how problems are solved, how their cities are planned and laid out, how transportation systems function and are organized, as well as how economic and government systems are put together and function...." (p.179).

Going by Hall's observation, it can be inferred that culture would have a pervading influence on how a group of people live, think and learn. The culture prevalent in the weaving community, for instance, would affect how members think, learn, and retain what they are taught and what they experience at home. It can also be assumed that it is culture that shapes their learning styles and conceptualization of geometrical figures in their cloth designs, for example, determining to a large extent to what use they put acquired knowledge from home experience in formal setting.

Culture is not static but dynamic and alters with the changing time and generation. Men constantly interact with his environment and both complement each other in the process of change and development. Any change in culture simultaneously alters the behaviour and course of actions of individuals who are directly or indirectly part of it. Culture means not only the material products of art and craft, etc but also includes the process of interaction with the different systems and mechanisms in any given society. Globalization and technological rage are examples of the fast changing nature and fusion of knowledge cultures. The extent to which use of technological tools, like the computer and internet, help men manipulate and solve problems, gather information, get connected to different cultures of the world with the 'click' of an object, etc gives profound insight about culture and men interacting and making each other. This is also apparently what Engels' had in mind when he wrote about tool-use and human evolution (Crain, 1980). Engels observed that once people began making tools, their minds also expanded. They began discovering new properties of natural objects, such as properties of stone and wood that facilitate cutting. Tool-use also led to new modes of cooperation and communication. As technologies advanced, people discovered the advantages of working together (Crain, 1980, pp.215-218). For example, people found that they could more effectively build a hut or a boat by joining forces. Eventually, owing to the felt need to convey accurate messages to co-workers, speech was developed. This example justifies the point that culture is evolutionary and not static.

Following the above approach to understanding culture as dynamic and evolutionary, the paper will now focus on discussions that will help us navigate the dialectical relationship between culture and cognitive development. It also seeks to explain that individuals learn and develop in the process of their participation in cultural activities. Learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers (Vygotsky, 1978, p.90).

1.3. Theoretical orientations on culture, learning and cognitive development

Following will be a brief general theoretical orientation on culture and cognition and the discussion will narrow down to the sociocultural theoretical approach as pioneered by the Russian psychologist, Vygotsky, to navigate the relation between individual development and cultural process.

General orientations for understanding cognitive development

Two broad approaches are associated with studies in cognitive development, viz., the nativists and the empiricists. Mishra (1997) refers this as the nature-nurture controversy considering that, the nativists assert that all perceptual and cognitive phenomena are inborn; that there is an inherent organization in information received from stimuli, and that it does not require any active construction by the organism to perceive the world. On the other hand, empiricists opine that the way organisms respond to stimuli in the environment exemplifies the role of experience and learning.

Following closely to these counter approaches are also orientations on cognition as described by cross-cultural psychologists like Berry, Poortinga, Segall and Dasen (1992), namely absolutism, relativism and universalism.

Absolutists view cognitive abilities and processes as essentially untouched by culture and are least concerned with the problems of ethnocentrisms. Example, the essential character of 'intelligence', 'honesty', 'achievement' etc is assumed to be the same everywhere, and ignores the possibility that the researcher's knowledge is rooted in their cultural conceptions of the phenomena.

Relativists take the other extreme position whereby, their cognitive life is locally defined and constructed, and postulates the existence of cognitive activity that is unique to a particular culture. Contextualizing the ongoing discourse to Piaget's theory on the stages of cognitive development, absolutists oblige that the developmental sequence, such as the sensory-motor (0-2 years), pre-operational (2-7years), concrete (7-11years) and the formal operational stages (11 years and above) are likely to be universal. Relativists on the other hand, argued that the notion of formal operations as the prized-end stage is a result of the western system; and that the ultimate criteria for any level of cognitive development should be context-dependent (Berry, et al, 1992). This position of relativism provides a non-ethnocentric stance from which to view cultural and psychological diversity.

Both absolutism and relativism are extreme orientations. Universalism is a middle path orientation which adopts that basic psychological process and cognitive variations are manifestations of specific cultural practices; it also seeks underlying similarities that are rooted in pan- human cognitive processes (Mishra, 1997; Berry, Poortinga, Segall and Dasen, 1992). The middle path orientation has been instrumental in shifting the focus of studies on cognitive development from considering thinking as a private, solo activity to thinking that involves interpersonal and community processes in addition to individual processes.

Sociocultural theory: An overview

Researchers interested in culture and cognitive development drew inspiration from the works of the Russian psychologist, Vygotsky, who occupies a central place in sociocultural discourses, owing to his path breaking research to integrate individual development in social, cultural and historical context. This approach is interchangeably referred to as the sociocultural, sociohistorical or cultural-historical approach.

In this perspective, the creation of a learning environment can be conceived of as a shared problem space, where children participate in the process of negotiation and co-construction of knowledge. A fundamental claim of this approach is explained largely by a popular term "appropriation" – a socioculturally evolved means of mediation and modes of activity. Proponents of this approach viewed that social phenomena are governed by a unique set of explanatory principles and that certain aspects of the individual's psychological functioning are determined by these social phenomena. This provides scope for explanation of individual's psychological processes, both cognitive and affective.

Key concept to sociocultural approach is the role of culturally developed signs and symbols as psychological tools for thinking. Drawing inspiration from Engels's material concept of tool-use, Vygotsky proposed the possibilities of mental tools or psychological tools. He is of the view that men also create 'psychological tools' in the process of developing material tools to monitor mental processes (Crain, 1980. pp.218-220). For example, when people used notched sticks and knotted ropes, it acts as an external aspect to help them remember events. The process of memorising is reconstructed through the transformation of an external object as a reminder of something. Later as culture developed, they created other mental tools. Vygotsky called the various psychological tools that people use to aid their thinking and behaviour 'signs'; he viewed that we cannot understand human thinking without examining the signs and symbols that cultures provide. When humans use signs, Vygotsky said they engage in mediated behaviour. That is, they do not just respond to environmental stimuli; their behaviour is also influenced or 'mediated' by their own signs (Vygotsky, 1930, p.26). Writing and numbering systems are two other important sign systems. Vygotsky primarily focused on cognitive skills and their relevance on cultural inventions such as literacy, mathematics, mnemonic skills and approaches to problem solving and reasoning. Going by this view, thinking involves learning to use symbolic and material cultural tools in ways that are specific to their use.

From this point of view, the use of psychological tools:

- Introduces several new functions connected with the use of the given tool and with its control
- Abolishes and makes unnecessary several processes, whose work is accomplished by the tool; and alters the course and individual features (the intensity, duration, sequence, etc) of all the mental processes that enter into the composition of the instrumental act, replacing some functions with others (i.e. it recreates and reorganises the whole structure of behaviour just as a technical tool recreates the whole structure of labour operations).

Vygotsky viewed that at any point in time, a child is functioning at a particular level of development, and that each child is capable of further development if supported and guided by experienced or expert partners. He advocated cognitive growth as emerging out of cultural practices or out of an expert's intervention by transferring skills to a novice learner whereby children learn to use the tools for thinking provided by culture through interactions with more skilled partners in the zone of proximal development (ZPD). The ZPD is the distance between the actual developmental level and the potential level of the child; this term is used to describe the child's potential to use the help of others to gain consciousness and reach higher intellectual grounds, transforming the meaning of the previous concepts prior to the intervention. While engaging with others in complex thinking that makes use of cultural tools of thought, children find ease to carry out independent thinking, transforming the cultural tools of thought to their own purposes (Rogoff, 2003). The more children take advantage of adult's support, the wider is their ZPD.

Proponents of sociocultural approach take individual-in-social action as their unit of analysis wherein; the primary issue is that of explaining how participation in social interactions and culturally organised activities influences psychological development. Taking this into account, mathematics and its nuances vis-à-vis geometry can be understood as a socially and culturally situated activity in a community of practice. Sociocultural approach highlights the role played by activity in mathematical learning and development; where activity is linked to participation in culturally organized practices. The term 'activity' is interchangeably used by socioculturalists as setting, context, task, situation, problem, goal, etc.

The emphasis on self-construction through and with available tools brings two things to light. Firstly, it speaks of the individual as an active agent in development. Secondly, it affirms the importance of contextual effects, wherein; development takes place through the use of those available tools at a particular time in a particular place (Daniels, 2001).

A brief preview of Bronfenbrenner's ecological system would be apt, then, to examine the social interactions, or the contexts in which we live, that govern our experiences.

Bronfenbrenner's Ecological System

Bronfenbrenner's ecological system has been instrumental in providing a model to help researchers think about individual development and cultural process. According to Bronfenbrenner's ecological model, environment is composed of one's immediate settings as well as the social and cultural contents of relations among different settings, such as home, school, and workplace. His primary concern was in specifying the properties and conditions of the social and physical environments that foster development within people's 'ecological niches'. He defined the ecology of human development as involving 'the progressive, mutual accommodation between an active, growing human being and the changing properties of the immediate settings in which the developing person lives, as this process is affected by relations between these settings, and by the larger contents in which the settings are embedded (1979, p.21). He proposed a number of structures, presented in concentric cycles, to explain the ecological system in which individuals function;

i. Microsystems: this is the individual's immediate setting. E.g. home, classroom, neighbourhood, religious institution, etc. One unit is related to other larger interpersonal structures wherein, even in immediate settings, individuals are dependent upon other significant third parties and larger groups.
ii. Mesosystem: refers to the interconnections between immediate settings which is

the home, the Microsystems. This setting links or ties together information, knowledge, attitudes, etc from one setting that helps to shape behaviour or develop in another setting and vice versa. For example, how the communication between home and school affect the child's ability to learn.

iii. Exosystem: includes those events in which children do not directly participate but affect him or her all the same in significant ways (parental occupation, balancing work schedules, child care arrangement, etc).

iv. Macrosystem: This contains the most complex system, the blueprint for the organisation of the society. This includes values, customs, resources, lifestyles, opportunities, and patterns of social interactions, like how the government decides to patronise federal funding for human services, perspectives on separation between religious institution and state etc.

In its subtle yet remarkable way, Bronfenbrenner's approach made a great contribution towards understanding the relations among the larger multiple settings in which children and their families are directly and indirectly involved. His model clearly indicates that the components of the ecocultural system interact and function as a coordinated system and make significant contribution to one's development. It is from here that 'culture', 'home' and 'environment' and related terms will be collectively and interchangeably used.

1.4. Learning in everyday life

With that theoretical orientation in the background, the paper will now move on to navigate the nature of learning in an indigenous cultural group, namely weavers' home.

Most of the socialisation experiences of children take place in informal settings within the family or among peers and siblings, and a fundamental part of one's daily activities. And most often children from indigenous cultures pick up learning of social cognitive skills by means of observation.

Alonge (1982) as cited in Ezeife (2002) observed that learning styles in indigenous cultures is essentially oral in tradition (listening, watching and doing), individualised instruction and group work. Indigenous knowledge is transmitted orally which is used to maintain the cultural heritage. They invest tremendous effort and ingenuity in devising mnemonic techniques to memorize, preserve and transmit their rich body of knowledge to future generations (Rampall, 2003).

Stairs (1995), again cited in Ezeife (2002), who compared and contrasted Aboriginal and Western models of education used the Inuit word 'Isumaqsayuq' to describe the Aboriginal model of education. "Isumaqsayuq is the way of passing along knowledge through the observation and imitation embedded in daily family and community activities, integration into the immediate shared social structure being the principle goal. The focus is on values and identity; developed through the learner's relationship to other persons and the environment". People of indigenous cultural backgrounds learn from prior experiences and so when the excited children from such communities enrol in school. the child is perplexed by the entirely new method of learning and guidance. Stairs (1995) describes the western model of teaching and learning as "ilisayuq, which means teaching involves a high level of abstract verbal mediation in a setting removed from daily life, the skills for a future specialized occupation being the principle goal" (Ezeife, 2002. p.180).

Weaving as a cultural activity is an embodied form of knowledge that is transmitted across generations within families and among women brought together through marriage, proximity, trade, feasting, work exchange, and other formal and informal mechanism. The craft is learned through experience, repetition and the senses and preserved in products of labour that are worn, used in daily tasks, presented as gifts and taken away by state officials as souvenirs. Hendon (2006) observed the passing of knowledge from one generation to another in Mayan culture and pointed out that learning first begins at home. Learning to weave was gradual and developmental in approach. For instance, at 5years of age. girls were allowed to hold the spindle, at age six, they begin to learn how to spin, and a few years later, they begin to weave (Hendon, 2006). Because of ample opportunities that children get to observe, learn and participate, directly or indirectly, from adult members at home, there have also been speculations that the process of learning begin prior to any direct interaction between individual and craft. For example, contemporary Mayan women who carry their infants on their back while engaged in the tasks of daily life 'joke that the child is also working' (Hudson, 2006: 362) as the child involuntarily follows the movements of her mother's body.

Weaving as a craft is a social process which includes activity around material resources, tools, operational sequences and skills, flexibility, creativity, choice of knowledge accumulated over time, often through verbal and non-verbal knowledge and observational learning, and specific modes of work coordination in a social context (Hendon, 2006). Contexts are the "threads" from which are woven the fabric of a society's total adaptation to its circumstances (Lee & Devore, 1976).

Weaving connects the body of the weaver to the loom symbolically as well as physically. Acquiring the ability to create design and choose colour combinations must be coupled with a mastery of multiple steps including different patterns, brocading, and embroidering. Brocading, in which supplementary weft yarns are inserted by the weaver into the warp using a pick, created cloth favoured by royal and noble Maya women (Hendon, 2006; p.362). Brocading, which contemporary weavers say, they enjoy doing because of the way it allows them to exercise their creativity and vary the design motifs over the length of the textile, requires precise counting and the ability to keep track of the complicated patterns. These abilities are engrained in the body through the learning process and by the technology itself. The loom itself appears to be a simple device, having no symbolical meaning except a pile of sticks, but the loom takes a whole new form and meaning when the weaver warps thread around it, positions herself on the loom, and the weaver controls the tension by the direction in which she moves her body forward and backward, opens and close the sheds in which weft threads are inserted by lifting heddles, placing and rotating the wooden batten, and using other hand- held implements as needed.

The above discussion pointed out that weaving is an embodied form of knowledge that is transmitted across generations in a sociocultural endeavour; and that learning to weave is a craft which requires specific skills, etc. It is interesting to note that learning to do the craft is embedded with rich information on the pre-literate teaching-learning methods. Gleaned some common learning styles from observations in the process of an activity (weaving) and ways of learning observed in other mundane activities.

1.4.1. Styles of learning in indigenous culture

- The focus in craft learning is on mastering context-specific skills.
- It is more person-oriented than information-oriented
- Learning is primarily through observation and imitation.
- Holistic (global) learning: Learning is often holistic, that is, the learner concentrates on understanding the overall concept or task before getting down to the details.

The following are some of the characteristics, culled from the above discussion on learning in indigenous culture

- Learning by observation: Children keenly observe the adult members in an ongoing activity. The children would sit in rapt attention and attend to the information available through the adult weaver's actions and body movements.
- Learning by doing (active participation): The children after observing the adult for many days and having found her niche in the activity, finally models the behaviour. E.g., after the girl child observes the adult weaver for a prolonged period, she gathers confidence to carry out the same task herself. It has been found that the child usually operates it skilfully on her very first try. Rogoff (2003) and Henderson (2006) have made similar observations.
- Readiness to learn: Adult weavers do not pressure the young weaver to do the craft. On the contrary, they wait till the child thinks she is ready to do the craft and participate in the activity. Vygotsky (1978), Piaget (1952) and Cole (1971) point put that a child would learn and solve problems only to the point that a child can do. Scaffolding / ZPD can only trigger through processes lying dominant in the child.

- Learning is gradual (self-regulated): Children learns and picks up skills to weave at her own pace.
- Adult's intervention: Adult members keep tract of the child's activities, often without the knowledge of the young member, and subtly provides prompts and cues whenever the young weaver seem to encounter any problem. Assistance offered is verbal or non-verbal; in the form of instruction or information

1.4.2. Sources of learning in indigenous culture

The following discussion will address questions like how do child and adult come to a mutual understanding about which action is correct and which behaviour is not acceptable? How the role and participation of each is organised?

Human development starts with dependence on caregivers. The developing individual relies on the vast pool of transmitted experiences of others. Vygotsky in his well-known "genetic law of development" emphasizes this primacy of social interaction in human development.

Every function in the cultural development of the child comes on the stage twice, in two respects; first in the social, later in the psychological, first in relations between people as an interpsychological category, afterwards within the child as an intrapsychological category... All higher psychological functions are internalized relationships of the social kind, and constitute the social structure of personality (Vygotsky, 1966; p. 44).

Rogoff (2003) observes that when beginning an activity, learners depend on others with more experience. Over time, they take on increasing responsibility for their own learning and participation in joint activity. She characterizes this process as guided participation. In her cross-cultural studies, she documents children's varying forms of participation with parents and peers. She found that even when children were not conversational partners with adults, they were involved in the adult world as participants in adult agricultural and household work. She describes the supportive engagement of Mayan mothers with their children as an example of the nonverbal guidance adults give children. The routine arrangements and interactions between children and their caregivers and companions provide children with ample opportunities to observe and participate in the skilled activities of their culture. Through repeated and varied experience in supported routine and challenging situations, children become skilled practitioners in the specific cognitive activities in their communities.

1.4.3. Observational learning

"Learning would be exceedingly laborious, not to mention hazardous, if people had to rely solely on the effects of their own actions to inform them of what to do. Fortunately, most human behavior is learned observationally through modeling: from observing others one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action." -Albert Bandura.

Most often children from indigenous cultures pick up learning of social cognitive skills by means of observation. Bandura (1962) opines that in social situations people often learn much more rapidly by observing the behaviour of others in an ongoing activity. When for example, children learn new songs or play house just like their parents, they often reproduce long sequences of new behaviour immediately. They appear to acquire large segments of new behaviour all at once, through keen observation alone.

Rogoff (2003) viewed that children's learning through observation of ongoing activities in everyday life resembles the structure of learning and assisting of mastery in apprenticeship. In many communities, people learn their trade through involvement in an apprenticeship. The novices learn largely through their engagement with other apprentices and the master in real production, observing their peers and the master and learning through their own involvement (Lave, 1988). Apprenticeships vary in their degree of structure and formality. Most often, helping the master's trade is prioritised and so only limited time and attention is devoted to strict instruction. Apprenticeships seem to be associated with specializations that cannot be communicated but can only be experienced (Coy, 1989). "Ways of knowing", "learning to see" are phrases commonly associated with apprenticeship experience and they are often associated with the physical performance of the duties entailed in the role that is sought. In apprenticeship training, the learning model is generally 'learning by doing'; watching, over and over again, and then trying to do things for oneself (Coy, 1989. p.2).

In one of Guatemalan subculture, the girls spend several years closely observing their mothers and older relatives as they weave. They also engage in play with modified, miniature looms beginning as young as age three before attempting to weave on a scaled down version of an adult one. Then, when the girl feels ready, she takes over, and she usually operates it skilfully on her very first try. She demonstrates no-trial learning; she acquires new behaviour all at once, entirely through observation. She does not need to fumble through any tedious process of trial-and–error learning with differential reinforcement for each small response. When new behaviour is acquired through observation alone, the learning appears to be cognitive. When the Guatemalan girl watches the expert and then imitates her perfectly without any practice, she must rely on some inner representation of the behaviour that guides her own performance. Thus Bandura believe that learning theory must include internal cognitive variables (Craine, 2000).

Observation also teaches us the probable consequences of new behaviour; we notice what happens when others try it. Bandura (1965) calls this process vicarious reinforcement. Vicarious reinforcement is also a cognitive process; we formulate expectations about the outcomes of our own behaviour without any direct action on our part.

We learn from models of many kinds - from symbolic models, such as the clothe designs and patterns, or models could be from the actions of adults and peers engaged in activity. Another form of symbolic modelling is verbal instruction as when a mother instructs her child how to roll the spool of thread or instruct her to cook supper. In this case, the adult member's verbal description along with a demonstration, usually teach us the most of what we need to know.

The preceding discussion on observational learning throw light on how child regularise her behaviour, think independently, and learn to conform to social norms and expectations as a member and participant of the larger social milieu.

1.4.4. Learning through guided participation

Communication and coordination during participation in shared endeavours are key aspects of how people develop. Participants adjust among themselves (with varying, complementary, or even conflicting roles) to stretch their common understanding to fit new perspectives.

From a sociocultural point of view, it is clear that children play active roles, along with adult members and other companions, in learning and extending the ways of their communities. Rogoff (2003) proposed two broad processes of guided participation which will be discussed in this section; first, children and their companions supporting shared endeavours by attempting to bridge their different perspectives using culturally available tools such as words, gestures, referencing actions and reactions. Second, their structuring of each other's involvement to facilitate engagement in shared endeavours. Mutual structuring occurs in the choice of activities children have access to as well as in interactions between children and their companions in the course of shared endeavours.

The term 'guided' here would mean to include and go beyond instructional interactions. Guided participation also focuses on the activities of the 'legitimate peripheral participants'. It includes varying forms of participation in culturally guided activities through the use of particular tools and involvement with cultural institutions.

Mutual bridging of meanings

In bridging different perspectives, partners seek a common perspective or language through which to communicate their ideas in order to coordinate their efforts. Mutual understanding occurs between people in interaction and never in isolation. Modifications in each participant's perspective are necessary to accomplish things together. The modifications are a process of development; as the participants adjust to communicate and coordinate; their new perspectives involve greater understanding (Rogoff, 2003). For example, a mother and a child might operate an object together, or a mother might attempt to assist a child trying to operate an object. Toddler and mother actively interpret and participate in the definition of situations in the direction of activities.

Bridging between meanings relies extensively on non-verbal means of communication. For example, in social referencing, people seek information about how to interpret ambiguous situations from the expressions of others. Social referencing is a very powerful way to gain and give information, and at the same time regulate receiver's behaviour. Children seek information in social interaction, attempting to obtain information from the direction in which caregivers point and gaze. Toddlers understand intonation contours, timing, emotional tone etc as gist of the caregiver's message. Emotional communication between parents and infants is also a widespread way of regulating infant mood.

Words provide children with meaning and distinctions that are important in their community. Young children make large contributions to their own socialization, assisted by other people's efforts to support their growing understanding. Mutuality in early language used is especially evident as some infants build discussions with others through successive terms that layer the infants' one word comments. Mutual involvement in bridging meaning occur world wide- although it takes a variety of forms, in different communities.

Mutual structuring of participation

Children and caregivers and other companions around the world together structure the situation in which children are involved (Rogoff, 2003). The structuring occurs through choice of which activities children have access to observe and engage in, as well as through in- person shared endeavours including conversations recounting of narrative and engagement in routines and play.

Caregivers, community practices and institution, and children's own choices mutually determine the situation in which children are present and have opportunity to learn.

Structuring of children's participation occurs as they choose to or choose not to do shores, or eves drop on their parents. Such choices may be made without the intention of providing a learning experience. But a times, the choices may be design explicitly around children's learning, as in the design of specialised institution for learning or availability of specialised training objects, such as baby walker, bay books and toy implements (Rogoff, p.287-288). Children's active monitoring of events around them makes clear the importance of the choice of events they are allowed or required to be around. Even when events are not staged for children's benefits or adjusted to their viewing, they gain important information through observing (Bandura, 1986).

Metacognition

Key component to autonomous learning, information handling, carry out instructions accurately, understand people's actions, distinguish different shapes and patterns, ability to convey one's thought to significant others; participate in adult conversation, etc, is metacognition. It refers to knowledge about, and awareness of one's own capabilities and cognitive plans vis-à-vis the task. Metacognition includes knowledge of cognition, where children perform task without any explicit awareness (about oneself as a learner and the factors that influence one's performance), and procedural knowledge (about the execution of skills) and conditional knowledge (about when and why to apply and retain cognitive actions).

Metacognition is acquired through autonomous learning, peer-regulated learning, and direct learning (Berry, et al, 1992). Metacognition appears to involve two stages of development. First, it appears at approximately five years when children begin to take conscious control of their behaviour and thinking. The second stage emerges at approximately age twelve, when children begin to take a more abstract analytical and systematic approach to control their thinking.

1.5. Review of Literature

Cross-cultural research has often been informed by the universal and culture-specific processes on cognitive development, either directly or indirectly; and research on numerical or mathematical cognition, problem solving, abstract thinking or subtle cognitive processes like learning styles, etc are no exceptions. A perusal of the available literature and review of studies grounded on culture sensitive approach reported here will substantiate the point that 'the context of practice and activity are closely linked and intertwined in cognitive functioning' (Khan, F; 2004).

Lave (1988) observed Liberian tailors' arithmetical problem solving on the job and found that everyday experience in the tailor shop provided opportunities or arithmetic learning that focused on the manipulation of quantities. Another observation was made on everyday activity grocery shopping in the supermarket. Interviews and observations conducted on arithmetic problem solving by schooled adults in California. Result showed that the high success rate in real-life problems was due to the powerful monitoring of a dialectical process between the setting and the activity that create and brings problems and solutions together.

Gleason (1973) observed that children routinely have difficulty in referential communications task, yet in everyday situations they adjust their communications to meet the demands of their listeners.

Farida Khan (2004) explains the relationship between everyday practices and mathematical understanding of working class children in three different settings viz., schooling, newspaper vending and paan selling. Children were compared on their knowledge of the number system and their competence and understanding in solving as set of mathematical word-problems. Results showed that vendors although not been oriented with formal mathematical knowledge, have a competent understanding of mathematical principles and computations enriched by their everyday practices.

A classic study of "mathematics in the streets and in schools" in Brazil, **Carraher, Carraher, Schliemann (1985)** found that children who made a living selling watermelons and sweets in the streets could calculate easily and accurately in the context but could not perform the same calculations when they were presented as 'school problems'. Such observations suggests life beyond investigatory setting (e.g., classroom) teems with ways of thinking, communicating and using symbols that are otherwise suppressed or wrapped up (Berry et al, 1997; etc).

In a review of studies contrasting learning in and out of school, **Rosnick (1987)** as reported in **Pick, A (1980)** pointed out that while school learning focused on individual cognition, abstract thought and general principles, out of school learning depended on shared cognition, contextualized reasoning and situation specific strategies and competencies.

Ginsberg and Allardice (1984) examined children's difficulties with elementary mathematics, namely cognitive difficulties of normal children in the social context of school. They tested the "cognitive deficit" hypothesis. Their findings failed to support the hypothesis. Their findings suggested that the vast majority of children with math difficulties (MD) do not suffer from deep-rooted cognitive deficits or fundamental disorders of mathematical thinking. On the contrary, MD children possesses informal mathematical concepts and skills, and that major contribution to mathematics difficulties is perpetuated by schooling itself, defined in the broad sense to include teaching, tests, text books, school atmosphere, and social values. The researchers viewed that MD children need good education and psychologists may help MD children learn under a different system by focusing on child's learning potential, which may emerge in radically new environment.

Stigler & Perry (1990) examined Asian – American difference in mathematical achievement and found that Asian children outperformed their American counterparts in computational skills, problem-solving and other mathematics related tests. Deeper inquiry unveiled that organization of mathematics classes in Asian and American schools are tied to cultural beliefs about the nature of individual differences and the nature of learning.

Broyon examined the influence of two different forms of schooling, modern and Sanskrit, on the development on metacognitive abilities vis-à-vis solving problems related to spatial notions (Sanskrit education is a traditional oral system of training and of transmission of knowledge). 36 children each from Sanskrit schools and modern schools were tested with some spatial tasks related to everyday cognition and with the Metacognitive Awareness Inventory (MAI). The hypothesis concerning the influence of the type of schooling is confirmed, especially for the individual task and the MAI. Both boys and girls from the Sanskrit schools scored better cognitively and metacognitively then students from modern schools.

Typically, a task used to study classification is to present a small collection of objects or shapes and to ask people to group together those that are alike. **Pick (1980)** reported the results of studies conducted by **Suchman & Trabasso (1966)** in the United States which showed a developmental trend toward the use of form rather than colour as a basis for grouping the shapes (Pick, A; 1980), such a trend is not always observed among children in other cultures and these cultural differences may be attributable to differences in education. For example Serpell (1969) found that Zambians are more likely to use form for classification as the number of years of their schooling increases, and young British children – who have attended nursery school – are more likely to use form than are young Zambian children who have not attended nursery school (Pick, A; 1980).

Cole et al (1971) conducted a study of cognitive abilities vis-à-vis classification, according to Kpelle system. Kpelle subjects mastered this task faster than American college students teaching in Liberia. A striking result was that Kpelle adults learn very rapidly only if the two classes to be formed were called "vine and leaf", and displayed slow learning when tested on pseudo-category. The American showed evidence of categorical learning at all; in fact, they had trouble telling one leaf from another, let alone establishing a response (category) for each leaf. In this study the Kpelle subjects clearly manifest knowledge and use of a cultural category, yet only that category is explicitly named.

Olson (1970) examines the effects of two related East African cultures (Logoli and Kipsigis tribes) on the development of ability to construct the diagonal. To this end the diagonal and elated problems were administered to 143 children of the Logoli and Kipsigis tribes. Analysis of the results showed that age, years of schooling, and tribe are significantly related to success on one or both the diagonals. A dramatic finding is the obvious difficulty that the African children have in copying Logoli tribes do not have in their language, words for geometric terms like square, triangle, circle, diagonal, rectangle or straight line. As such language impoverishment has obstructed the Logoli children from making distinctions critical to the construction of the diagonal.

There are evidences in which cultural factors operate in memory. For instance, cultural groups that are in the habit of managing life without lamps or other sources of light at night would highly demand individuals to keep things in fixed places and remember them. **Mishra, (1997)** and colleagues have evidences for this from their studies on a groups from tribal Indian cultures. They compared incidental and intentional recall of children for "locations" and "pairs and pictures". There was greater recall accuracy for the "locations" than paring of pictures.

Cole, et al, (1971) studying memory among preliterate Liberian Kpelle, who use categorization, demonstrated that the preliterate Kpelle subjects fared poorly on free-recall memory task but benefited in tasks where items were inserted in a story, whereby the sequence of events provided reason for categorization

Memory has also been implicated in the explaining of large differences in mathematical problem solving skills between Asian (Chinese and Japanese) children & American children, as identified by Stevenson and his colleagues. **Stigler, Stevenson (1986), Miller (1987),** etc found that young Chinese children could recall large number of digits. The explanation is that most Asian used the structure of number words, such as "ten one" instead of "eleven", which makes counting easier; also there are differences in the time required to pronounce number words in the language involved. Memory span has been found to be larger for short term long words. Thus, short numbers, like in Chinese, offer mnemonic advantage. This phenomenon is an expression of culturally valued scheme of learning and do not suggest that children of a different culture are less adequate of cognitive operations.

Greenfield, P & Maynard, A.E (2003) investigated the link between modes of apprenticeship and the development of skills by examining the spatial skills involved in creating, setting up, and weaving the warp of a loom. The test was conducted on 160 Zinacantec and Los Angeles children ranging from age 4 to 13 years, each age level equally represented, and 80 children equally representing gender and location. The children were tested on the role of cultural learning in the development of Piagetian stages of spatial representation. Results showed there were effects of experience. Reflecting overall familiarity with weaving, Zinacantec children performed significantly better than children in Los Angeles on these tasks. A significantly two-way interaction between culture and gender reflected the specific effect of weaving experience. The significant difference between Zinacantec girls and Zinacantec boys indicate an effect of active weaving participation, experienced only by Zinacantec girls.

Chassapis Dimitrius (1998) conducted a study focusing on the process by which children develop a formal mathematical concept of the circle by using various instruments to draw circles within the context of a goal-directed drawing task. Analysis of the data showed that the use of circle tracers and templates provide regulation and control of the human hand movement but do not radically transform the children's spontaneous concepts of the circle. This suggests that the outcome of a circle-drawing operation is actually available to the children as a mental image prior to its materialization by pencil tracing on a piece of paper.

Irwin, Schafer, and Feiden (LCHC, 1983), who were sceptical of claims that unschooled Liberians (Mano) generally lack the ability to classify because they perform poorly when sorting geometrical shapes. To support their stand, they conducted a set of task, to Liberian unschooled and U.S. schooled subjects. Subjects had to categorize and if possible, reclassify each set along three dimensions. The Liberian subjects showed greater difficulty sorting geometric shapes than Americans, for whom it is a trivial task by the age of 10-12 years. But when the material to be sorted was changed to rice, (assorting is central to macro-economic activity, and rice variations are talked about in everyday discourse) the result was reversed. The African subjects were able to sort the rice, shifting dimensions and accounting for their sorts as skilfully as the U.S. sample had when the task involved geometric shapes. When U.S. subjects were faced in sorting bowls of rice, they demonstrated hesitation and bewilderment like that of the African farmers when faced in geometric shapes.

Hattie (1996) conducted a study that compared the strategies used by three different groups of upper secondary school students to regulate their own learning processes: Australian students, Japanese students at school in Japan, and Japanese students studying in Australian schools. Although students in the three groups used a similar range of strategies, the pattern of use for each cultural group varied. The Japanese students'used memory strategies significantly more than did the Australian students. Furthermore, although Japanese students studying in Australia resembled their Australian counterparts more than their Japanese counterparts on many of the strategies, they still attached significantly greater importance to the use of memorization than did the Australian students.

Azmitia (1988) acknowledged the impact and influence of peer interaction in problem solving. Eighty 5-year-olds participated in 4 sessions in which they built a replica of a Lego model. Collaboration was found to be more conducive to learning than independent work, and children were able to generalize their skills. However, these conclusions were qualified by the fact that children's expertise and that of their partners, the acquisition of task strategies, the quality of verbal discussion, children's tendency to observe and imitate their partners, and experts' tendency to provide guidance mediated learning

Cross cultural research using the ecocultural paradigm has led to the conclusion that ecological and cultural factors do not influence the sequence of developmental stages but they do influence the rate at which they are attained. Cultural differences are expected to occur at the performance (surface) level for concepts that are culturally valued (i.e., are needed for adaptation in a particular ecocultural setting) and also at the competence (deep) level of concepts that are not valued.

Sinha, et al (1996) examined the role of some ecocultural and acculturational factors in intermodel perception of stimuli, which vary on the dimension of size, shape, height, and texture. The study was conducted on Birhor (remained nomadic, hunter, gather), Asur (recently sedentary), and Oraon (longstanding sedentary) groups. Findings revealed significantly effect of both ecocultural and acculturational features of the groups and thus, substantiated the ecocultural model. The Birhor's better judgment of shape, size and height of intermodel perception task may be attributed to their marked analytical abilities, owing to their hunting and gathering experiences in the forest.

Dash & Mishra (1989) examined the recall performance of school and non-school-going children in a natural setting using, as the task, a card game called 'call' popular in rural Orissa. Eighteen school and 18 non-school-going children of grade six from a rural area participated in this card game which allowed the experimenter to obtain estimates of immediate and delayed recall performance for each subject. There was practically no difference between the school and non-school-going children in respect of their overall memory competence including immediate and delayed recall. The findings suggest that when non-school children are provided with a task situation that spontaneously activates their memory potential, they perform as well as their school-going peers.

Another variable that loom large in learning and cognition is metacognition. Davidson and Free body (1988), for e.g. argued that there are socio-economic and ethnic differences in the metacognitive knowledge children bring to school (e.g., degree of study/ reading devoted in the home), and this in turn lead to success in school. There are metacognitive skills developed outside school.

Güss and Wiley (2007) examined the influence of culture on metacognitive strategies, wherein they sampled students from Brazil, India, and the United States were assessed on five strategies in three life domains to investigate cross-cultural similarities and differences in strategy use, nationality and uncertainty avoidance values Uncertainty avoidance was expected to lead to high frequency of decision strategies. Results showed no effect of uncertainty avoidance on frequency, but an effect on facility of metacognitive strategies. Comparing the three cultural samples, all rated analogy as the most frequent strategy. Only in the U.S. sample, analogy was also rated as the most effective and easy to apply strategy. Every cultural group showed a different preference regarding what metacognitive strategy was most effective. Indian participants found the free production strategy to be more effective, and Indian and Brazilian participants found the combination strategy to be more effective compared to the U.S. participants. As key abilities for the five strategies, Indians rated speed, Brazilians rated synthesis, and U.S. participants rated critical thinking as more important than the other participants. These results reflect the embedded nature and functionally of problem-solving strategies in specific cultural environments.

Munroe & Munroe (1971) observed how far from home Kenyan children typically wandered and they were also asked to perform tests of spatial ability. The children from each pair who wandered out, the children from each pair who wandered farther from home were found to perform better on most of the tests. Thus, the children's skill at performing the spatial task was related directly to their spatial experience in the environment. It can also be concluded that early socialisation experiences and typical styles of living foster certain ways of thinking about and representing spatial relations.

Hughes (1997) initiated Aboriginal Ways of Learning (AbWoL) Project to investigate recurrent Aboriginal learning styles conclude from their pilot testing that while there is no evidence for a single Aboriginal learning style, there are some recurrent learning styles which are more likely among Aboriginal students. Similarly there are also recurrent learning styles which appear to be more likely among Non-Aboriginal students. From this we can conclude that every cultural setting has models of learning styles unique to its ways of living, passing knowledge down generation.

Childs &Greenfield (1980) analysed the Zinazcantecs' procedural model of weaving apprenticeship, where girls who are taught to weave by their mothers or other female relatives, or neighbours in an informal apprenticeship, both verbal and non verbal aspects for the role of the learner and teacher in different parts of the weaving process. They found that the transmission of weaving skills was highly scaffolded through non verbal communication and assistance, coordinated with verbal speech acts. However, there was no positive verbal reinforcement. Findings from empirical study of the next generation of weavers indicate continued scaffolding and absence of positive verbal reinforcers as characteristics of the teaching and learning of weaving in Zinacantan, although there was a decline of scaffolding among families engaged in weaving commerce (Maynard and Greenfields, 2003).

Maynard and Greenfield (2003) investigated the link between modes of apprenticeship and the development of spatial skills by examining the spatial skills involved in creating, setting up, and weaving the warp of a loom. Both sets of problems were presented to children aged 4–13 in Nabenchauk, Mexico, and in Los Angeles, USA. While the sequence of operational development was the same across both domains and both cultures, Zinacantec children were more precocious with the weaving problems, whereas U.S. children were more precocious with the spatial problems adapted from Piaget and Inhelder. After a brief instructional procedure, children in both Nabenchauk and Los Angeles improved on the weaving problems only, within the maturational constraints typical of concrete operational development. They concluded that: (1) An implicit ethnotheory of cognitive development, built into the sequencing of cultural tools, can be as developmentally valid as an explicit formal theory. (2) Culture-general Piagetian stages are harnessed in culture-specific situations. (3) Maturational readiness interacts with both long-term cultural experience and short-term learning experience to actualize concrete operations in a specific context. Cross-context generalization of Piagetian stages is far from automatic; it requires cultural learning.

Hugh Mathews (1995), reviewed studies on young Kenyan children's behaviour in large-scale environments and their environmental awareness. The result showed that children who are without formal training and with limited access to maps are able to draw relatively sophisticated place representations and recall their local environment in vivid terms. Results also showed that culture influences expressive style if not cognitive ability.

Sabbotskii (1987) conducted research in kindergartens where adults, who avoided being authoritative and interfering, imitated childlike behaviour: they showed confusion, and lack of self-assurance, and made blatant mistakes. In these situations, children's behaviour was found to be more creative and they acted with greater freedom and independence. This study confirmed that peer learning, with minimal direction and supervision from adult creates conditions that are favourable to cognitive development.

Rachel Ben-Ari (1997) conducted a study in Israel to evaluate the effectiveness of Complex Instruction (CI) in facilitating cognitive development of students. CI was introduced to 36 heterogeneous classrooms in six schools; samples included 1,017 students, 503 boys and 514 girls in grades 3-5. Findings supported the prediction that there is a positive relationship between level of student interaction and the progress on the cognitive tests. The study also unveiled that there is a relationship between teachers who exhibited a relatively low supervisory behaviour, direct and interference and a relatively high rate of behaviours intended to develop children's thinking skills.

Wertsch et al (1984) conducted a study focussing on formal schooling and household economic activity and their implication for psychological processes. It examined how familiarity with one or the other of these two activity settings influences the subject's interpretation and performance of a task. Analysis revealed substantial differences in the interactions involving mothers and teachers. In general, the mothers tended to perform task behaviours and used direct forms of regulations more frequently than the teachers did. There were major differences between interactions between mothers and teachers in terms of proposition of episodes in which the child actually looked at the model. Children working with their mothers carried out this step in a mean of only 39% of the episodes. In contrast, children working with teachers carried out this step in a mean of 86% of the episodes. This difference is statistically different. More adult participation/ interference and child observed.

This demonstrated that although learning is an important goal for all involved in the context of apprenticeship, and presumably in both traditional and non traditional settings that are less institutionalised, it has not emerged as an independent activity-motive system. The activity of learning is extricably linked to productive or economic activity. The motives that define and structure the activity are economic and professional rather than educational.

Wu Shali and Keysar Boaz (2007) evaluated the effect of culture by asking Chinese and American pairs to play a communication game that required perspective taking. Results of the evaluation demonstrated that Chinese participants were more tuned into their perspective than were the Americans. The Americans also often failed completely to take the perspective of their partner, whereas the Chinese almost never failed.

Findings revealed that cultural patterns of interdependence focus attention on the other, causing Chinese to be better perspective takers than Americans. Members of both cultures are able to distinguish between their perspective and another person's perspective but cultural patterns afford Chinese the effective use of this ability to interpret other people's actions.

Jean Brooks-Gunn, et al (1993) estimates the effects of neighbourhood characteristics on the development of children and adolescents by using two data sets, each of which contains information gathered about individual children and the families and neighbourhoods in which they reside. There are reasonably powerful neighbourhood effects – particularly effects of the presence of affluent neighbours on child IQ, teenage births, and school leaving, even after the differences in the socioeconomic characteristics are adjusted for. Findings revealed that white teenagers benefit more from the presence of affluent neighbours than do black teenagers.

Chapter 2

RATIONALE, OBJECTIVES AND HYPOTHESES

2.1. Rationale of the Study

Geometry is an essential part of mathematics education. It forms a fairly large section of math syllabus at the primary levels till secondary levels in schools. However, a child's understanding and conceptualization of basic geometric concepts and later complex geometric phenomena is not commonly known or paid attention by many. Research in the area of mathematics and education has been large and is still growing but studies focusing in the area of geometry vis-à-vis keeping cultural and personal experiences in mind. is scarce, especially in India, leaving researchers and educators grappling for a source to turn to while dealing with issues concerning teaching and learning of geometry, beginning at the elementary level.

An overview of mundane everyday-life of different indigenous cultural backgrounds reveals members engaged in different activities like cultivating, buying and selling, bargaining, cooking, doing craftwork, planning and estimating family budget, playing games. house construction, etc (Cole, et al., 1971; Rogoff, 1984 ; Lave,1988; Zaslavsky, 1973; Gerdes, 1998,etc). Ezeife (2002) records the observations made by Hartfield, Edwards, and Bitter (1997) on geometric concepts and applications, "...the first concepts of congruence were developed in Africa and Asia...cotangents and similar triangle principles were used in building of African pyramids. Eskimos built igloos in the shape of a catenary. Mozambicans built rectangular houses by using equal-length ropes as the diagonal. The Babylonians used the right angle theorem 1500 years before Pythagoras was born". Such observations displayed that people of indigenous cultural backgrounds possess high degree of expertise in informal way of doing mathematics and related fields. It is possible then that children of indigenous cultural backgrounds showing difficulty in grasping the niches of school mathematics may actually possess knowledge of calculation, measurement, problem-solving, estimating, reasoning, so on and so forth manifested within the context of their everyday personal and cultural life.

Taking cue from such observations and speculations made by psychologists, anthropologists, sociologists, educators, etc this paper seeks to examine the cultural nature of human development; and seeks to explain how children engage and participate in their cultural activity of garment weaving, and learn to distinguish different geometrical figures and concepts, seen in their clothe designs and patterns. It also seeks to explain how people's performance in any activity largely depends on the circumstances that are routine in their community and on the cultural practices they have grown accustomed to. The everyday experiences of children who do weaving is notable for study because weavers routinely deal with shapes and patterns in their clothe designs. They use different metaphors for these designs or pattern and often times, they come up with new shape or pattern in the process of warping; and the original shape also take a whole new meaning than when it was started.

The question here then is how is learning organized in the child's immediate environment, namely home? How does the child learn to participate in the household activities as members of the family? Does participation in certain activities accelerate child's cognitive processes? How does the child learn to master, or at least come to understand the different mechanisms working together in his surrounding?

Recent cross-cultural research studies started taking keen interest in describing mental changes that are assumed to occur within the individual, independent of contextual influences. The emphasis that thinking and learning, vis-à-vis problem solving, reasoning, abstract thinking etc is a solo, individual activity characterised by developmental stages have been replaced by observations that thinking and learning is a social and cultural enterprise. This approach studies how people come to comprehend their world through active participation in shared endeavours with other people as they engage in social and cultural activities.

A perusal of a large number of the available literature reveals that children coming from indigenous cultural backgrounds invariably perform poorly on academic and laboratory settings. These findings arbitrarily sidelined the effect of home environment and social cultural milieu and credit all cognitive development to schooling. However, review of recent cognitive studies grounded on culture sensitive approach reported learning in contexts and performance of tasks develop gradually and so much of the children's behaviour and cognitive functioning depends on their environmental facilities, opportunities and constraints because there is a positive correlation between culture and cognition. There is absolutely no doubt that schooling and formal learning have high significant effect on child's cognitive functioning but research on memory, language and mathematics, etc reveals that child's social and cultural experiences also has much to contribute to flair in reasoning, problem solving, estimating, planning, organising, etc. Gleason (1973) observed that children routinely have difficulty in referential communication tasks, yet in everyday situations they adjust their communications to meet the demands of their listeners. Such observations suggests life beyond investigatory setting (e.g., classroom) teems with ways of thinking, communicating and using symbols that are otherwise suppressed or wrapped up (Berry, et al., 1997; etc). Cole, et al, (1971) studying memory among preliterate Liberian Kpelle, who use categorization, demonstrated that the preliterate Kpelle subjects fared poorly on free-recall memory task but benefited in tasks where items were inserted in a story, whereby the sequence of events provided reason for categorization. Studies (e.g., Davis and Ginsberg, 1993) also unveiled that adult guidance and parental instruction (verbal and non-verbal) influences child's cognitive performances. Lave's (1998) study on Liberian tailor's arithmetical problem solving showed that everyday experience in the tailor shop provided opportunities for arithmetic learning that focused on manipulation of quantities. Studies on arithmetical abilities between Asian children and American children also reveal that cognitive performance has significant correlation with the differences in how numbers are represented in different languages and culture.

The National Curriculum Framework (NCF), 2005 provided broad guidelines for preparing textbooks and accordingly National Council of Educational Research and Training (NCERT) revised and introduced new math textbooks for some middle school and high school classes for the year 2007. Lessons include teaching and learning basic geometric concepts, like explanation of symmetry without using much jargon and also explanation of surface area and volume using simple activities, etc. Likewise, New Delhi Municipal Council (NDMC) schools is making an effort to launch to a special Building and Learning Aids project with the support of UNICEF that focuses on practical orientation of difficult subjects like mathematics. It is heartening for the researchers and educators interested in the field of geometry to know that efforts are being made now to give special emphasis to geometry and arithmetic which very often make the children 'sweat'.

2.2. Assumptions

In traditional home settings, ample opportunities are available for children to observe adult work and begin to participate in family work at an early age. Children learn simple household skills and are expected to gather wood, fetch water, clean the house and cook, care-giving younger siblings, do craft, etc. They watch adult members work and then pick up the task once they find the niche to do. These home experiences constitute an important influence on children's learning process, like self-regulation, creativity, taking initiative in learning, self motivation, internalization, guided learning, taking responsibility, etc. Children usually display flair in operating observed skills, like without fumbling through tedious process of trial and error learning involving differential reinforcement for each small response. Therefore, it is assumed that home experiences and participation in specific cultural activities affects the learning process of children.

It is assumed that children who do weaving will perform better than children who don't in identifying basic school geometrical shapes and describing concepts. Weavers routinely deal with shapes and patterns in their clothe designs. They use different metaphors for these designs or pattern and often times, they come up with new shape or pattern in the process of warping; the original shape also take a whole new meaning than when it was started. It would then mean that a shape or figure can be represented in many aspects since a concept has several properties. When presented with basic formal geometrical figures, children may adopt the indigenous method and attend to minute details, which very often go unnoticed otherwise, and give better description and explanation of the concept.

It is on this ground that the present study proposes to examine how certain aspects of culture orients individuals cognitively like, learning geometrical shapes and patterns which require ability to identify, distinguish, discern features of different shapes and formulate patterns, etc. Accordingly, a test of geometrical shapes and patterns had been constructed to serve the purpose of the study. The primary concern of the study is to examine if children who do weaving differ from children who do not in contriving shapes and patterns based on their everyday cultural and personal life. Also, another underlying interest in the study is to examine if certain aspects of culture trigger children's thinking. Keeping the above mentioned observations and concerns, the following objectives and hypotheses had been formulated.

2.3. Objectives of the Study

- To examine if participation in the cultural activity of garment weaving influences children's understanding of geometrical shapes and patterns in a social situation.

- To examine whether children in the Weaver group differ from children in Non-Weaver group in operating cognitive activities like abstract thinking and reasoning

2.4. Hypotheses

- Children who do weaving will differ significantly from children who do not in comprehending geometrical shapes and patterns in a social situation.

- There will be a significant difference between children in the Weaver group and Non-Weaver group in cognitive activities like abstract thinking and reasoning

Chapter – 3

METHODOLOGY

> *"What kind of a bird are you if you can't fly"? chirped the bird. "What kind of a bird are you if you can't swim"? replied the duck.*
>
> S. Prokofiev,
>
> *Peter and the Wolf.*

The present study consists of an exploratory research design. This is a comparative study on children of two groups (weaving and non-weaving groups) in Senapati District, Manipur. There were two phases in the study-

First phase: In the first phase, the researcher mapped out the personal and cultural life of the weaving community and the general experiences of both groups of children, by means of observation and unstructured interviews. This phase covers broadly the following:
Family size, occupational status, education status, child-rearing practices, participation in household chores (division of labour), mode of communication, time spent in doing craft, and other activities; playing games and other leisure activities, etc.

Second phase: After this, different paper and pencil tasks were administered to the children. The aim is to examine how much did child's personal and general experiences oriented the child with geometrical shapes and patterns before she is actually introduced to formal geometrical concepts. For this purpose, a test was constructed to assess on the samples included 30 children who weave and 30 children who do not, as full time weavers constantly deal with shapes and patterns in garment weaving. The test was administered individually in the chamber of a non-teaching staff in the school. An unstructured interview in a conversational mode was used all throughout the assessment to elicit in depth information from the child. Tasks were simple wherein, initially children were presented with some concrete objects having different geometrical shapes and patterns. It required the child to examine the shapes and conjure up as many examples as possible. Scores for each task were assigned differently depending on the nature of the task and information it seeks to elicit.

3.1. Sample

Purposive sampling technique has been used in this study. The sample consists of 60 girls belonging to two cultural groups (weavers and non-weavers). One group consisted of 30 girls who do weaving and the other group consisted of 30 girls who do not weave. Out of the 30 girls who do weaving 15 are in class III, the other 15 are in class IV, to maintain the homogeneity of the sample. Respectively 15 out of 30 girls that do not weave are in class III and 15 girls are in class IV. The average age range of children in all groups of weavers and non-weavers as well as in classes III and IV is 8-9years respectively. The girls in the study belong to the Mao tribal community, in Senapati District of Manipur state, India. Children attending English-medium schools from three Mao villages were considered for the present study. The mother-tongue of all the children in the study is Mao.

Only girls were included as participants for the study as weaving is regarded as a female occupation. Although from information given by primary sources it was found that some boys also do know the craft. Standard III and IV were taken for study to control the effect of school instruction in developing children's understanding and conceptualisation of geometrical shapes and patterns. The underlying purpose of study is to explore and examine the influence of incidental learning of geometrical shapes and patterns on children before they are subjected to intentional learning. Therefore children of class III and IV were taken for study since the schools under observation start imparting basic geometrical lessons only from class IV, towards the end of the academic year (September-October). Children before being subjected to intentional learning of formal geometry lessons are taken as norm for the study.

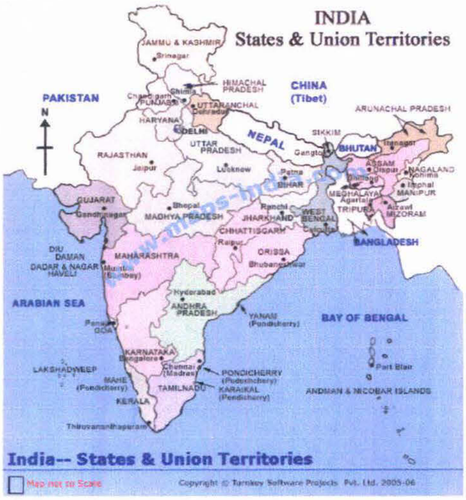
3.1.1. Brief background of Mao tribal community

The background study was done by approaching local residents of the villages, who also acted as key informants of the study. For procuring information on personal experiences of weavers, a full-weaver was contacted who eventually also served as key contact person.

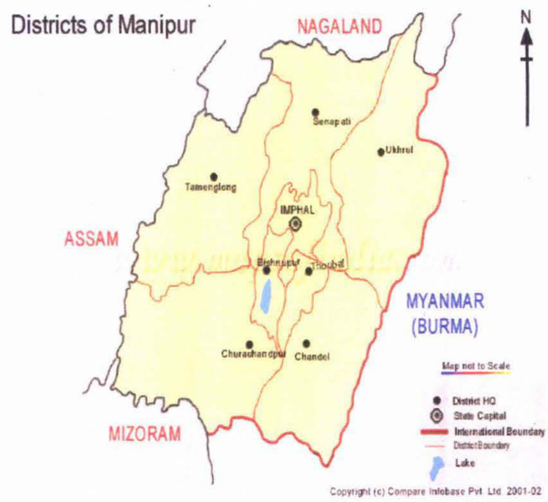
The Mao community comprises 34 villages. According to a survey conducted by the Mao Integrated Development Association (MIDA), in 2002, the population of the Mao community is approximately 25,000. The total literacy rate was reported to be 53% out of which the male literacy rate is approximately 64.38% and the female literacy rate is 44.19% approximately.

The main occupation of the Mao community is rice cultivation and agriculture. Weaving is generally considered as a seasonal activity engaged by women folks, usually before and after paddy cultivation period (May-July). However, weaving in some household is a full time activity, e.g. the households taken in the present study, and the products sold from garment weaving largely contributes to the family income. Other occupations of Mao community are grocery shopkeepers, vegetable vendors, teachers and educators in educational institutions, bus drivers, employees of government offices, etc. The family income level of both groups in the study is more or less the same; they come from middle-class homes by rural standards.

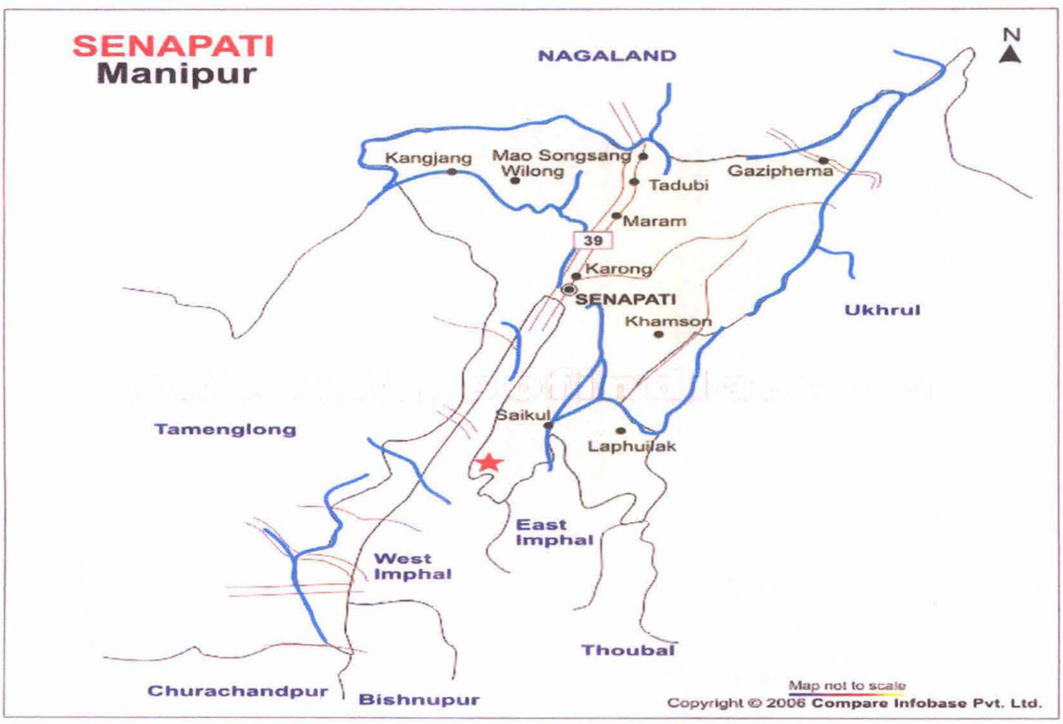
Daily activities of Mao women, other than their main occupation include doing craft like knitting, weaving, stitching, doing household chores, cooking, fetching water, child-care, fruit gathering, collecting firewood, etc. Information gathered from primary sources by means of unstructured interview in conversational mode, reveal that in homes where there are full-time adult weavers, children as young as five years begin to show interest in the craft. Children often join the adult weavers in their free time or on holidays. A toy-loom is usually prepared for them and they weave alongside the adult weaver. Leisure activities of children are more or less the same as their adult family members. It includes role-play, baby-sitting, fetching water, cooking, kitchen-play, playing games like hide-



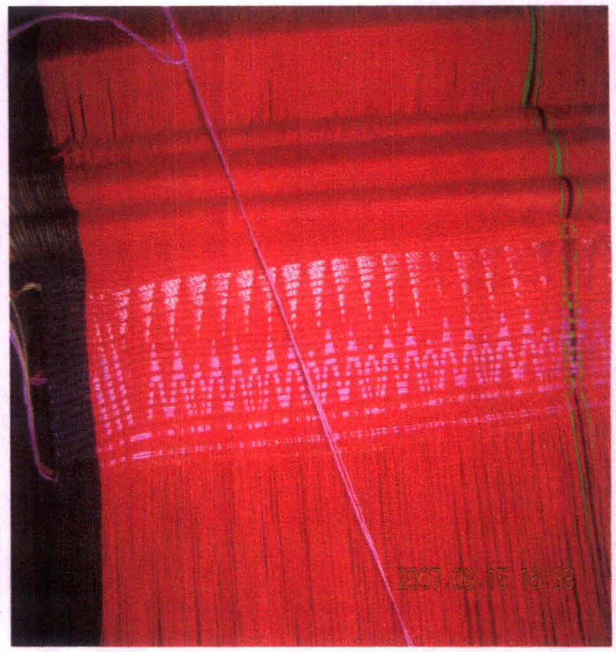
Map of India



Map of Manipur State, India

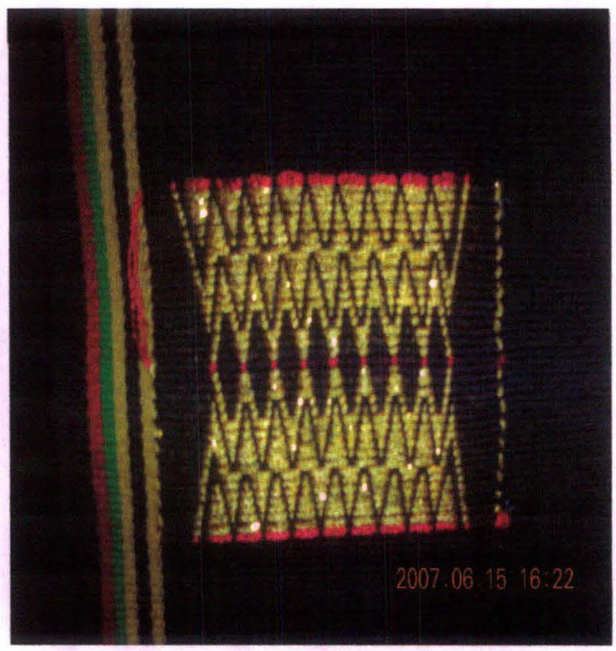


Map of Senapati District, Manipur



Small bamboo bars in the loom used for weaving patterns

A thread inter lacing between the woolen yarn to form intricate patterns



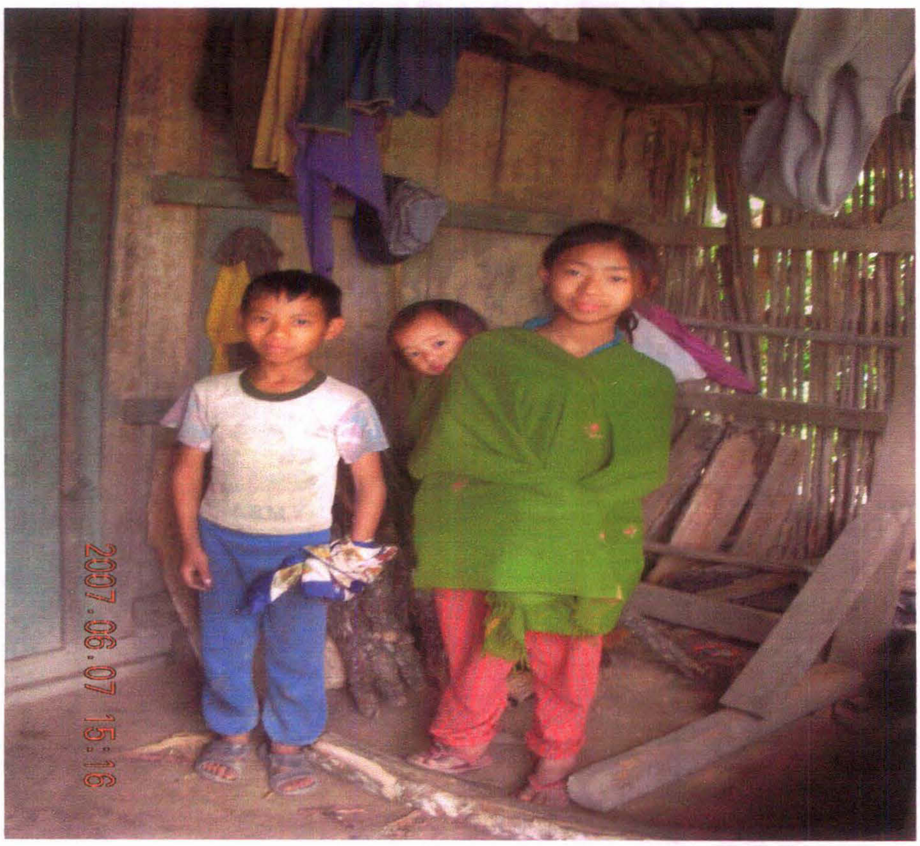
A weaver working out an intricate pattern

A popular pattern seen in mao cloth designs

A mao woman warping woolen thread around two bamboo poles of the foot loom for weaving.

Two children observing a young mao girl weaving

Child spooling wool as mother weaves



Young care-giver

Two mao girls playing 'okhei-omei' (similar to modern day board games).

Peers watching their female counterparts playing 'otu kate'

and-seek, stone games, going to the field, gathering fruit, and assisting adult family members in daily wage earning, such as selling vegetables, etc. None of the children under observation reported of owning television set in their homes. The family's only possessions of the so called modern technological gadgets are basic radio and tape record player and telephone connection in some homes.

So basically, the life setting of children of both groups is not very different from each other. They do household chores at home, take care of siblings, go to the field, gather wood. and fetch water, cook meals, wash clothes, dishes etc. Some children in the season work on wages.

3.2. Measures used in the Study

Two broad psychological processes are involved in the process of learning geometrical shapes and patterns, namely, perception and conceptualisation. The former involves learning with the help of physical stimulus, in the presence of material form, while the later involves learning by means of an image in the absence of physical objects, firstly , by recognising the visual forms or objects and secondly, by reconstructing the perceived images. These two psychological processes are essential for learning and performing tasks related to geometrical shapes and patterns. Both processes involve ability to seek information, discriminate information and select from alternatives. Accordingly, a test consisting of 7(seven) items was constructed to examine the various ways of acquiring the shapes/forms and patterns. The shapes and objects included in the test were drawn largely from the responses provided by children while conducting the preliminary survey. Only the basic elementary geometrical shapes were included in the study. The details of the items used are for the study is given below:

Item Description and Scoring

To assess the ability to perceive and conceptualise different geometrical shapes and formulate patterns, 7(seven) items were constructed which required students to think and give examples of different geometrical shapes and patterns, describe and identify them, categorize objects on the basis of their shapes, formulate patterns and give explanations and so on. No true standardized scheme was employed for the scoring. Scoring was done on the basis of the responses provided by the child. For example, for item 1, a maximum score of three was assigned if the child could give five or more examples for a given geometrical shape. Additional explanation carried one point each. It is also worth noting here that children sometimes gave responses only after providing some cues and prompts by the experimenter. For example, in item no. four, children were prompted to describe the properties of the shapes shown to them. In such cases, scoring was done on the basis of spontaneous and suggested or prompted responses. A score of two points was allotted for spontaneous response and one each for suggested responses. The item wise description and scoring are as follows:

Item One: Recognition of Shapes

In item one the children are shown six objects with different geometrical shapes viz., sphere, cuboids, cube, cone, cylindrical and pyramid. It required the child to think and conjure up as many examples as they can from their everyday perceptual experiences for each shape that are shown to them. This item seeks to understand the child's ability to talk about shapes in a social situation A score of three points each is allotted for naming five or more examples of each shape; 2(two) points for naming three-four examples and 1(one) point each for naming one–two examples respectively.

Item Two: Categorisation

This item is employed to substantiate the first item. A list of names was provided to the children and they were required to categorise the names of objects on the basis of their shapes. A total of thirty names were listed and each name could be assigned to one of the six solid shapes shown in item one. A total score of thirty was assigned for the items, wherein one score is assigned for each correct response.

Item Three: Curved and Plane Surface

This item is included in the test to assess if children have the ability to distinguish between different solid shapes. A list of names of objects was again provided to the children. A brief instruction was given after which the children were required to state whether the objects provided have a curved or a plane surface. A list of altogether ten names was provided and 1(one) point is assigned for each correct response.

Item Four: Two-Dimensional Test (2D)

Since features are primitive elements of perception, this item is included to assess the ability to seek information, discriminate the same from alternatives and select the information to the task at hand. Accordingly, four different geometrical shapes, namely square, rectangle, circle and triangle were included in the test item. Each shape was shown to the children one at a time and it required them to describe or explain the shapes in as many ways as possible. In other words it required the children to describe the properties or features of the given shape. A score of 2(two) is assigned for each spontaneous explanation provided by the children; a score of 1(one) point each for every suggested or prompted response.

Item Five: Three-Dimensional Test (3D)

Since we live in a world with three dimensions where we constantly deal with solid shapes all the time, the ability to represent and interpret 3D geometrical relations is thus an important skill. This item was included to test if children can also distinguish and three-dimensional models, as two-dimensional models, and attend to the features of the same. Here, the description of the features of the shapes was associated with the presence of the physical or material objects. For this purpose, the following 3(three) 3 D objects were presented to the children:

i) a chalk box (square shape)
ii) a pencil-box (rectangle shape)
iii) a traditional necklace bead (hexagonal shape).

Each object is shown to the children one at a time and it required them to provide verbal description of the properties of the objects. A score of 2 (two) points is assigned for each spontaneous verbal and additional explanation provided for the objects. Responses procured after prompting is treated with the score of 1(one) point.

Item Six: Pattern Recognition

This item consists of five figures consisting of four sub-figures placed in different positions and three figures from here form a pattern. A figure in the test distorts the pattern and forms a new pattern all by itself. This item requires the child to conceptualise the figures in different positions in space and accordingly identify the figures following the same pattern and discriminate the figure that will lead to formulation of a new pattern. A score of 1(one) each is assigned for correct recognition of figures following the same pattern. A score of 1(one) each is assigned for identification of the new pattern and 1(one) score each was assigned on providing additional explanations.

Item Seven: Pattern Formulation

This item is a pattern formulation task that substantiates item six. Six figures consisting of three sub-figures of pattern forming tasks were presented to the children. Like in item six, it required the children to examine the patterns of each given figure and then extend the figure by following the same pattern. Each correct response is assigned one point. Additional verbal explanation and description were analysed qualitatively.

3.3. Interviews

Since the purpose of the study was to examine if participation in certain cultural activities influences child's ability to understand geometrical shapes and patterns, children were asked to give verbal explanation and reasons to justify their answers, in addition to the paper and pencil test items, as to what are the properties of the figure they have drawn, why they think a figure is different from the rest, why patterning a figure will lead to a new pattern, etc. Therefore, in the process of administering the test, cross-questioning and probing was done to elicit in depth information and assess if the child know and understand shapes and patterns in more ways than what meets the eye. For this purpose, effort was made to conduct unstructured interview in an informal conversational mode at the time of administering the test. Prompting and cues were given when the child could not verbalise her response. Suggested words and examples were dropped to help the child articulate what she actually wants to say.

3.4. Pilot Study

A preliminary visit to the homes of weavers was made. Interaction with the adult weavers and their children and enquiry on shapes and patterns found in the clothe designs help formulate the items in the study. It was found from the preliminary survey that the shapes and patterns in garment weaving were formulated from traditional ornaments and species of significance found in the region, like necklace bead, spear, feathers of rare bird species, etc. Interestingly, many clothe designs also depict folk tales and cultural history of the communities living together in harmony before the intervention of western culture and the exodus of these communities to different parts of the region.

Commonly used shapes and patterns having formal geometrical relevance were identified with the help of expert weavers and the same were produced to the children to elicit responses. The items that appear ambiguous and fail to procure adequate responses from the children were eliminated. A particular child was asked to draw the shape of a triangle by looking at the rooftop and asked to draw the same in different positions. Conclusion drawn fro the drawing indicates that the child showed acute difficulty in moving the object from the actual position. For this reason, 3D tests and other pattern recognition and formulation items were simplified. Also, it was found that children are not very successful in articulating the reasons for their responses. Therefore, in-depth responses and information had to be elicited by providing ample cues and prompts by the researcher. Since prompts and cues were constantly provided to elicit information and responses, children were scored on the basis of original and suggested response.

3.5. Procedure

The study was done on the students of class III and IV from three different English medium schools in three Mao Villages in Senapati District, Manipur. Having located the samples with the help of key contact persons, the children were contacted through their schools. First, permissions were taken from the Principals of each school and then the students were contacted for the administration of the test. The test was administered individually in the non-teaching staff chamber in the school.

The students were given the following instructions before the administration – "I am going to show you some concrete objects, pictures of figures and list of names of different shapes and patterns. I will also ask some questions in the process. Please be attentive and try to follow my instructions and answer the questions I ask. But do not be scared of performing well or not as your responses will only be used for my study".

Since all the students had Mao dialect as their mother tongue, except for three students whose mother tongue is not Mao but speaks and understands equally well, the test was administered in Mao. Each test item had to be explained to the children in Mao.

The administration of the test began with an informal interview, in a conversational mode, which included questions regarding their family backgrounds, occupation of parents and other members of the family and other leisure activities. This was followed by the test during which, each figure and object were shown to them and explained to the children; in a regular, informal conversational manner. Each task began with an explanation of what the task is all about and also what is required from the child. They were asked to draw, describe or explain what the given object look like in their own words. The students' responses on each of the figures and objects were recorded and the figure drawn is also noted down. For most of the figures and objects, additional hints and cues had to be suggested to elicit in depth information. An unstructured interview in a conversational mode was used all throughout the assessment to elicit in depth information from the child. However, if after several prompting the child is unable to formulate shapes or provide explanations they were asked to move on to the next item. There was no time limit for giving response but on average each child took forty to sixty minutes. The same procedure was followed for all the children.

3.6. Data Analysis

Data were analysed using both quantitative and qualitative techniques. Quantitative analysis of data was done by employing 't'-test and partial correlation. T-test showed the mean differences of performance in terms of scores obtained by the participants in

Geometrical Shapes and Patterns Test. Partial Correlation measured the relationship between test scores of each individual item.

In order to enrich the quantitative data, qualitative analysis was done simultaneously wherever verbal queries and responses were made by the participants. An unstructured interview in a conversational mode was adopted throughout the administration of Geometrical Shapes and Patterns Test to elicit responses and substantiate the quantitative findings. Information regarding parents' occupation, leisure activities, and responsibilities etc they have at home was included in qualitative analysis.

Chapter – 4

RESULTS, DISCUSSION AND CONCLUSION

This chapter will provide the results of data obtained from test items administered to sixty children (thirty children who do weaving and thirty who do not). The chapter will analyse and discuss the data obtained for each group tested and also analysis will be done on data obtained for each test item. The test consists of 7(seven) items requiring the child to construct figures and shapes, identify, describe and so on. Finally, on the basis of the results and discussion, a conclusion for the present study will be drawn and direction for further inquiry will be considered.

4.1. Results and Discussion

The response of the children from both groups (weaver and non-weaver) were scored and analysed statistically according to the scoring criteria mentioned in chapter 3. In order to examine the difference between the children belonging to the Weaver group and children belonging to the Non-Weaver group on their performance on the tasks on Geometrical Shapes and Patterns, the 't'-test was employed. The results showed that there is significant difference between the performance of the two groups of children on various tasks on Geometrical Shapes and Patterns, viz., recognition of shapes, categorising names on the basis of shapes, distinguishing curved and plane surface figures, description of 2D features, description of 3D features, pattern recognition and pattern formulation, respectively. The results showed considerable difference between the mean scores of both Weaver and Non-Weaver groups on tasks on Geometrical Shapes and Patterns. Table 4.1 shows the Mean, SD and 't'-values obtained by both groups of children on the basis of their performance in the given tasks.

Table 4.2

Summary of the Mean, SD and 't'-value of total scores for tasks on Geometrical Shapes and Patterns between class III & IV children in Weaver group and class III & IV in Non-Weaver group

Groups	N		Class III	Class IV	df	't'-value	p
W	30	Mean (SD)	67.06 (5.36)	67.26 (4.65)	28	.109	.914
NW	30	Mean (SD)	55.46 (4.48)	59.06 (4.94)	28	2.087	.046

*p<.05, **p<.01

SDs are given in parentheses

Table 4.2 presents the Mean, SD and 't'-value of total scores for tasks on Geometrical Shapes and Patterns between class III & IV children in Weaver group and class III & IV in Non-Weaver group. Table 4.2 showed that there is no significant difference between class III and IV children in the Weaver group on the performance of tasks related to Geometrical Shapes and Patterns. The 't'-test result in table 4.2 showed that the mean scores of Class III and IV in the Weaver group are 67.06 (SD=5.36) and 67.26 (SD=4.4.65) respectively wherein the 't'-value is .109 and p<.914 which is non-significant on the standard confidence levels (i.e. p<0.01 and p<0.05). This indicates that the performance of the children from both classes in the Weaver group were more or less the same. This could also imply that participation in the weaving activity has oriented children in the Weaver group to perform equally well on various tasks of Geometrical Shapes and Patterns and that the years spent in schooling has no significant influence on the performance of the same. On the other hand, the mean scores for performance on tasks of Geometrical Shapes and Patterns between class III and IV girls in the Non-

Table 4.2

Summary of the Mean, SD and 't'-value of total scores for tasks on Geometrical Shapes and Patterns between class III & IV children in Weaver group and class III & IV in Non-Weaver group

Groups	N		Class		df	't'-value	p
			III	IV			
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Weaver group was 55.46 (SD=4.48) and 59.06 (SD=4.94) respectively. The differenc the mean scores between class III and IV in Non-Weaver group was found to significant ('t'=2.087, p<.05). This indicates that schooling must have had so influence on the children belonging to Non-Weaver group on their performance Geometrical Shapes and Patterns.

Interestingly, table 4.2 also showed that class III children in the Weaver group (M=67 performed better than class IV children in the Non-Weaver group (M=59.06) on tasks Geometrical Shapes and Patterns. This implies that garment weaving as a cultural acti does have an influence on children's ability to carry out certain formal geometrical task

Table 4.3

Mean and SD of individual items for Weaver and Non-Weaver children

Groups	N		Geometrical Shapes and Patterns						
			Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7
W	30	Mean	10.20	14.23	9.56	13.36	5.73	8.46	4.86
		SD	(2.09)	(1.01)	(.67)	(2.17)	(.69)	(2.60)	(1.13)
NW	30	Mean	9.0	13.4	9.13	10.7	5.13	6.93	2.96
		SD	(1.89)	(1.07)	(.89)	(2.47)	(1.12)	(1.61)	(1.12)
Total	60	Mean	9.6	13.81	9.35	12.03	5.43	7.7	3.91
		SD	(2.06)	(1.11)	(.82)	(2.67)	(.98)	(2.28)	(1.47)

SDs are in parentheses.

Item 1 - Recognition of Shapes
Item 2 - Categorisation
Item 3 - Curved & Plane Surface
Item 4 - 2D Test
Item 5 - 3D Test
Item 6 - Pattern Recognition
Item 7 - Pattern Formulation

Table 4.3 showed the average scores obtained by the two groups of children. The mean scores and SD on each individual item (item 1 to 7 viz., recognition of shapes, categorising objects on the basis of their shapes, distinguishing between curved and plane surface figures, description of 2D features, description of 3D features, pattern recognition and pattern formulation, respectively) for children in the Weaver group are *Mean=10.20, SD=2.09; Mean=14.23, SD=1.01; Mean=9.56, SD=.67; Mean=13.36, SD=2.17; Mean=5.73, SD=.69; Mean=8.46, SD=2.60; Mean=4.86, SD=1.13* respectively; while the mean and SD scores on each test item for children in the Non-Weaver group are *Mean=9.0, SD=1.89; Mean=13.4, SD=1.07; Mean=9.13, SD=.89; Mean=10.7, SD=2.47; Mean=5.13, SD=1.12; Mean=6.93, SD=1.61; Mean=2.96, SD=1.12* respectively.

The results indicate a marked difference on their overall performance, except item 3 and item 5. Item 3 required children to ponder over a list of names of objects provided, in the absence of concrete objects, and state whether the objects has curved or plane surface. Table 4.3 showed very close difference between the two groups on item 3, wherein the mean scores for Weaving group was M=9.56 (SD=.67) and M=9.13 (SD=.89) for the Non-Weaving group. Similarly, item 5 required children to describe the properties or features of 3D objects by showing them concrete material of solid shapes. They were provided cues and prompt to give responses. The mean scores of item 5 in table 4.3 showed that there is no marked difference between Weaver girls and Non-Weaver girls, wherein the mean scores were 5.73 (SD=.69) and 5.13 (SD=1.12) respectively. Even then, children from the Weaver group performed marginally better than children from the Non-Weaver group.

Marked difference between the two groups can be observed in items like feature description of 2D figures, pattern recognition and pattern formulation test items and so on. The mean scores for item 1 (recognition of shapes) between Weaver and Non-Weaver girls were M=10.20 (SD=2.09) and 9.0 (SD=1.89) respectively. This indicates that children belonging to the Weaver group performed considerably better than children in the Non-Weaver group in the task that required them to examine solid shapes provided to them and conjure up as many examples as possible from their everyday perceptual experiences for each figure shown.

The mean scores of item 2 (categorisation of objects on the basis of their shapes) for children in the Weaver group was M=14.23 and M=13.4 for children in the Non-Weaver group respectively. The children in the former group evidently performed better than the latter group.

Similarly, children who weave performed considerably better than children who do not weave in item nos. 4, 6 and 7 respectively. Item 4 required description of 2D figures of different shapes and the mean scores for girls in both groups, as provided in table 4.3, were Mean=13.36, SD=2.17 and Mean=10.7, SD=2.47. Likewise, results showed that performance in item 6 (pattern recognition) Weaver girls performed (Mean=8.46, SD=2.60) much better than the Non-Weaver girls (Mean=6.93, SD=1.61). The mean scores for item 7 between girls who do weaving and girls who don't was M=4.86 (SD=1.13) and M=2.96 (SD=1.12) respectively.

Also, as pointed out earlier, the results in table 4.3 showed that the mean scores for item 3 and 5 did not vary much, wherein the mean scores are M=9.56, SD=.67 and M=9.13, SD=.89; and, M=5.73, SD=.69 and M=5.13, SD=1.12 for children in both groups respectively.

The most remarkable difference in the performance of test items between the two groups was evident in item 4, wherein the task was to describe the features or properties of each of the four given 2D figures. The mean scores of children in the Weaver group was found to be 13.36 (SD=2.17) and 10.7 (SD=2.47) for children in the Non-Weaver group. Similarly, the least observable difference in the performance of test items between the two groups was item 3 wherein, the mean scores are 9.56 (SD=.67) and 9.13 (SD=.89) respectively. The task was simple and it required the children to examine a list of figures and state whether they have curved or plane surfaces.

The results indicate that certain aspects of culture can have an influence on geometrically related tasks such as recognition of shapes, categorising objects on the basis of shapes, distinguishing curved and plane surface figures, description of 2D features, description of 3D features, pattern recognition and pattern formulation. All in all, the results indicate that culture influences child's perception and conceptualisation of geometrical shapes and patterns.

Table 4.4

't'-values for scores on individual items on Geometrical Shapes and Patterns test between Weaver and Non-Weaver group

	Total test	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7
t	7.727	2.330	3.107	2.106	4.430	2.470	2.736	6.496
df	58	58	58	58	58	58	58	58
p	.000**	.023*	.003**	.040*	.000**	.016*	.008**	.000**

*p<.05, **p<.01

As is evident from the results analysed earlier, there is a considerable difference between the two groups under observation on the performance of tasks on Geometrical Shapes and Patterns. To substantiate the results presented in table 4.3 and also to provide direction and state with confidence the significant difference between the scores obtained by both groups of children, 't'-test analysis was employed to analyse the difference in performance on each individual item between the two observed groups.

Table 4.4 provides the 't'-values for each individual item for both children of the Weaver group and the Non-Weaver group. Results in table 4.3 showed that children in the Weaver group (M=67.16, SD=4.93) performed better than children in the Non-Weaver group (M=57.26, SD=4.98) on tasks on Geometrical Shapes and Patterns. The results in table 4.4 substantiate the results of table 4.3 by pointing out the level of significance for each individual item between the two groups under observation. The table showed that there was significant difference between children in the Weaver group and Non-Weaver group in the performance of each individual item on tasks on Geometrical Shapes and Patterns. Brief analysis of each test item should substantiate the findings.

In item 1 (recognition of shapes), the students were shown six concrete objects and the children were required to conjure up examples of their shapes from their everyday perceptual experiences and group them under each of the objects shown to them. The mean scores, as showed, in table 4.3 was found to be M=10.20 for children in the weaver group and M=9.0 in the non-weaver group. This indicates that children in the Weaver's group performed better in the task required for naming as many examples as possible of the figures shown. Table 4.4 showed that the mean score between children in Weaver and Non-Weaver's group for item 1 was found to be significantly different ('t'=2.330) at .05 level. This result can be substantiated by taking a close look at their responses. Weaver children could conjure up as many as ten examples for one concrete object shown whereas Non-Weaver participants could provide a maximum of six examples only for the shape of concrete objects shown. It is worth pointing here that children from the Weaver group did not require much intervention from the examiner and therefore, their responses were mostly spontaneous and original. For example, the only time a girl Loni in the Weaver group sought assistance was, "I know one more example which look like this [points to cone shape object] but the edges are not round. Should it be curved?" Such spoken words reveal that children in the Weaver group are engaged in active mental thought, perusing their life-space to recollect shapes and forms to fulfil the required task.

On the other hand, Non-Weaver children required assistance from the examiner as they occasionally pause in the middle of the test for want of conjuring more names. Some of them appear to be at a lost to connect the shape of objects to the forms or shapes that other material objects possess. All in all, the examples provided by both groups of children were impressively wide-ranging, i.e. they provided examples from the shapes and forms perceived in their homes like bed, window, glass, candle, cup, coaster, photo frames, fire-blower, etc, to objects generally encountered or dealt with anywhere, e.g., marble, basketball, ludo [dice], spool stick, plum rooftop, cap, tree stem peach, etc. They also provided such examples like, eyeball, gift- box, puff [type of local sweet/snack that comes in the form of pyramid], etc. These responses showed that children in both groups have developed the ability to perceive and discern various shapes and forms in their social situation but the result indicate that children in the Weaver group have greater competence for the same. It is interesting to note that the Weaver group could respond using more differentiated and wide ranging examples, indicating their thoughts wandered and perused large part of his life space in a short time. Example, for the pyramid, the children in the Weaver group could provide examples like, tent, arrow, sword tip, spool stick, candle, puff, etc. Children in Non-Weaver group could provide two or three examples at the most, like, cheese, rooftop, and hut. Also another observation made here between the Weaver and Non-Weaver group children is Weaver children displayed the potential to discriminate between sizes, or space. For example, a Weaver child Kayia asked, "Can big and small size of the same object be considered as two different examples?"

The effect of weaving on performing tasks requiring children to categorise objects on the basis of their shapes, item 2, was found to have high significant difference between the two groups ('t'=3.107, $p<.01$). This indicates that weaving has an influence on children's performance in categorising or generalising the shapes of objects. Seventeen out of thirty children in the Weaver group could categorise the shapes and forms of all the thirty objects correctly, while, only five out of the thirty children in the Non-Weaver group could correctly categorise all the thirty names on the basis of their forms. It is observed that some children displayed confusion over the two forms cone and pyramid.

Similarly, results show significant difference between girls who do weaving and who do not ('t'=2.106), $p<.05$, in their performance on item 3 that requires distinguishing between curved and plane surfaces. Twenty children in weaving group could make correct statements for all the ten objects while only thirteen children in the Non-Weaver group could make correct statement for all the ten objects shown to them without examiner's intervention. It was observed that few children from both Weaver and Non-Weaver group displayed slight confusion while providing statement for the [one rupee coin]. Example, Asoni, Weaver group, said, "It [one rupee coin,] is a plane surface" but on asking if it has sharp or curved edges, she corrected her response [see appendix-I for items used in the study]. Likewise, several Non-Weaver children displayed similar confusion when responding for this item.

Item 4 required the children to discriminate the features of different elementary geometrical shapes. Interestingly, the results showed that difference in the performance between the two groups under observation were found to be highest for this item. With reference to table 4.3, results showed that the mean for children in the Weaver group is M=13.36 (SD=2.17) and for Non-Weaver group is M=10.7 (SD=2.47). The results in Table 4.4 reveals that performance in item 4 between the two groups was found to be highly significant ('t'=4.430, $p<.01$).This indicates that children who do weaving were able to give better description of the features and properties of 2D figures in item 4 than children who do not weave. A close look at the responses revealed that children in the Weaver group were able to procure many information from the material provided, discriminate them and provide ample description, if not all. Non-Weaver children continuous cues again to be able to provide responses. For instance, Nenia, in the Non-Weaver group particularly displayed difficulty attending to any more description after providing two correct responses, two lines in the [square] and two lines in the [rectangle] figures. On asking, "[Pointing to the square figure] how many lines does this figure have?" To which she replied, "two". Point to me which are the two lines, to which she pointed the two horizontal lines. "Are they equal in length? Do you notice any corners or joints?" After such cues, she was able to discriminate five features altogether for the four figures shown to her. Wherever required, participants were provided similar prompts and cues. As such, responses provided with the help of cues and prompts were scored one and a solid two were given for feature description if child discriminates those features on her own.

On task requiring children to describe the features or properties of 3D objects (item 5), the mean scores between children who do weaving and children who don't was also found to be significantly different at p<.05 level ('t'=2.470, p=.016). A closer observation revealed that most children applied the mode of discriminating features from the previous item 4. Hence, it showed in the result that the responses between Weaver and Non-Weaver children did not vary much. Children from both groups could provide only as many as three features for one figure and their responses were more or less the same. Many responded, thus, "It [pencil box] has eight corners, two faces, and eight lines". It was observed that children from neither of the groups could seek information about whether, the opposite lines are equal, or point out if the first and the second figure [dice and pencil box] share common properties, etc. the experimenter had to help them attend to these details. This indicates that Weaver and Non-Weaver group performed more or less the same but statistically, their differences could be shown by M=5.73 (SD=.69) and M=5.13 (SD=1.12) for the Weaver and Non-Weaver respectively. Table 4.3 showed that the difference was found to be significant at p<.05 level ('t'=2.470, p=.016).

Item six consists of five sets of figures each comprising of a series of figures. The task required children to examine a set of figure one at a time and discriminate a figure in the set that violates the pattern of the figure. The position of the figures was shifted but the properties remain the same. Simultaneously, a figure in the set distorts the pattern. This item attempts to assess if the participants possesses the ability to think in space. Participants from both the groups were able to correctly identify the figure that violates the set but differences crept in when they were asked to provide verbal explanation or reasons why and how the figure distorted the pattern. The mean scores between the two groups under observation showed remarkable difference (Mean=8.46, SD=2.60 and Mean=6.93, SD=1.61 respectively). One Weaver child replied, "[referring to the first set] there are two lines upon one line while the lines in other figures cross each other". Katini, from the Weaver group again bluntly but correctly points out, "there is no centre point", which goes to mean that the figure is odd and distorts the set because the lines do not intersect in the middle while the other figures follow the trend and intersect in the middle. Table 4.4 showed that the difference in the performance of item 6 between children in the Weaver and Non-Weaver group was found to be highly significant ('t'=2.736, $p<.01$).

Similarly, performance on item 7 that consists of pattern formulation task requiring children to examine a set of figures and follow the same trend to complete a pattern, the results in table 4.4 indicates high significant difference ('t'= 6.496, $p<.01$) between children who do weaving and children who don't. A deeper look on the performance for item 7 is deemed fit as it involved mental representation of the perceived model. Twelve children in the Weaver group could correctly represent the entire six perceived model while, none of the Non-Weaver children could provide correct responses for all the perceived models. The drawings (representation) of the participants showed that they looked at the patterns presented to them and picked up enough information of the pattern from most alternatives but they did not pick up information to reproduce the pattern. Any performance is a sequential act. As such, it involves a continuous set of decisions at each point in time as to how to begin, how to continue, and how to terminate. Each of these points requires information. It can therefore be explained that, the children in the Weaver and Non-Weaver group who could not provide the correct pattern in test item 7 failed to procure the information necessary for each of these decisions because of the unelaborated and undifferentiated state of their perceptual knowledge. For instance, it is interesting to note that the figures represented by the children who gave incorrect required response show that they have perceived the pattern only in terms of its orientation or its regularity, yet their drawing reveal that neither of these features were relevant to the performatory act. For instance, the drawing of the first sub-item in item 7 show that the children most apparently did not know that the pattern perceived by them should be extended by following the same pattern horizontally and not vertically. In other words, they lacked the ability to select information. This is the critical point between perceiving and performing. Performing an act such as copying, or making, or speaking, requires different perceptual information than the act of perceiving or recognising an event amongst a set of simple alternatives. To recognise a figure or form in the context of a set of static forms it is necessary only to detect the feature or features. On the other hand, performatory activity such as drawing or reconstructing the model requires perceptual information for the guidance of each component of the act. This clearly points out that to formulate images in mind and reproduce them does not require the same information as to define in words the concept of the model. In both cases however, the information is perceptual, and both requires information appropriate to the alternatives with which the child is faced if she is to succeed. They differ primarily in the fact that each activity: discriminating, drawing, constructing, and defining involve somewhat different sets of alternatives for which different cues, features, or information must be selected from the model. The result in the tables show marked difference between the scores of the children in the Weaver group and Non-Weaver group wherein, the mean for Weaver children is 4.86 (SD=1.13) and mean for the Non-Weaver is 2.96 (SD=1.12). The results in table 4.4 indicates high significant difference ('t'= 6.496, $p<.01$) between the two groups. This could mean that active participation in the garment weaving had oriented the Weaver children adequately to discriminate between these two forms of seeking and eliciting perceptual information.

The results reported here clearly indicate that everyday experiences and participation in the cultural activity of garment weaving has a significant effect in children on performing tasks involving geometrical shapes and patterns. This means that children in the Weaver group had received adequate orientation in their home by means of observing adult members doing weaving and also through their participation

4.2. Discussion

On examining the scores and verbal response of the students in both groups, it seems that Weaver and Non-Weaver children have different ways of perceiving various forms and shapes. The results showed Weaver and Non-weaver children varied greatly while perceiving and discriminating forms and shapes and discriminating objects and attending to details, etc. but the two groups showed to perform more or less the same on the task requiring them to distinguish between the two basic surfaces of solid shapes, namely, curved and plane surface.

The responses of the children in the test item 1 revealed that Weaver children showed greater competence to identify and recognize different shapes and forms from their daily perceptual experiences. This is substantiated by their response to item 2 that consists of a list of names that the children encounter and deal with everyday. This indicates their sensitiveness and awareness to forms and shapes owing to their observation and participation in garment weaving with adult members, whereby, the clothe designs and patterns acquainted and oriented them to the different forms and shapes around us. Also, the children in Weaver group is able to acknowledge and appreciate the different forms and shapes perceived in home utensils, objects in school classroom, play-things, or forms and shapes in commercial goods or as trivial as the shape of sweets or other eatables. The clothe designs in garment weaving are representations of cultural events and daily experiences and the weavers try to depict these rich experiences. Hence, it can be concluded that participation in garment weaving has an influence on the child's ability to discern between various shapes and forms, many of which may be applicable to formal geometrical curriculum.

The responses in item 4 and 5 showed that both Weaver and Non-Weaver children did not perform satisfactorily but show potential all the same to learn by discriminating between available information, terminating and selecting information required for fulfilling the task at hand. The results showed that children in the Weaver group were found to have greater potential to attend to details and discriminate.

The responses of the children that test the ability of the child to think in space is interesting. To assess this ability, two items (6 and 7) were constructed wherein, it consists of a series of a set of figures that forms a patterns.

Item six consists of five sets of figures, each comprising four sub-figures. The figures in each set form a pattern except for one that distorts or violates the pattern. The positions of the figures were shifted and the child is required to perform spatial thinking in order to discriminate the figure that violates the patter. This task requires the ability to do divergent thinking wherein the child simultaneously searches if the figure is following the trend and also if the figure is distorted when the position is shifted. In item six, the position of each figure that follows the same trend is shifted but the properties remain the same. One figure that violates the trend altogether leads to formulation of a new pattern. This item attempts to assess if the participants possesses the ability to think in space. The response of the children to test this ability to recognise patterns and discriminate a figure in the set that violates the pattern of the figure is interesting. Participants from both the groups were able to correctly identify the figure that violates the set but differences crept in when they were asked to provide verbal explanation or reasons why and how the figure distorted the pattern. The result showed that children in the Weaver group were found to have greater potential to perceive the patterns in the series of figures provided. In other words, they showed greater potential to perform spatial and abstract thinking.

Responses of the children to item 7 that sought to assess child's ability to perform at the abstract level is also interesting. It consists of six items comprising of three sub-items. It required the children to represent each of the figures that follow the same trend and form pattern. The responses of the Weaver children showed that they were able to correctly perform the required abstract thinking. This can be asserted by the representation of the model in their drawing. Each figure in the items follows a pattern. It required the child to examine the pattern and extend the figure. Responses showed that children displayed the ability to perceive the model correctly. This observation was confirmed by responses of earlier items. Similarly, as is mentioned earlier, children who were unable to reproduce the correct model were able to perceive correctly, indicating the presence of perceptual development, but they erred when they try to reproduce the same. It indicates that participants showed that they looked at the patterns presented to them and picked up enough information of the pattern from most alternatives but they did not pick up information to reproduce the pattern. It can therefore be explained that, the children in the Weaver and Non-Weaver group who could not provide the correct pattern in test item 7 failed to procure the information necessary for each of these decisions because of the unelaborated and undifferentiated state of their perceptual knowledge. For instance, it is interesting to note that the figures represented by the children who gave incorrect required response show that they have perceived the pattern only in terms of its orientation or its regularity, yet their drawing reveal that neither of these features were relevant to the performatory act. For instance, the drawing of the first sub-item in item 7 show that the children most apparently did not know that the pattern perceived by them should be extended by following the same pattern horizontally and not vertically. In other words, they lacked the ability to select information. Olson (1970) viewed that different perceptual information is involved in 'perceiving' or recognising the pattern and performing or copying the model. To recognise a figure or form in the context of a set of static forms it is necessary only to detect the feature or features. On the other hand, performatory activity such as drawing or reconstructing the model requires perceptual information for the guidance of each component of the act. This clearly points out that to formulate images in mind and reproduce them does not require the same information as to define in words the concept of the model. In both cases however, the information is perceptual, and both requires information appropriate to the alternatives with which the child is faced if she is to succeed. They differ primarily in the fact that each activity: discriminating, drawing, constructing, and defining involve somewhat different sets of alternatives for which different cues, features, or information must be selected from the model. The result indicates that children in the Weaver group performed better in the test to assess child's ability to correctly reproduce or represent models. This would mean that children in the Weaver group active participation in the garment weaving had oriented the Weaver children adequately to discriminate between these two forms of seeking and eliciting perceptual information.

4.3. General Discussion

In this study effort was made to understand the nature of learning geometrical shapes and patterns between children who do weaving and children who do not. An interesting aspect of both groups undertaken for study was that children from both groups hail from Mao community in Manipur State wherein rice cultivation and agriculture is the main occupation of the village folks, and weaving was one of the main occupations for women and young girls in the past. Weaving requires specific skills, time, labour and a whole lot of complex cognitive processes and often the returns received from the products of weaving do not tally with energy, labour and resources invested in making of the product. For this reason, many women had given up doing the craft and started engaging in other more productive bread earning activities like agriculture and selling vegetables, etc. Down the line now, weaving as a full time occupation amongst women had declined considerably and there are not many full time weavers in the vicinity. Such observations constraint the study but because weaving involves complex perceptual and conceptual processes like visual representation, attending to details, keen observational skills, formulation and organisation of ideas, etc. it made the present study notable and interesting to examine the influence that weaving, as a craft, has on children's performance on various tasks on Geometrical Shapes and Patterns. Keeping in mind such observations, the study attempted to examine the children's ability to talk about shapes in a social situation, distinguish objects or figures with different shapes, their ability to attend to details, and their abilities to discern patterns and also formulate new patterns, etc. Accordingly, as mentioned earlier, a test was constructed which consists of 7(seven) items requiring the child to construct figures and shapes, identify, describe and so on. The findings of the study are discussed in the light of the objectives and hypothesis formulated earlier in the study.

The result clearly shows that Weaver children perform much better than Non-Weaver children in Geometrical Shapes and Patterns Test. These results imply that participation in the cultural activity of garment weaving has significant influence on various cognitive processes like visual representation, attending to details, seeking information and selecting information specific to the task and terminating irrelevant information that eventually leads to accurate performance of any task, formulation and regulation of ideas, and so on.

It was mentioned earlier that the average age range of children in the present study were 8-9 years old. According to Piaget, children belonging to the age-group of 7-11 years develop the ability to think at the concrete operational level but not in abstract terms. The underlying characteristics at this stage is the ability to perform cognitive tasks involving conservation of number, classification, relations or functions, in which thinking is governed by fundamental rules of logic. Test results proved Piaget's claim that children's ability to perform at the concrete operational level develop at this stage. For instance, item 2 requires children to categorise names of objects on the basis of their shapes and children from both Weaver and Non-Weaver groups showed the ability to perform at the concrete operational level. The responses of children to item 2 indicate that the girls in Weaver group performed impressively well whereby, out of the thirty lists of names (familiar and unfamiliar) provided for categorisation, 17 children in the Weaver group could classify all names of objects correctly. On the other hand, only 5 children in the Non-Weaver group could correctly categorise all objects on the basis of their shapes. This could mean that participation in the weaving activity had influenced the child on the performance of the task of categorisation. Various cross-cultural studies have revealed that participants in the study showed ease in tasks on categorisation when the task includes items that are talked about and dealt with in everyday discourse. Participants manifest knowledge and use of cultural mode of categorising items. A study conducted by Irwin et al (LCHC, 1983) on unschooled Liberians rice cultivators revealed that the subjects showed great difficulty when asked to sort geometric shapes and also reclassify them on the basis of their dimension. But when the material was replaced by rice the result was remarkable. The subjects were able to sort the rice, shifting dimensions and also accounting for their sorts skilfully. Rogoff (2003) observed that adults in many communities sort items into functional groups, such as putting a hoe with a potato because a hoe is used to dig up a potato. Cole et al (1971) conducted a study of cognitive abilities vis-à-vis classification, according to Kpelle system. They reported a striking result that Kpelle adults learn very rapidly only if the two classes to be formed were called "vine and leaf", and displayed slow learning when tested on pseudo-category. The American showed evidence of categorical learning at all; in fact, they had trouble telling one leaf from another, let alone establishing a response (category) for each leaf.

As the results show, Weaver children and Non-Weaver children differed significantly on tasks on Geometrical Shapes and Patterns. The girls in the Weaver group performed better in all test items on Geometrical Shapes and Patterns than their Non-Weaver counterparts. Such differences in the performances can be due to the orientations that Weaver children receive from their home environment and observation of adult members who weave, or perhaps their own participation in the craft. Learning to weave is a complex process. Children learn the craft by means of keen observation as the adult member silently do the craft. Bandura (1962) observed that in social situations people learn much more rapidly by observing the behaviour of others. He points out that observational learning process involves four sub-processes. Firstly, it involves imitation of a model by attending to the behaviour of the model; secondly, some way of retaining what was observed in symbolic form and thirdly, the necessary motor skills to reproduce the behaviour. Lastly, Bandura observed that performances or reproduction of learned behaviour is largely governed by reinforcement contingencies, many of which are 'vicarious reinforcements'. It means performances are influenced by the consequences one sees accrue to the model, as in the reward and punishment model of learning. Rogoff (2003) also threw some light on the process of learning through observation of some ongoing activities in everyday life. She viewed that observational learning resembles the structure of learning and assisting of mastery in apprenticeship. Lave (1988) pointed out that learning largely takes place through observation and engagement with peers and experts in real production.

In the present study, although children in Weaver and Non-Weaver group are from the same Mao tribal community and they share almost the same cultural experiences, the personal experiences of children at home in the Weaver group were found to be much more stimulating in terms of their opportunities to engage in household economic activity like weaving which triggers certain cognitive processes, mentioned earlier. Wertsch et al (1984) observed that familiarity with schooling and household activity influences the subject's interpretation and performance of a task. The observed activity of learning in home is extricably linked to productive or economic activity and therefore, learning is a much more goal-oriented activity. The motives that define and structure the activity are economic and professional rather than 'educational'.

The researcher observed that certain aspects of cognitive development are nurtured by culture. The result in table 4.1 has this to substantiate the point, wherein, the results showed that class III children in the Weaver group performed better than class IV children in the Non-Weaver group on geometrical shapes and patterns test. This indicates that child's personal and cultural experiences orient and acquaints the child to perform cognitive tasks like spatial thinking, abstract thinking, etc. The present study supports the view that culture influences cognitive development of the child.

4.3. Conclusion

The present study was an attempt to examine to examine if certain aspects of culture triggers child's cognitive development, vis-à-vis understanding geometrical shapes and patterns. The objectives of the study was to examine if participation in the cultural activity of garment weaving influences children understanding of geometrical shapes and patterns in a social situation. It was also a point of interest to examine whether children in the Weaver group differ from children in Non-Weaver group in operating cognitive activities like abstract thinking and reasoning.

For the purpose of the study, a test consisting of 7(seven) items was constructed to examine the various ways of acquiring the shapes/forms and patterns. It required students to think and give examples of different geometrical shapes and patterns, describe and identify them, categorise objects on the basis of their shapes, formulate patterns and give explanations and so on.

A sample consisting of 60 girls belonging to two cultural groups (weavers and non-weavers) were selected. Children who had not received formal geometrical instruction were kept as the norm for sample selection. One group consisted of 30 girls (15 girls each in class III and class IV) who do weaving and the other group consisted of 30 girls (15 girls each in class III and class IV) who do not weave. The average age range of children in all groups of weavers and non-weavers (classes III and IV) is 8-9years respectively. They attend English medium schools. The test on geometrical shapes and patterns was administered individually in the non-teaching staff chamber in the school. There was no time limit for giving response but on average each child took forty to sixty minutes.

4.4. Findings

The findings of the present study are:

- It is found in the study that Weaver and Non-Weaver children differ significantly in their perceptual understanding of geometrical shapes and patterns.

Weaver children performed significantly better than their Non-Weaver counterparts, which could partly be due to their frequent but rich perceptual involvement in dealing with forms and shapes in weaving. This oriented and acquainted them to be sensitive and attend to forms and shapes elsewhere, be it in a social situation, or in their playfield, or in schools, etc. Children in the Weaver group were also found to acknowledge and appreciate shapes and figures in such trivial forms as is found in the food (like, bread is considered as coming in the form of square, etc). Supporting evidence is found from the finding that Weaver children scored significantly better than Non-Weaver children on tasks that required them to conjure up examples from their daily perceptual experiences, categorise objects on the basis of shapes, etc.

- It was also found that participation in the cultural activity of garment weaving triggers children's spatial thinking to a certain extent.

Children in the Weaver group were found to perform better in tasks that attempt to assess the ability to exhibit spatial thinking. This can be substantiated by the result that indicates that they showed greater competence when compared with the performance of the Non-Weaver group.

4.5. Implications of present study

1. The study found that children could identify ample examples of elementary geometrical figures from their everyday perceptual experiences. Children also displayed ease of categorising and discriminating shapes or forms when examples of shapes and forms available in our day to day lives were provided to do the task. Taking cue from these observations, curriculum workers and experts can take note of this and try to implement a more contextualised learning, wherein, learning geometry can be made relevant to daily experiences of children and less intimidated by the subject.

2. The study found that participation in garment weaving has an influence on the child's ability to discern between various shapes and forms, many of which may be applicable to formal geometrical curriculum. We live in a world of solid shapes, forms and figures and we constantly deal with them. As elementary geometry lessons also deal with solid shapes and figures, curriculum workers can take note of this finding and introduce culture-sensitive syllabus for effective geometrical learning.

4.7. Limitations of the study

There had been certain drawbacks in the study and these were presented below:

1. Despite efforts to refine the selection of items used in the study and make them reliable for procuring desired outcomes, the test measures could not elicit adequate responses from children. This study is, thus, limited by not employing any standardised tools.

2. The results in the study are limited because children's first time encounter with a researcher from outside in a one-to-one setting created mixed feelings of excitement and anxiety. This greatly hindered their responses.

3. Also due to time constraints, in-depth interview and observation of children could not be conducted satisfactorily.

4. In the present study, sample was drawn from a homogeneous social and cultural environment in which children also attended the same schools, spoke the same language, shared almost the same responsibilities at home, etc, the observable difference being weaving as an additional activity for children in the weaving group. Adequate measures to examine the influence of schooling and maturation on discerning geometrical shapes and patterns were not employed and therefore, doing the same would have enriched the study.

5. The present paper suffered for want of expert guidance, feedback and constructive suggestions.

4.8. Further Research Suggestions

1. This study was carried out only with children from the same Mao tribal community, yet it showed marked differences between the two groups under study. A comparative study between two distinct cultural groups could provide richer data for further research and generalising findings under the sway of culture and cognition.

2. This study was undertaken to examine only the elementary geometrical shapes and patterns by taking class III and class IV students. A longitudinal study to examine the conceptualisation of specific geometrical concepts in a particular community or across cultures would greatly enrich and extend the current research findings.

3. An in-depth ethnographic study of communities engaged in similar activities to examine and compare different cultural models of learning can be proposed.

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Appendix - I

Geometrical Shapes and Patterns Test
For Class III and Class IV children (8-9 years)
Emeni Kayina

This test is meant to assess if the child's participation in certain cultural activities influence their performance on tasks on Geometrical Shapes and Patterns. The test can be used for the purpose of assessing if everyday experiences of children orient children to with formal geometrical shapes and patterns prior to formal instruction on geometry lessons. As such, children before being subjected to formal geometrical instruction should be kept as a norm to conduct this test.

Instructions:

The students will be instructed as follows: *"I am going to show you some concrete objects, pictures of figures and list of names of different shapes and patterns. I will also ask some questions in the process. Please be attentive and try to follow my instructions and answer the questions I ask. But do not be scared of performing well or not as your responses will only be used for my study".*

Test Items:

I. Recognition of shapes

Here are some concrete objects with different shapes. Look at the objects. Now, think of as many examples of these solid shapes as you can and name them:

i. Sphere
ii. Cuboids
iii. Cube
iv. Cone
v. Cylinder
vi. Pyramid

2. Categorization

Here is a list of names of objects. The shape of each object belongs to either one of the concrete objects shown in item one. Please go through the lists carefully and accordingly, group the names of objects with shapes that correspond to the shapes of concrete objects shown to you earlier.

Earth, pencil-box, dice, fire-blower, ball, rooftop, oro (traditional basket), marble, pop*, mountain, match-box, spearhead, chalk, mouth loud-speaker*, Christmas- tree, cap, candle, chalk-box, bell, passion-fruit, door*, alarm clock*, lip-gloss*, plum, gift-box, tent, window*, brick, bottle, duster.

*responses from pilot study revealed that there is a fixed general understanding of the shapes of these objects.

3. Curved and Plane Surface

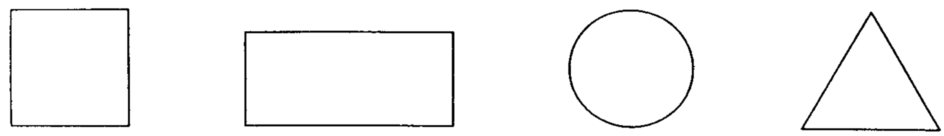
Instruction: All objects with straight edges have a plane surface. Similarly, all curved objects have curved surfaces.

Now, state whether the following objects have plane or curved surface:

i. table-top
ii. black-board
iii. fire-blower
iv. egg
v. exercise book
vi. one-rupee coin
vii. ball
viii. chalk-box
ix. ball
x. candle

4. Two-Dimensional Test (2D)

Closely examine the following figures and describe their features or properties



5. Three-Dimensional Test (3D)

Show the following concrete objects and ask the child to describe the features of each object.

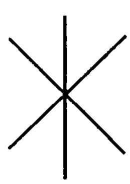
i. Chalk box

ii. Pencil box

iii. Necklace Bead

6. Pattern Recognition and Formulation:

Look at the following figures. Identify which figure does not follow the trend with the rest of the figures and provide reasons to your response.



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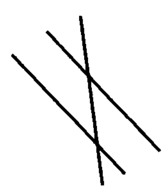

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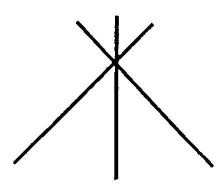

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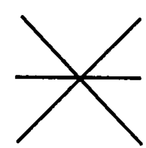

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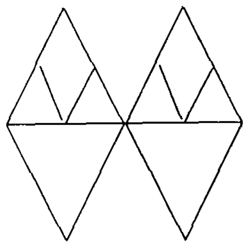

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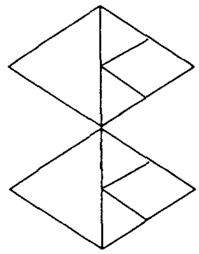

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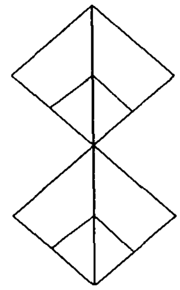

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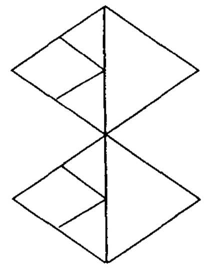

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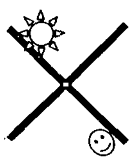

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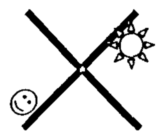

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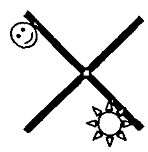

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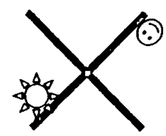
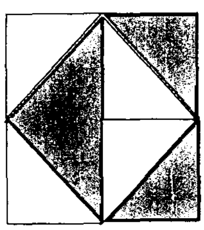


iii.d



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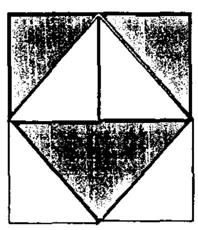
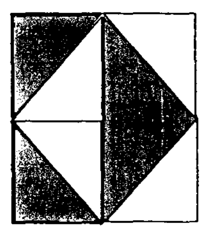


iv.b



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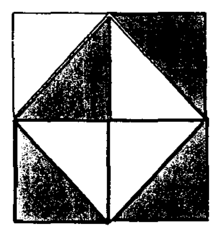

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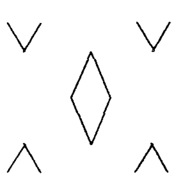
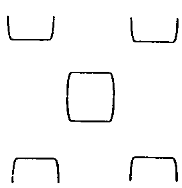


v.a



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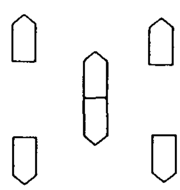

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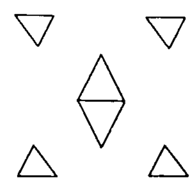
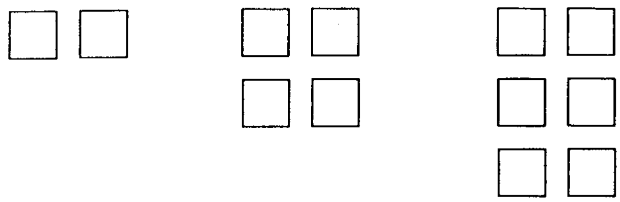
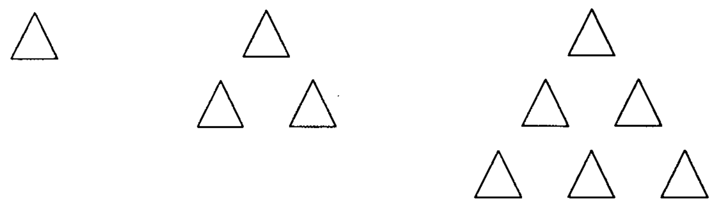
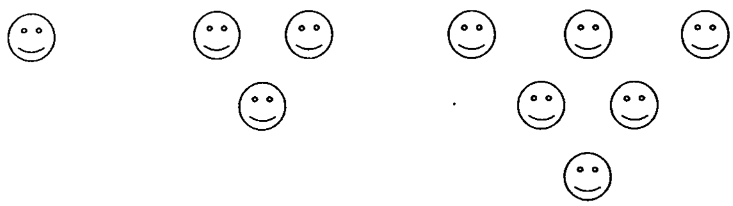


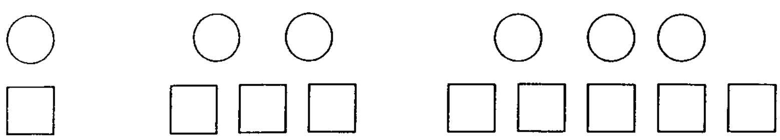
v.d

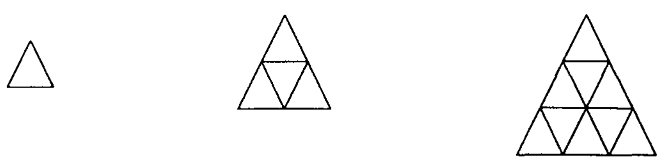
7.3. Formulation of Patterns:

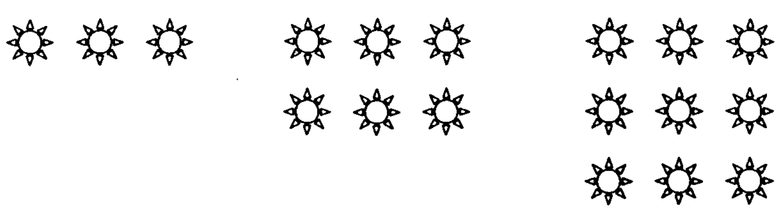
i. 

ii. 

iii. 

iv. 



vi. 

Appendix II

The individual score of Weaver group on all test items

Item No. W	1	2	3	4	5	6	7	Total Score
1	8	14	10	16	6	16	5	75
2	9	15	10	16	6	10	6	72
3	10	12	10	16	6	9	6	69
4	12	15	9	14	6	9	4	69
5	14	15	9	12	6	9	4	69
6	8	14	10	12	5	12	3	64
7	7	13	10	12	5	10	5	62
8	9	13	8	12	4	8	5	59
9	10	15	10	12	7	8	4	66
10	12	15	10	10	6	6	6	65
11	10	15	10	14	6	11	6	72
12	11	12	9	10	6	10	4	62
13	11	15	10	12	5	10	6	69
14	8	14	8	12	7	6	3	58
15	12	14	10	16	6	11	5	75
16	15	15	9	12	6	9	2	68
17	11	15	10	19	7	10	5	77
18	8	15	10	14	5	8	4	64
19	10	15	10	16	5	12	6	74
20	9	14	10	13	6	8	6	66
21	12	15	9	12	6	7	4	65
22	14	15	10	12	6	9	6	72
23	7	15	9	15	5	9	6	66
24	8	15	10	13	5	6	6	63
25	9	15	10	15	6	4	6	71
26	12	14	10	12	6	6	4	68
27	10	13	10	10	6	6	4	62
28	11	12	10	12	6	5	4	61
29	11	14	8	16	5	5	6	69
30	8	14	9	14	5	5	5	63
Total								

The individual score of Non-Weaver group on all test items

Item No. NW	1	2	3	4	5	6	7	Total Score
1	10	15	9	10	6	9	4	63
2	9	15	10	10	6	5	4	59
3	8	14	10	12	3	9	3	59
4	9	14	8	8	5	5	2	51
5	6	12	8	8	3	6	3	46
6	6	12	9	12	5	5	2	51
7	8	15	9	10	5	6	3	56
8	8	14	10	10	3	8	2	55
9	10	14	10	8	6	6	4	58
10	6	13	8	12	6	6	4	55
11	8	12	8	8	6	6	4	52
12	10	13	8	14	3	8	5	61
13	11	13	9	8	5	5	2	53
14	11	14	10	10	5	6	3	59
15	8	14	10	10	3	6	3	54
16	9	14	10	13	7	4	1	58
17	4	14	10	12	5	6	0	51
18	8	14	10	8	6	7	3	56
19	8	13	10	12	6	8	5	62
20	11	13	10	15	5	9	3	66
21	10	12	8	8	6	6	2	52
22	11	13	9	6	6	6	4	55
23	10	13	8	10	6	8	3	58
24	11	12	8	10	4	9	4	58
25	8	14	10	11	6	5	3	57
26	9	12	8	16	6	9	2	62
27	9	15	9	11	5	8	2	59
28	10	12	10	10	5	9	2	58
29	12	12	10	15	5	9	3	66
30	12	15	8	14	6	9	4	68
Total								

Appendix-III

Correlation matrix for Weaver and Non-Weaver children on all test items

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7
Item 1	1.000	.181	.024	.091	.296	.189	.211
Item 2		1.000	.313	.253	.198	.125	.300*
Item 3			1.000	.211	.124	.193	.179
Item 4				1.000	.156	.456**	.434**
Item 5					1.000	-.002	.131
Item 6						1.000	.299*
Item 7							1.000

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Correlation matrix for Weaver group on all test items

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7
Item 1	1.000	-.017	-.061	.059	.160	.383*	.323
Item 2		1.000	.337	-.044	.096	-.124	.011
Item 3			1.000	.080	-.018	-.065	-.199
Item 4				1.000	-.022	.459*	-.053
Item 5					1.000	-.239	.004
Item 6						1.000	.263
Item 7							1.000

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed)

Correlation matrix for Non-Weaver group on all test items

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7
Item 1	1.000	.174	-.058	-.199	.348	-.056	-.235
Item 2		1.000	.103	.228	.093	.075	.149
Item 3			1.000	.111	.186	.274	.280
Item 4				1.000	.044	.303	.411*
Item 5					1.000	-.024	-.266
Item 6						1.000	.022
Item 7							1.000

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).