



## Poverty and Brain Development in Children: Implications for Learning

Victor E. Dike<sup>1</sup> 



<sup>1</sup>Founder and CEO, Center for Social Justice and Human Development (CSJHDEV) - an NGO in Sacramento, California, United States

### Abstract

Debates on the effect of poverty on brain development in children and its implications for learning have been raging for decades. Research suggests that poverty affects brain development in children and that the implications for learning are more compelling today given the attention the issue has attracted. For instance, studies in the fields of cognitive neuroscience, educational neuroscience, and developmental psychology have shown that living in poverty may indeed change how the brain grows and develops and may have implications for learning through adulthood and professional opportunities. This paper argues that living in poverty may put pre-school and school-aged children at health risks and behavioral problems in the classroom as it upsets brain development. Drawing from available pertinent literature, this paper will through descriptive design and in-depth analysis identify areas of the brain affected by poverty, implications for learning, and recommend possible ways teachers can apply their knowledge of the brain in the classroom to ameliorate the challenges faced by children living in poverty.

**Keywords:** Brain, Development, Children, Learning, Teaching, Behavior, Classroom.

### Contents

1. Introduction .....	65
2. Conclusion .....	67
References .....	67

**Citation** | Victor E. Dike (2017). Poverty and Brain Development in Children: Implications for Learning. Asian Journal of Education and Training, 3(1): 64-68.

**DOI:** 10.20448/journal.522.2017.31.64.68 

**ISSN(E) :** 2519-5387

**Licensed:** This work is licensed under a [Creative Commons Attribution 3.0 License](https://creativecommons.org/licenses/by/3.0/) 

**Funding:** This study received no specific financial support.

**Competing Interests:** The author declares that there are no conflicts of interests regarding the publication of this paper.

**Transparency:** The author confirms that the manuscript is an honest, accurate, and transparent account of the study was reported; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained.

**History:** **Received:** 6 March 2017/ **Revised:** 10 April 2017/ **Accepted:** 14 April 2017/ **Published:** 21 April 2017

**Ethical:** This study follows all ethical practices during writing.

**Publisher:** Asian Online Journal Publishing Group

## 1. Introduction

This paper explores poverty and brain development in children as it seeks to have a better understanding as to whether poverty alters the structure of the brain of children during its growth and development and the implications on academic performance. Drawing from pertinent available literature on the topic it will identify areas of the human brain affected by poverty, and their impacts on children's learning process. It will also recommend possible ways teachers can apply their knowledge of this topic in the classroom to ameliorate the challenges faced by school-age children living in poverty.

Poverty is ubiquitous and has varied definitions. However, for this paper, poverty is defined as "a state or condition in which a person or community lacks the financial resources and essentials to enjoy a minimum standard of life and well-being that is considered acceptable in society" (Investopedia, n.d). Studies in the field of educational neuroscience, cognitive neuroscience, and developmental psychology with the emerging brain technologies have exposed the inner structure of young human brain and how it grows, develops, and functions (Hair *et al.*, 2015). For Sousa (2011) "Learning involves the brain, the nervous system, and the environment, and the process by which their interplay acquires information and skills" (p.91).

Hair *et al.* (2015) that examined the scores on "cognitive and academic achievement and brain tissue" as well as "the gray matter of the entire brain, frontal lobe, temporal lobe, and hippocampus" found that children living in poverty performed poorly in school relative to children not exposed to similar life condition. The study warned that the longer children are exposed to poverty, the more "their academic deficits" (p.827). It also observed that these conditions will continue until they are adults and, therefore, will contribute to low life and poor professional achievement (Hair *et al.*, 2015).

According to Mani *et al.* (2013) quite often the poor, including children living in poverty are unable to perform some cognitive-related tasks, because poverty enforces a mental "burden" on them, diverts "attention and reduces effort." This is probably because "poverty-related concerns" drains their mental "resources" thereby "leaving" them with less mental energy for other activities (p.976).

Thus poverty "reduces cognitive capacity" of the poor as other studies show that poverty influences language that is linked to the temporal lobe, executive functioning, and the frontal lobe (Noble *et al.*, 2006; Kishiyama *et al.*, 2009; Hackman *et al.*, 2010). Deficiencies in the executive functioning of people exposed to poverty occur during infancy, childhood, and adolescence through adulthood (Hair *et al.*, 2015). The executive function that is supported by a part of the brain called the prefrontal cortex (Casey *et al.*, 2000) can be vulnerable in children with past experiences with poverty. Given the delicate nature of the brain, toxic environments are said to affect the major areas that are involved with the thinking and learning process (Sousa, 2011).

The effect of poverty on brain development during childhood is said to be a widespread social condition that can cause neurological problems. The longer a child is exposed to poverty and stress, the larger the negative impact on the cognition, emotion, and self-regulatory learning skills of the person (Lipina and Colombo, 2009). Although impoverished environments and stress have undesirable effects on brain development, but the implications on learning may vary on individuals (Lupien *et al.*, 2009). Those living in poverty or in low socioeconomic status (SES) may suffer from depression or chronic stress more than those in higher SES (Almeida *et al.*, 2005). This brings us to the next section that focuses on the areas of the brain affected by poverty.

### 1.1. Research Methods

Information for this descriptive paper was derived from the review of pertinent literature in the areas of educational neuroscience, cognitive neuroscience, and developmental psychology. This means that the primary method of collecting data for this paper was an extensive review of available related literature for an in-depth analysis of poverty and brain development in children and implications for learning process.

### 1.2. Problem Statement

Debates on the implications of poverty on brain development in children, and their ability to learn effectively have been on-going for decades, but they are much more compelling in the 21<sup>st</sup> Century technologically-driven learning process. For teachers to function effectively they need to have deeper understanding of how the brain works, how stress and poverty affect the thinking and learning process of their students, particularly the young ones, so as to adopt differentiated instructional strategies to meet the needs of all students.

### 1.3. Research Questions

This paper focuses on the following questions: How much can a child's environment affect the growth and development of his or her brain? What sections of the brain are affected by poverty? What sections of the brain are essential for learning? How can teachers apply their knowledge of poverty and brain development to the classroom?

### 1.4. Areas of the Brain Involved

The parts of the brain affected by prolonged experience with poverty include those linked with the working memory, impulse regulation, visuospatial, language and cognitive conflict (Noble *et al.*, 2005). The *magnetic resonance imaging* (MRI) (Sousa, 2011) brain scans of children during a long duration with poverty have shown that children from 'poor and near-poor households' have 'lower average in frontal and parietal lobe volumes of gray matter' (Hanson *et al.*, 2013; Kolb and Gibb, 2015) than children from well-off families.

Research suggests that poverty in early childhood may influence the development of hippocampal and amygdala connectivity in a way that will lead to negative mood symptoms during the latter part of childhood (Barch *et al.*, 2016). By focusing on the training of basic cognitive skills with the help of "functional magnetic resonance imaging (fMRI)" (Sousa, 2011) and other neuroscience derived techniques, studies have found the possible cognitive effects of poverty and stress on learning (Mani *et al.*, 2013).

The frontal lobes that are at the front of the brain and behind the forehead are the *prefrontal cortex* are collectively branded the “executive control center” of the brain. They deal with planning, thinking, solving problem, and regulating emotional system as well as paying attention (Sousa, 2011). Any distress to the frontal lobe can cause behavior and personality changes.

The temporal lobes deals with sound, music, face, and object recognition and some part of long-term memory as well as house the speech center. The occipital lobes are used mainly for visual processing, while the parietal lobes focus on spatial orientation, calculation and some types of recognition (Sousa, 2011). These areas are associated with the working memory, impulse regulation, visuospatial, language and cognitive conflict (Noble *et al.*, 2005). While the thalamus controls all incoming sensory information (except smell) and directs them to the brain, the hypothalamus monitors the internal systems to maintain the body balance. It is, therefore, harmful if the body system slips out of balance, as “the individual” cannot “concentrate on cognitive processing of curriculum materials” (Sousa, 2011).

The hippocampus is central to learning, memory, and stress response, while the amygdala processes emotional (especially fear) and social information (Sousa, 2011). And the gray matter is said to be one of the two major tissues in the brain (the other is white matter) that is processing information and executing actions.

The social and economic condition in which a child is raised affects his or her learning potential. Studies have observed that those living in poverty may suffer from depression or chronic stress more than those in higher socioeconomic class (SES) (Almeida *et al.*, 2005). Thus ‘nurture and not nature’ is said to play an important role in brain development and cognitive function of children living in poverty (Hair *et al.*, 2015). Next section will focus on the implications on children’s learning process.

#### 1.4. Implications for Learning

This paper also seeks to understand whether the effect of poverty on brain development can hamper the academic performance of children. For Woolfolk (2014) “extreme deprivation can have negative effect on brain development” and individual’s ability to learn (p.38). Hair *et al.* (2015) has warned that the longer children are exposed to poverty, the more “their academic deficits” (p.827). Thus any forces that have adverse impact on physical development of the brain and the cognitive development will lead to “changes in thinking, reasoning, and decision making” (Woolfolk, 2014) with possible adverse implications on children’s learning.

Trauma to the focal brain areas that include the frontal lobe (the brain region that is mainly central to the control of attention, inhibition, emotion regulation, and complex learning) is likely to impair learning (Sousa, 2011; Woolfolk, 2014). A student may not learn effectively without the ability to pay attention in class and control his or her emotion. Thus there is an undeniable connection between the brain and classroom learning in the domain of emotion and stress (Woolfolk, 2014).

The temporal lobe that controls memory and language comprehension, such as recognizing words, connecting sounds with letters of the alphabet, and attaching meaning to words, is critical to learning. Students cannot learn effectively without the capability of processing information and attaching meaning to words heard in the classroom (Sousa, 2011). The hippocampus, which is a brain structure that plays a central function in processing spatial information and connected to long-term memory functioning is critical to learning, because it is “essential to the creation of meaning” (Sousa, 2011). Anything that disrupts this process impairs learning as material learned in class will be difficult to be recalled for such children (Sousa, 2011).

The thalamus controls all incoming sensory information (except smell) and directs them to the brain, while the hypothalamus monitors the internal systems to maintain the body balance. Learning will be impaired if the body system glides out of balance as “the individual” affected cannot “concentrate on cognitive processing of curriculum materials” (Sousa, 2011).

The hippocampus is central to learning, memory, and stress response, while amygdala processes emotional (especially fear) and social information or how individuals interact with the environment (Sousa, 2011; Barch *et al.*, 2016). The cortex is said to be more susceptible to environmental influences than other areas of the brain (Gluck *et al.*, 2008; Schacter *et al.*, 2009; Woolfolk, 2014). It is, therefore, logical to argue that deficit in the observed processes may considerably affect children’s learning, educational and professional success in future.

There are some relationships between socioeconomic status (SES) and learning or academic achievement. Children living in poverty have myriads of social and academic problems, including stress or chronic stress and negative peer influences (O’Connor, 1997). As noted earlier, this group of children may suffer from depression more than their peers in higher SES (Almeida *et al.*, 2005). The longer a child lives in poverty, the greater the level of its impact on his or her academic achievement (Woolfolk, 2014).

Their social and economic conditions notwithstanding, some children living in poverty are high academic achievers (O’Connor, 1997). Living in poverty can give some children the intrinsic motivation or “mindset” Dweck (2006) to work harder to succeed and thus escape poverty. Poor children with “growth-mindset” (Dweck, 2006); Dweck (2006) can perceive themselves as “works-in-process” (Dweck, 2007) as they believe that their situation is not “fixed”- that it is malleable and can be developed through “hard work.” For them challenges can be morale boosters and not intimidating as they believe that they can improve their conditions by putting more efforts in whatever they are doing. Finally, next segment will discuss how teachers could apply their knowledge of this topic to the classroom.

#### 1.5. Teachers and Application to the Classroom

Teachers are major players in the learning process as they have always endeavored “to change the human brain everyday” (Sousa, 2011) and how it learns. They enter the classroom everyday armed with their lesson plans, in-depth knowledge of the content, and experience with the hope that they will change the mind-set of their students’ and thus help them to understand and remember what they will teach. Teachers apply their knowledge in the

classroom to ameliorate the challenges of learning created by the impact of poverty on children's brain development (Sousa, 2011).

To help children living or affected by poverty, teachers should first understand the nature of their problems through brain-based evaluation or assessment. Knowing the issues facing them will determine the intervention strategies a teacher should adopt (Woolfolk, 2014). Since classrooms are today populated by children with varied background and learning style, teachers should adopt multiple instructional approaches or strategies to meet their learning needs and improve their educational outcomes (Burden and Byrd, 2010; Sousa, 2011; Woolfolk, 2014). The ability of learners, especially those with learning difficulties to retain information, differs with teaching methods applied by the teacher and the learning environment (Sylvester, 2003).

In addition, since children exposed to toxic environment are prone to stress, emotion, and anxiety that impede learning, it is important for their classrooms to become 'as stress-free as possible' (Sousa, 2011) If students are not feeling safe, and if they are anxious, they are unlikely to focus in classroom activities or learning (Sylvester, 2003; Woolfolk, 2014).

For Sousa (2011) "learning occurs more easily in environments free from threat or intimidation...whenever a student detects a threat, thoughtful processing gives way to emotion or survival reactions"(p.66). Teachers should also attract the students' attention by giving them interesting and challenging assignments they can apply in the real world. Without that teaching and learning will suffer. As Sousa (2011) has observed, "people will participate in learning activities that have yielded success for them and avoid those that have produced failure" (p.58).

Additionally, teachers should develop a democratic classroom climate where students are treated as equals and allowed to express their opinion without unnecessary interruption during class discussion. In such an environment that is motivating, students will "develop trust in the teacher; exhibit more positive behaviors; are less likely to be disruptive; show greater support for school policy; and sense that thinking is encouraged and nurtured" (Sousa, 2011).

Family and community support are important for children in living poverty. Families living in poverty should work with schools in their efforts to educate their children. But for this cooperative venture to be successful, schools must respect the culture of the families and what they stand for (Burden and Byrd, 2010). Lev Vygotsky's social perspective theory of learning emphasized the importance of social interaction and cultural tools (Woolfolk, 2014). Positive outcomes are produced when parents and schools are working together (Burden and Byrd, 2010).

## 2. Conclusion

This paper has provided a brief overview of how poverty affects brain development in children, the areas of the brain affected, and implications on learning abilities. It has noted that poverty has destructive impact on children's basic brain development, learning, and academic performance. The paper also noted that neuroscience has added much more information as to what is known about how poverty affects the brain, how students living in poverty learn, and how the brain functions. Furthermore it has noted that some of the parts of the brain affected by prolonged experience with poverty include those associated with the working memory, impulse regulation, visuospatial, language and cognitive conflict (Noble *et al.*, 2005). In addition, it emphasized that prolonged exposure to poverty and pollutants could cause chronic stress and poor cognitive skills as well as impaired emotional-social relationships with their peers, distraction, and poor retention of information from lessons in class (Noble *et al.*, 2005).

In conclusion, the major argument in this paper is that when teachers have proper understanding of the basic fact about the brain, how it grows and develops as well as the functions of different sections of the brain affected by poverty, and implications on the learning abilities of school children will enable us to appreciate why students and others behave differently in certain situations (Sousa, 2011). That will give teachers, teachers' educators, and policymakers the practical tools to design and implement strategies to resolve the socio-economic and educational challenges facing school-aged children living in poverty today.

## References

- Almeida, D.M., S.D. Neupert, S.R. Banks and J. Serido, 2005. Do daily stress processes account for socioeconomic health disparities? *Journals of Gerontology Series B-Psychological Sciences and Social Sciences*, 60(2): S34-S39. [View at Google Scholar](#) | [View at Publisher](#)
- Barch, D., D. Pagliaccio, A. Belden, M.P. Harms, M. Gaffrey, C.M. Sylvester, R. Tillman and J. Luby, 2016. Effect of hippocampal and amygdala connectivity on the relationship between preschool poverty and school-age depression. *American Journal of Psychiatry*, 173(6): 625-634. [View at Google Scholar](#) | [View at Publisher](#)
- Burden, P.R. and D.M. Byrd, 2010. *Methods for effective teaching: Meeting the needs of all students*. 5th Edn., San Francisco, CA: Allyn & Bacon.
- Casey, B.J., J.N. Giedd and K.M. Thomas, 2000. Structural and functional brain development and its relation to cognitive development. *Biological Psychology*, 54(1): 241-257. [View at Google Scholar](#) | [View at Publisher](#)
- Dweck, C.S., 2006. *Mindset: The new psychology of success*. New York: Ballantine Books.
- Dweck, C.S., 2007. The secret to raising smart kids. *Scientific American Mind*: 1-6. Available from <https://www.scientificamerican.com/magazine/mind/2007/12-01/> [Accessed April 7, 2017].
- Gluck, M.A., E. Mercado and C.E. Myers, 2008. *Learning and memory: From brain to behavior*. New York: Worth.
- Hackman, D.A., M.J. Farah and M.J. Meaney, 2010. Socioeconomic status and the brain: Mechanistic insights from human and animal research. *Nature Reviews Neuroscience*, 11(9): 651-659. [View at Google Scholar](#)
- Hair, N.L., J.L. Hanson, B.L. Wolfe and S.D. Pollak, 2015. Association of child poverty, brain development and academic achievement. *JAMA Pediatrics*, 169(9): 822-829. [View at Google Scholar](#) | [View at Publisher](#)
- Hanson, J.L., N. Hair, D.G. Shen, F. Shi, J.H. Gilmore, B.L. Wolfe and S.D. Pollak, 2013. Family poverty affects the rate of human infant brain growth. *PLoS One*, 8(12): 1-9. [View at Google Scholar](#)
- Investopedia, n.d. Poverty @. Available from [www.investopedia.com/terms/p/poverty.asp](http://www.investopedia.com/terms/p/poverty.asp) [Accessed February 18, 2017].
- Kishiyama, M.M., W.T. Boyce, A.M. Jimenez, L.M. Perry and R.T. Knight, 2009. Socioeconomic disparities affect prefrontal function in children. *Journal of Cognitive Neuroscience*, 21(6): 1106-1115. [View at Google Scholar](#) | [View at Publisher](#)
- Kolb, B. and R. Gibb, 2015. Childhood poverty and brain development. *Human Development*, 58(4-5): 215-217. [View at Google Scholar](#) | [View at Publisher](#)
- Lipina, S.J. and J.A. Colombo, 2009. *Poverty and brain development during childhood: An approach from cognitive psychology and neuroscience*. Washington, DC: American Psychological Association. Retrieved from <http://psycnet.apa.org/books/11879>. [Accessed April 7, 2017].

- Lupien, S.J., B.S. McEwen, M.R. Gunnar and C. Heim, 2009. Effects of stress throughout the lifespan on the brain, behavior and cognition. *Nature Reviews Neuroscience*, 10(6): 434-445. [View at Google Scholar](#)
- Mani, A., S. Mullainathan, E. Shafir and J. Zhao, 2013. Poverty impedes cognitive function. *Science*, 341(6149): 976-980. [View at Google Scholar](#) / [View at Publisher](#)
- Noble, K.G., M.F. Norman and M.J. Farah, 2005. Neurocognitive correlates of socioeconomic status in kindergarten children. *Developmental Science*, 8(1): 74-87. [View at Google Scholar](#) / [View at Publisher](#)
- Noble, K.G., M.E. Wolmetz, L.G. Ochs, M.J. Farah and B.D. McCandliss, 2006. Brain-behavior relationships in reading acquisition are modulated by socioeconomic factors. *Developmental Science*, 9(6): 642-654. [View at Google Scholar](#) / [View at Publisher](#)
- O'Connor, C., 1997. Dispositions toward (Collective) struggle and educational resilience in the inner city: A case analysis of six African American high school students. *American Educational Research Journal*, 34(4): 593-629. [View at Google Scholar](#) / [View at Publisher](#)
- Schacter, D.L., D.T. Gilbert and D.M. Wenger, 2009. *Psychology*. New York: Worth.
- Sousa, D.A., 2011. *How the brain learns*. 4th Edn., Thousand Oaks, CA: Corwin.
- Sylvester, R., 2003. *A biological brain in a cultural classroom*. 2nd Edn., Thousand Oaks, CA: Sage.
- Woolfolk, A., 2014. *Educational psychology: Active learning edition*. 12th Edn., San Francisco, CA: Pearson Education, Inc.

### **Author's Biography**

Victor E. Dike, EdD, is the Founder and CEO of the Center for Social Justice and Human Development (CSJHDEV), an NGO in Sacramento, California that provides educational and skills training services to the underserved groups in the area. A professional educator, he has more than 20 years of experience in education, ranging from high school/adult education to the university level. Victor Dike was formerly an adjunct professor, School of Engineering, Technology and Media, National University (Sacramento Campus), California. He holds a doctorate in Educational Leadership and Management (with concentration in Human Resource Development) from Drexel University, Philadelphia, Pennsylvania (2013). A prolific writer, he is the author of several books and has contributed chapters to other books. His books include *Leadership, Democracy, and the Nigerian Economy: Lessons from the Past and Directions for the Future* (Second Edition), North Charleston, SC: CreateSpace Independent Publication (2016, November 25), *Leadership and Governance: Implication on the Nigerian Economy*. North Charleston, SC: CreateSpace Independent Publication (co-authored with Dr. Meshack Okpala and Dr. Agatha Ekeh, January 10, 2014); *Leadership without a Moral Purpose*, BookSurge Publications (2009); and *Democracy and Political Life in Nigeria* (2nd edition), iUniverse, Inc. (2006). Dike has also written numerous peer-review articles including, "Human capital development, technological capabilities and national development: The Nigerian Experience," *African Journal of Science, Technology, Innovation & Development*, 2012, 4(2), 11-28; "Planned intervention and organizational development: the role of leadership in Change Initiatives. *African Journal of Science, Technology, Innovation and Development*, 2014: 1-6; "Leadership and the Nigerian Economy". *SAGE Open*, March 2, 2014, (4), 1-10; and "Why Nations Fail" To Develop: The Case Of Nigeria.' *SAGE Open*, October 28, 2015, 5(4), 1-12.