Africentric environmental adaptation and students’ cognitive styles

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ABSTRACT
The purpose of this paper is to examine the effects of environmental adaptation on the cognitive styles of students in African cultures. The paper is motivated by an observed disequilibrium between students’ eco-cultural perceptual styles and the western academic learning models typically sponsored by schools. The paper is illumined by Witkin’s distinction of cognitive styles to Field Dependence (FD) and Field Independence (FI). The paper is backed by an empirical study that was carried out using both qualitative and quantitative methods of data collection and analysis. A total sample of 80 students, 24 parents and 12 teachers both rural and urban settlements of Nso ethnicity of Cameroon were chosen for the study. The qualitative data were analysed using the systematic process of content analysis while descriptive and inferential statistics were used for quantitative data. The qualitative findings of the study showed that the Nso eco-cultural orientation posits a preservationist environmental adaptation, oral mode of communication and collective/interpersonal social pattern. These findings correlated with students’ cognitive styles as the results of the study proved that in both rural and urban settlements, students were more FD (67.0%) than FI, at a significant level of P<0.001 as regards categorization, processing styles and attribution. Furthermore, only 23.9% of the academic learning process strategies were effectively in favour of FD students, thus more of FD students (67.3%) failed in academic subjects than FI students. Nonetheless 59.5% of the students who failed were good in ethno-science skills with a significant level of P<0.001. The conclusion, recommendations and significance of the study were based on the fact that if a student displays a cognitive preference that is common and accepted within his/her cultural group, it should be viewed as a “difference” from what the mainstream society promotes in schools; not as a “deficiency” or “failure”. Hence, while taking cognizance of students’ FD cultural perceptual styles, teachers and educational administrators should provide strategies for transfer and acquisition of other FI ways of perception in students.

Keywords: Cognitive styles, environmental adaptation, field dependence, field independence, categorisation, attribution, processing

Introduction
Cultural diversity in the way people acquire, process and display information has led psychologist to posit a link between environmental adaptation and cognitive styles (Witkin, Moore, Goodenough, & Cox, 1977; Berry 1976). In 1988, Anderson found out that because the social, cultural and environmental milieus of ethnic and racial groups differ, one should expect these differences to be reflected in their respective cultural/cognitive styles. Despite this understanding, most literature of what constitutes culture, cognitive style and learning is dominated by Eurocentric theories and methodologies. This therefore poses a complexity as to what can be appropriate for African cultures, in an attempt to bring a link between the cognitive styles that students acquire through their eco-cultural and environmental backgrounds on the one hand; and the learning tasks, strategies and instructional methods that are sponsored in schools, on the other hand.

Cognitive styles refer to the different ways by which people process information. Cognitive styles are usually classified into field dependent (FD)—those who exhibited high dependency on the surrounding field; and field independent (FI)—those who exhibited low dependency on the field. Cognitive styles encompass multiple cognitive processes such as perception, thinking, attention and decision making. This paper nonetheless focuses on perception (amongst the other cognitive styles) based on Witkin’s (1954) categorization of cognitive styles to field dependent and field independent, which is limited to perception. Witkin (1954) main finding was that there were individual differences in how people performed the perceptual tasks and these differences were stable over time and across tasks. It is therefore justifiable to limit the study of cognitive styles to perception. Perception is an interpretative mechanism that enables the establishment of meaning through sensory stimulations (Tchombe, 2011). Hence, cognitive and perceptual
styles are used interchangeably in the, to encompass three major aspects, namely, categorization, processing and attribution.

This paper aims to establish the fact due to differences in environmental adaptations in different cultures, students can adopt different cognitive styles. Taking cognizance of this fact, it is important to note that environmental adaptation as a psychological construct is the way that groups and individuals develop their customary and individual behaviours as adaptations to the demands of their ecology, as they live in particular ecosystems (enculturation). In psychology therefore, individual behaviour is seen to adapt to both the ecological and cultural contexts; thus individual behaviours will be developed to meet the demands and constraints of these contexts.

**Conceptual and theoretical considerations**

**Cognitive Styles: Field dependence vs Field independence**

When field dependents interact with stimuli, they find it difficult to locate the information they are seeking because other information masks what they are looking for. Field independents find it easier to recognize and select the important information from its surrounding field. When information is presented in an ambiguous, unstructured format, the field independent will impose his/her own structure on the information. The field dependent will attempt to understand and learn that information as it is presented and without restructuring it.

Another way to look at field dependence and independence is through a global versus articulated cognitive style. Those with a global perspective, field dependents, see things in the entire perceptual field (the forest rather than the trees). In other words, field dependents have difficulty separating the part from the complex organization of the whole. The analytic style presented by field independents allows them to create their own models for things they want to understand or articulate to others.

FI hinges on the perceptual skill of "seeing the forest for the trees." A person who can easily recognize the hidden castle or human face in 3-D posters and a child who can spot the monkeys camouflaged within the trees and leaves of an exotic forest in coloring books tend toward a field independent style. The "field" may be perceptual or it may be abstract, such as a set of ideas, thoughts, or feelings from which the task is to perceive specific subsets. Field dependence is, conversely, the tendency to be "dependent" on the total field so that the parts embedded within the field are not easily perceived, though that total field is perceived most clearly as a unified whole (Brown, 1994).

There are advantages and disadvantages to FI and FD learning styles and both are important for learning. The FI learner excels in classroom learning which involves analysis, attention to details, and mastering of exercises, drills, and other focused activities. The FD learner, by contrast, seems to achieve a higher degree of success in everyday language situations beyond the constraints of the classroom; tasks requiring interpersonal communication skills. Listed in table 1 below are the principal characteristics of the two cognitive styles and the implications of each for learning (Ellis 1993).

**Table 1: Field dependence vs Field independence**

<table>
<thead>
<tr>
<th>Field independence</th>
<th>Field dependence</th>
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</thead>
<tbody>
<tr>
<td>1. Impersonal orientation i.e. reliance on internal frame of reference in processing information</td>
<td>1. Personal orientation i.e. reliance on external frame of reference in processing information</td>
</tr>
<tr>
<td>2. Analytic i.e. perceives a field in terms of its component parts; parts are distinguished from background</td>
<td>2. Holistic i.e. perceives field as a whole; parts are fused with background</td>
</tr>
<tr>
<td>3. Independent i.e. sense of separate identity</td>
<td>3. Dependent i.e. self view is derived from others</td>
</tr>
<tr>
<td>4. Not so socially aware i.e. less skilled in interpersonal/social relationships</td>
<td>4. Socially sensitive i.e. greater skill in interpersonal/social relationships</td>
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Accordingly therefore, field dependent individuals prefer a more global than analytic perceptual styles, a more concrete than abstract perceptual styles and a more external than internal locus of control.

**Environmental Adaptation**

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The ability of a child to adapt to his/her environment has been considered by Gardner (1999) in his theory of multiple intelligences. Ecological/environmental adaptation refers to the ways by which people learn, adjust and make use of the local environment. It is important that within the African context, the child is able to know how to make use of the natural environment around him or her. This is the contextual and practical aspect of intelligence and reflects how the child relates to the external world about him or her. Sternberg (1985) states that it is adaptation to, shaping of, and selection of real-world environments relevant to one’s life. This has to do with how the group perceives and make use of the natural environment. How children learn to participate in economic activities and how children construct and make use of their play objects.

How the African perceives nature is of practical importance to the way he/she organises his/her thought pattern. In African traditional cosmology, humankind is perceived as part of nature, as opposed to the Western conception (exemplified by Christian religion, but also by Islam) in which humankind is above nature and is thus allowed to conquer and control it. This leads to two types of reasoning, global and symbolic on the one hand, based on experience and geared to explaining the final goal of events, analytical and experimental on the other hand, geared to explaining causal effects (Dasen, 2011).

The main economic and occupational activity can be seen as another influence on cognitive style. For example, some cultures rely on highly developed perceptual skills for survival. Cultures, which depend primarily on agriculture and animal husbandry, emphasize customary routines in order to survive. Child upbringing practices focus on responsibility, conformity to customs, and the value of traditional ways. Cultures, which depend primarily on hunting, gathering, and to some extent fishing, for survival require more self-reliance and application of skills under varying circumstances. Child upbringing practices while touching traditional methods also tend to encourage more individual initiatives (Berry 1976).

A child’s participation in family life through active engagement in the major economic activity is of capital importance to African parents and elders. Accordingly, within the Nso culture, children accompany adults to the farms where they participate by observing and emulating what adults do. From about age six, children can be seen with tiny blunt utensils digging the soil, planting seeds, chasing birds away from crops, and harvesting. Over the years, boys are expected to know how to clear while girls are socialized into hoeing and weeding. Through interaction with parents and elders children acquire necessary knowledge about the land, the soil, different seasonal crops, and trees that were imbued with spirits and therefore not cuttable. Thus, African children tend to more concrete than abstract because of their direct contact with the physical environment. Besides farming, animal husbandry (rearing of goats and fowls) stands out as another major economic activity of the Nso people (Wirdze, 2012).

Furthermore, we can establish a cultural difference in the play objects that children use in their play activities. While children in the western culture tend to be exposed to artificial play objects like toys, children within the African use natural play objects like sticks, plants, soils, stones. From these, children learn to make other play objects like toys and house furniture like chairs and benches. In relation to the daily routines that children engage themselves in, Berry (1976) found a strong eco-cultural factor when studying field dependence and field independence (FDI) cross-culturally across a wide range of societies: members of nomadic hunting and gathering societies tend to be more field independent than members of sedentary societies living from subsistence agriculture.

**Social constructivist theory (Vygotsky, 1978)**

One of the first attempts to consider intellectual or cognitive development as a construct of socialization was made by the Russian psychologist Lev Semyonovich Vygotsky. According to Vygotsky (1978), individual intellectual development cannot be understood without reference to the social milieu in which the child is embedded. For Vygotsky, children’s cognitive development must be understood not only as taking place with social support interaction with others, but also as involving the development of skill with socio-historical development tools that mediate intellectual activity. Hence, where Piaget looked at developing children and saw junior scientists, working by themselves to develop an independent understanding of the world, Vygotsky saw cognitive apprentices, learning from master teachers the skills that are important in the child’s culture (Feldman, 2003).

Vygotsky argued that children’s efforts to understand their world are embedded in a social context. They strive to understand their universe by asking questions. For instance, “How do machines work?” “Why is the sky blue?” “Why does the weather change?” In answering such questions, adults guide a child’s growth in
important ways. They not only provide instruction but also foster the child’s motivation and interest. Adults present challenges for new learning. Thus, in many respects, the young child is an apprentice in thinking. Parents, child-care workers, and older siblings act as mentors stimulating intellectual growth. Children learn to think through guided participation in social experiences that explore their world. Vygotsky argued that what children can do with the help of others may be more indicative of their mental development than what they can do alone.

Vygotsky maintained that for each developing individual there is a zone of proximal development, a range of skills that the child can perform with assistance but not quite independently. How and when children master important skills is partly linked to the willingness of others to provide scaffolding, or sensitive structuring of children’s learning encounters.

**Zone of Proximal Development (Zpd)**

The definition of zone of proximal development according to Vygotsky is, the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers (Vygotsky, 1978). In other words ZPD is the level at which a child can almost, but not fully, perform a task independently, but can do so with the assistance of someone more competent (Feldman, 2003). As understood by Vygotsky, a child usually follows or imitates an adult’s example for acting and reacting, and gradually develops the ability to perform tasks without any assistance. Hence, zone of proximal development is the difference between what a child can do with help and cannot do without assistance or guidance.

The provision for assisted performance by parents, elders, older siblings, child care givers and more competent peers to a child, is known as scaffolding. It is the support for learning and problem solving that encourages independence and growth (Feldman 2003).

Scaffolding may include assistance with planning, organising, doing and/or reflecting on the specific task. Such assistance is best made available in a timely manner matched to the learning needs and interests of the learner. Within the African context, scaffolding is seen as when parents give assistance to their children in cooking duties and farming. Furthermore, during games and play songs, more experienced peers and older siblings scaffold children to a mastery of games and draw out appropriate social meanings from them.

**Empirical study**

The conceptual and theoretical considerations of this paper are guided by an empirical study that was carried out amongst adolescent students of Nso, in the Northwest Region of Cameroon.

**Research method**

A mixed research method was used for the study with the use of both quantitative (cognitive style test) and qualitative (interview guide) techniques of data collection. Based on a purposive sampling technique, a sample of 80 adolescent students from both rural and urban communities were chosen for the study. Both descriptive and inferential statistics were used to analyse data.

**Findings of the study**

The major objective of the study was to find out the effects of environmental adaptation on the cognitive styles of students. The findings of the study showed that:

Accordingly, 70.9% of the students were global (FD) while 29.1% were analytical (FI). This difference was significant at the level of $\chi^2=28.90; df=1; P<0.001$. It was realized that students from the village focused more on a whole 67.9% as well as their town counterparts 73.7%. As per sex, both the male 69.8% and the female 71.7% focused more on a whole though the female slightly more but this difference was not statistically significant. 71.7% of the 11 to 12 years of age were more global as well as 70.5% of 13 to 14 years of age. It was equally realized that 75.6% of form two students were global while 69.6% of form three students were equally global. These results are summarised in the following chart.
Furthermore, the likelihood ratio test was used to calculate the variable that was most predictive of cognitive style. The following table presents the results.

Table 2: Likelihood ratio test indicators on cognitive styles

<table>
<thead>
<tr>
<th>Effect</th>
<th>Model Fitting Criteria</th>
<th>Likelihood Ratio Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting type</td>
<td>-2 Log Likelihood of Reduced Model</td>
<td>Chi-Square</td>
</tr>
<tr>
<td></td>
<td>110.130</td>
<td>4.027</td>
</tr>
<tr>
<td>Age</td>
<td>131.541</td>
<td>25.438</td>
</tr>
<tr>
<td>Class</td>
<td>113.776</td>
<td>7.673</td>
</tr>
<tr>
<td>Gender</td>
<td>107.041</td>
<td>.939</td>
</tr>
</tbody>
</table>

According to this test, the lesser the test ratio, the greater its predictive value. Thus, according to the likelihood ratio tests it was seen that Age was the most predictive element on the analytical components of cognitive styles with a ratio of 0.069. This was followed by setting type 0.402, class 0.466 and gender 0.919.

Qualitative explanations according cultural environmental adaptation

The above analysis by which students were more global than specific could be explained qualitatively based on a harmonious environmental adaptation culture of the people gotten from focus group discussions with parents and students. According to the findings it was realized that Nso people are basically preservationist, which leads to a harmonious relationship with nature. The main activity of the people is farming and there is a strong belief in an interrelation between the natural, spiritual and human. The people strictly believe in God Almighty and other deities and ancestors that relate with humans. Children commonly play with natural tools like soils, sticks, trees, stones etc. This leads to people to perceive the humans as being in unity with nature. This translates into more harmonious, unifying and global perceptual styles. The above is illustrated in the following conceptual model.
Based on further qualitative findings, it was seen the Nso environmental adaptation mode gives room for global perceptual styles as illustrated in the figure below.

**Figure 2: Conceptual Model of Nso Environmental Adaptation**

**Figure 4.3: Conceptual Model of Nso Environmental Adaptation and Global Perceptual Style**

According to the findings it was realized that Nso adolescents live in a culture where people are
basically environmental preservationist, with high harmonious environmental adaptation to nature. There is a strong belief in an interrelation between the natural, spiritual and human. The people strictly believe in God Almighty and other deities and ancestors that relate with humans. Children commonly play with natural tools like soils, sticks, trees, stones etc. The harmony with nature is equally manifested through the practice of traditional medicine and the preservation of certain plants and animals of high cultural value. Furthermore, the main activity of the people is agriculture. This leads people to perceive the humans as being in unity with nature. This harmonious environmental adaptation correlates with results that showed that students were more global (holistic) than analytic (specific) in their perceptual styles. It was equally noted that within the Nso ethnicity, there was little or no difference between rural and urban settlements, gender and age, when it comes to issues of environmental adaptation. Hence, there were no significant differences in relation to cognitive styles in relation to settlement type, gender, age and class.

The findings and results of this study were consistent with earlier findings of a study carried out by Tapé (1994) in Côte d’Ivoire. According to his findings, within the African Cosmo-vision, humankind is part of nature, as opposed to the Western conception (exemplified by Christian religion, but also by Islam) in which humankind is above nature and is thus allowed to conquer and control it. Tapé conducted his research amongst schooled and unschooled adolescents and came to the conclusion that African adolescents showed preference for more global and symbolic perceptual styles, based on experience and geared to explaining the final goal of events. As opposed to analytical and experimental perceptual styles, that is geared to explaining causal effects.

There is equally a body of empirical studies to support the findings of this study that the agricultural orientation of the Nso ethnicity can be associated with global and holistic cognitive styles. For example, Uskul and colleagues compared neighbouring villages in the Black Sea region of Turkey that differed in terms of their primary economic activity (Uskul, Kitayama, & Nisbett, 2008). The present study is consistent with the findings of Uskul and colleagues (2008) who found that those from farming and fishing communities categorized objects more thematically and showed more contextual patterns of visual attention than those from a neighbouring herding community. This is also consistent with earlier studies carried out by Berry (1967) and Witkin & Berry (1975), who found that more sedentary communities (such as farming communities and cooperative fishing communities) tend to be characterized by a more interdependent social orientation and holistic cognition (specifically field dependence or the tendency to have difficulty separating objects from their contexts. On the other less sedentary communities, where individuals earn their living in relatively isolated ways (such as herding communities and hunter-gatherer groups) tend to be characterized by a more independent social orientation and analytic cognition (specifically field independence).

In the light of Witkin and Berry’s (1975) comprehensive review of cross-cultural studies of FD-FI individuals, one can infer that cognitive style can be conceptualized as environmentally and culturally sensitive individual difference in cognition and could be predicted from the analysis of an individual’s cultural and acculturation characteristics.

While the above review suggests that cultural differences in cognitive styles are due to the environmental adaptation, this is not to say that other factors such as genetic dispositions does not have an impact on cognitive styles. According to Varnum, Grossmann, Kitayama, and Nisbett (2010) one must be cautious in drawing strong causal conclusions. One implication of the lack of a significant relationship indicates that other extraneous variables other than environmental adaptation could be responsible students’ cognitive styles. In relation to this proposition, we should take cognizance of the fact that while Witkin et al’s (1954) initial study highlighted global vs analytical perceptual styles, the “core” of cognitive style was rooted in an individual’s innate predispositions and personality type. The idea of innate disposition is supported by the studies of Tallon-Baudry and Bertrand (1999), who found out that the cortical size and connectivity patterns may be critical in determining visual perceptual organization. Accordingly, larger scale cortical rhythms are associated with more global object perception. Furthermore, Romei et al. used the Navon task to show that the entrainment of slower rhythms (5Hz) caused more global biases, whilst faster rhythms (20Hz) induced more analytical biases. It is tempting to speculate that slower rhythms facilitate global integration exactly because the global precepts require the integration of signals separated by larger distances on cortical maps, and thus require longer times (thus optimizing slower rhythms) to achieve integration.

The process called brain lateralization, by which certain functions are located more in one hemisphere than the other, have equally been used to explain differences in cognitive styles. For most
people, the left hemisphere concentrates on tasks that necessitate verbal competence, such as speaking and reading. The right hemisphere develops its own strengths, especially in nonverbal areas such as comprehension of spatial relationships, recognition of patterns, reasoning (Zaidel, 1994). Hence while the right hemisphere is more analytical the left is more global.

Conclusively, the above dispositional explanations may have some relations with cognitive styles, but seem to explain more of cognitive ability than styles. Insofar as styles are a matter of preference, they are more related to environmental factors and modes of ecological adaptation.

Conclusion

In order to effectively ascertain the influence of environmental adaptation on one’s cognitive style preferences we have to prevent the two extremes of over stereotyping and over generalizing. That is, in the first case, total insistence on cultural diversity to the detriment of the universal human nature; or, in the second case, extreme denial that cultural differences exist, which fails to recognize and honour the characteristics that give a group their sense of personhood. In the light of McIntye (1996), this dichotomy can be synthesized by keeping in mind the following psychological underpinnings:

All cognitive processes like attention, perception, critical thinking, deduction, induction, abstraction, conceptualization, problem solving, decision making etc, are found in all cultural groups.

Some processes are demonstrated and applied more in some cultural situations than in others; but the first point still remains.

Individuals within a particular culture display the traditional preference and cultural markers of that group to varying degrees… from a “very limited intensity” to a “very high intensity”. These variations can be due to ethnic group differences with the larger culture, socio-economic status, degree of acculturation to the mainstream society, gender and religion.

If a student displays a cognitive preference that is common and accepted within his/her cultural group, it should be viewed as a “difference” from what the mainstream society promotes in schools; not as a “deficiency” or “failure”.

References