Worldview and Academic Self-Concept (ASC) as Predictors of Biology Achievement among Nigerian Senior Secondary School Students

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Abstract

In this study, a global predictor variable, worldview, and a specific predictor variable, Academic Self-Concept (ASC), were investigated for their predictive powers on achievement in biology. Participants were final year secondary school students ($N=530$, age = 16- to18- year-olds) from Nigeria. Data for the study came from two instruments, the Academic Self-Concept Scale (ASCS) and the Belief Systems Analysis Scale (BSAS) as well as from the final Senior Secondary Certificate Examination. Results from the analysis of data using spearman rho correlation and regression analysis suggest that worldview is a better predictor than ASC, violating the specificity matching principle. It was also found that ASC was negatively correlated to worldview and mediated between worldview and achievement. Chance evidence from the study also reveals this cohort of students to believe in the intervention of a deity (God) in nature. Science education cannot, therefore, neglect the worldview of students if a major breakthrough is to be recorded in its research and provisions for the minority groups.

Keywords: worldview, academic self-concept, biology achievement, specificity

matching What Inhibits Science Learning?

What really inhibits science learning? Put in another way what are the comparative powers of conceptual paradigms, socio-cultural paradigms and psychosocial paradigms in accessing science knowledge? These are the ultimate questions science education efforts always inadvertently try to answer. Educators therefore, continuously seek for variables to manipulate in order to enhance learning. It does appear that for different cultures the variables to be thus manipulated would differ. The Trends in International Mathematics and Science Study (TIMSS) 1995-2007 reveal that African countries continuously rank low in mathematics and science achievement. The results of the TIMSS 2007 study further reveal that blacks are disadvantaged in accessing mathematics and science knowledge even in USA (Gonzales, Williams, Jocelyn, Roey, Kastberg & Brenwald, 2008). It is interesting to note that on the contrary, the Asian countries and culture do well in their native countries or as a sub-culture within the USA. What then can we attribute these trends to? Can the patterns be sufficiently understood to direct science education provisions? From this general perspective we consider the comparative roles of one psychosocial paradigm (academic self concept) and a socio-cultural paradigm (worldview) in accessing science knowledge.

Worldview

Worldview refers to the totality of presuppositions developed by an individual that organise and direct knowledge and beliefs (Mbajiorgu, 2003). These originate from the culture of a group of people as a result of their unique world experiences over several millennia. In science education we restrict these basic assumptions or presuppositions "to the amalgam of experiences and explanations of phenomena developed from birth" (Mbajiorgu, 2003, p. 147). Kreitzer (2010) conceives worldview to be the fundamental cognitive, affective and evaluative presuppositions a group of people possess about natural phenomena and which they use to order their lives. Kearney (1975) one of the pioneers of worldview study identified six broad universal categories of worldview to include, Relationships, Causality, Time

and Space, Classification, Self and Other. Worldview scholars recognize that different cultures may possess different sets of presuppositions about these worldview categories.

There is a clear distinction between the afrocentric worldview and the eurocentric worldview (Carroll, 2010; Obasi, Flores & James-Myers, 2009). The hallmark of the afrocentric worldview is captured by Neblett, Hammond, Seaton and Townsend (2010, p. 107) and include:

> *spirituality* (belief in a being or force greater than oneself); *collectivism* (emphasis on cooperation); *time orientation* (equal importance attributed to past, present, and future and time flexibility); *orality* (preference for receiving stimuli and information orally); *sensitivity to affect and emotional cues* (acknowledgment of others' emotional and affective states); *verve and rhythm* (rhythmic and creative behavior); and *balance and harmony with nature* (balance between one's mental, physical, and spiritual states).

Many researchers in science education argue strongly in favour of worldview (for example, Cobern 1996) in non-western science education as deterministic in science learning. They contend that alternative conceptions are difficult to relinquish because they are supported by the students' assumptions and presuppositions regarding natural phenomena (Vosniadu, Ioannides, Dimitrakopoulou, & Papademetriou, 2001). These assumptions and presuppositions have helped the students in the development of explanatory frameworks that have proved powerful over a long period of time and in a wide range of circumstances (Cobern, 1996). As Deniz, Donnelly and Yilmaz (2008, p. 428) put it, "endorsing a construct such as acceptance of evolution, which does not have much leverage within the social and cultural milieu, requires major changes in people's worldview". Deniz et al. (2008) in their study found only thinking disposition (that embodied belief systems) to have correlated significantly with acceptance of evolution at 0.01 level of significance.

The importance of worldview has been demonstrated by Mbajiorgu, Ezechi and Idoko (2007). Understanding the place of this variable in learning in non-western cultures is very vital because Cokley et al. (2003), Ewing, Richardson, James-Myers, and Russell (1996), and Montgomery, Fine and James-Myers (1990) have also demonstrated that there are important ethnic differences between students of African origin and others. Montgomery et al. (1990) assert that the afrocentric worldview is clearly exhibited by individuals with African background. Mbajiorgu (1999), Mbajiorgu and Anolue (2000), Mbajiorgu and Iloputaife (2001) and Mbajiorgu et al. (2007) have proven beyond doubt that the afrocentric worldview exists among students of Igbo origin in Nigeria. This they found influences these students' conceptions of science and the scientist, as well as their achievement in science and use of science knowledge. The question is what is the contribution of this variable relative to the specific predictor variable, academic self-concept to science achievement?

Academic Self-Concept and Achievement

The self, which is a worldview category is the perception of an individual about himself/herself. This is cognitive in nature and "generally refers to the totality of a complex, organized, and dynamic system of learned beliefs, attitudes and opinions that each person holds to be true about his or her personal existence" (Yahaya, 2012: 2). Hau (2009) believes that self-concept of school age children is one of the most important variables determining their academic achievement and social development. Positive self-concept is necessary because it enhances the development of some psychological and outcome variables. Educators have been particularly interested in how students construe the self as this has some causal effect on criterion or outcome variables such as motivation, interest, academic performance/achievement and anxiety (Ferla, Valcke, Cai, 2009; Swann Jr., Chang-Schneider, & McClarty, 2007).

A number of researchers believe that there are cultural differences in the construction of the Self especially, between cultures with individualistic and collectivistic ideologies (Carroll, 2010; Hau, 2009; Obasi, Flores & James-Myers, 2009). Chiu and Klassen (2009) for instance, stated that self-concept

operates differently across cultures. In other words, members of a culture including children can hold coherent views about the Self. This in turn will determine how they interpret the Self in contexts such as the school. The Self can be sub-divided into academic and non-academic components.

Academic self-concept is the individual's perception of his/her ability in academic achievement situations developed from their experiences with and interpretation of the school environment, both physical and psychosocial (Ferla, Valcke & Cai, 2009; Guay, Larose & Boivin, 2004). This is a multidimensional construct developed based on beliefs formed from social comparative information as well as from reflection on what the individual has done or can do in comparison to their expectations and the expectations of others about their academic abilities. This has been found to correlate highly with academic achievement (Green, Nelson, Martin & Marsh, 2006; Guay, Larose & Boivin, 2004; Lyon, 1993; Marsh & Craven, 2006; Marsh & Koller, 2004; Yun, Farran, Lipsey & Bilbrey, 2010).

The causal ordering of ASC and achievement has been the focus of studies since the 1970s. Three models have been identified in this regard, the skill development model and the self-enhancement models, which contrast one another and the compromise reciprocal effect model. It has been demonstrated that ASC and achievement have reciprocal effect on each other (Green, Nelson, Martin & Marsh, 2006; Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005). A high ASC suggests a high achievement and the reverse is also true, that is, a high achievement also suggests a high ASC. In non- western cultures this may be confounded. This is because an individual from a collectivist culture may be humble as well as be more socially oriented "leading them to hold a less favorable self-concept than their achievement level would predict" (Hau, 2009: 1). A higher achievement, on the other hand, does not necessarily mean a better scientific worldview. This is because an individual may compartmentalize his cognitive structure such that he is a good science student in the classroom yet holding onto a non-scientific worldview (Aikenhead & Jegede, 1999). A high afrocentric worldview or non-scientific worldview would suggest a poorer achievement and a less favourable ASC. Since the Self is a component of worldview, it is expected that they should be related in some way. This study, therefore, seeks to determine if worldview and ASC are related and their individual and combined effect on achievement. It will also determine their relative contributions to achievement. Finally, we will be considering if the criterion-predictor relationship of specificity matching is upheld.

Purpose

In this study, two related variables, worldview and academic self- concept have been selected for study. The predictor-criterion relationship i.e. specificity matching would predict academic self-concept to have a more predictive power in the determination of academic achievement—in this case biology achievement—than would the global predictor variable, worldview. Again students with higher afrocentric worldview would be expected to have higher collectivist orientation which might lead them to be more humble and more socially oriented. This would in turn be expected to lead to less favourable academic self-concepts but not necessarily poor achievement in biology. We, therefore, predict a negative relationship between an afrocentric worldview and achievement, as well as between an afrocentric worldview and ASC. We also predict a positive relationship between ASC and achievement. This may, however, not be substantial given the culture of the present cohort of students.

Methods

Context of the Study

The study was carried out in Nigeria. Nigeria is the most populous black nation in Africa and gained her independence from the British colonial masters in 1960. The citizens are deeply religious and almost invariably believe in the existence of deities. Indigenous science education began with a curriculum conference in 1969. This resulted in the initial science curriculum that has undergone several revisions. Presently the school system is divided into three levels, the basic education (comprising of 6 years of primary school and 3 years of junior secondary school); 3years of senior secondary education and

the higher education level. The senior secondary school, the level at which this study is pitched, has separate curricula for biology, chemistry and physics.

Nigeria last participated in international science evaluation in 1984. The report stated that there was a general consistency in all countries concerning the content of science taught across 12 years of schooling in the fields of biology, chemistry, and physics, but not in earth science (International Association for the Evaluation of Educational Achievement [IEA], 2008). Nigeria was found to have one of the poorest mean scores in biology despite the higher mean age and grade level of the Nigerian students as compared to their counterparts in the study (Postlethwaite, 1991). This is in line with our earlier claim that African countries/cultures perform, rather, poorly when compared to other countries.

Participants and Knowledge Content

Final year secondary school students (*N=560,* age = 16- to18- year-olds) drawn randomly from 29 secondary schools in Enugu, an urban city in South Eastern Nigeria, participated in the study. The students were in their final year of secondary school and had done biology for nearly three years. A final examination (Senior Secondary Certificate Examination, SSCE) is usually given at the end of the three years of senior secondary school. The continuous assessments and end of term examinations serve to prepare the children for this final examination. Most of the children come from the same ethnic group, the Igbo ethnic group and share the same cultural experiences. The two instruments used in this study were administered to these students during their final year. Their SSCE biology result was obtained a year later, that is, after their graduation from their respective schools.

Instrumentation

Two instruments were used to collect data. These include the Academic Self-Concept Scale (ASCS) and the Belief Systems Analysis Scale (BSAS).

Academic self-concept scale (ASCS). The ASCS was developed by Reynolds, Ramirez, Magrina and Allen (1980) and further validated by Reynolds (1988). This instrument has been widely used and assesses how positively one views his/her academic ability. This is a 40-item four point rating scale ranging from strongly disagree (1) to strongly agree (4). Those with high academic self-concept have high rating on the scale.

Belief systems analysis scale (BSAS). This was developed by Montgomery and Myers (1999) using college students of African origin. The BSAS seeks to assess the optimal Afrocentric worldview. It is again a 40 -item rating scale with the following response options: completely agree (5), mostly agree (4), undecided (3) mostly disagree (2) and completely disagree (1). A high score indicated a more afro-centric worldview.

To adapt the instruments, they were given out to an expert in Measurement and Evaluation, a lecturer in Psychology, and three lecturers from Science Education for a face validation. They were to check if they were adequate for collecting data from the participants and to check for any items that would discriminate against the culture of the participants. A number of items were restructured after this to arrive at the final instruments. Any reference to knowledge content was anchored in biology. Subsequently, the instruments were administered to 20 students (average age = 18 years) from a secondary school in the same city not used in the investigation. A reliability analysis using the Cronbach alpha model was done. For ASCS a coefficient of .81 was obtained. The Item Total Statistics showed that the weakest item if deleted only raises the overall coefficient to .83. For BSAS a coefficient of .68 was obtained. Again if the item that was weakest was deleted, a coefficient of .71 was obtained. This indicated high internal consistencies and that the instruments could be used in Nigeria.

Data Types, Sources and Analyses

The two instruments yielded ordinal data. The students were required to check (✓) the response option they agree with. The lowest a participant could score on the two instruments was 40. The highest score obtainable from ASCS was 160 while that of BSAS was 200. A third source of data was the final biology examination students sat for, the Senior Secondary Certificate Examination (SSCE). This yielded interval data. The grades came as reversed stanine scores. These were converted to t-scores before being used for the analysis. The scores obtained from the participants ranged from F9 (28.60) to A1 (89.50).

Before using the data obtained, all negative statements in the instruments were scored in reverse order. An initial correlation was done using the scores obtained from the two instruments and the SSCE. We took these to be independent factors. We also carried out a regression analysis to determine the predictive powers of worldview and ASC over academic achievement.

Results and Discussion

The range of 60.90 for achievement in biology, 123 for worldview and 105 for academic self-concept, indicate adequate variability in the scores and therefore, warranted further analysis (see Table 1 for the descriptives).

Table 1 Descriptions of Achievement in biology, worldview and Academic Self-Concept

Variable	N	Range	Minimum	Maximum	Mean	Std. Deviation
achievement	530	60.90	28.60	89.50	50.0647	10.03673
worldview	530	123.00	64.00	187.00	125.6693	17.97831
academic self concept	530	105.00	46.00	151.00	119.7911	16.08742

In line with our prediction, there was a negative correlation between the afro-centric worldview and achievement (-0.364); and the afro-centric worldview and ASC (-0.231). The effect sizes were substantial and significant at the 0.05 level of significance although not very high. There was a weak positive correlation between ASC and achievement (0.097) in line with our predictions (see Table 2). The effect size here is not as high as those reported by many researchers such as Green, Nelson, Martin and Marsh, 2006; Guay, Larose and Boivin, 2004; Lyon, 1993; Marsh and Craven, 2006; Marsh and Koller, 2004; Yun, Farran, Lipsey & Bilbrey, 2010).

These associations may not be interpreted as indicating that afro-centric views are responsible for poor academic functioning as Marsh et al. (2005) have demonstrated that there is reciprocal effects in the causal path between ASC and achievement—ASC affecting achievement which in turn affects ASC and vice versa. It will be axiomatic to adduce the same causal pathway to worldview and achievement.

The question that begs an answer from the above is: what is the causal ordering between worldview, ASC and achievement? Exploring the causal ordering between these three will have a significant influence on science education provisions to students from non-western as well as minority cultures. Since no studies known to the researchers have looked at worldview and academic self-concept, this could be taken as an

exploratory study while further studies could use more sophisticated designs such as repeated measures at two or more time points to determine the causal ordering in order to identify areas of emphasis in provisions at different points of a child's school life.

Table 2 Intercorrelation Matrix between Worldview, Academic Self-Concept and Achievement in Biology

Variable	1	2	3
1. Achievement	1.00		
2. Worldview	-0.364**	1.00	
3. Academic Self-Concept	0.097	-0.231**	1.00

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

A further test with the multiple regression model reveals the contributions each variable made to biology achievement. Together, the afro-centric worldview and ASC contributed only 10.8% of the variance in the biology achievement. However, a careful look at the result (Table 3) shows that worldview acting alone contributed 11.5% of the variance whereas ASC contributed only 1%. It does appear that the combined effect of worldview and ASC was lower than that of worldview alone. The standardized beta values show that achievement in biology decreases by 0.332 and increases by 0.037 when worldview or ASC increases by one standard deviation respectively. The levels of significance for the F and t values suggest the beta value of the afro- centric worldview is significantly lower than zero whereas the beta value for ASC is not significantly higher than zero. The specificity matching principle was therefore, violated.

Table 3 Multiple Regression of Worldview and ASC on Achievement in Biology

Variable	R^2	Adjusted R^2	F	df	Sig.(F)	β	t	Sig.(t)
Worldview	.115	.111	25.935	1	.000	-.332	-4.875	.000
ASC	.011	.006	2.127	1	.146	.037	.540	.589
Worldview * ASC	.117	.108	13.067	2		.000		

The result of this study adds to the increasing amount of evidence that suggest worldview may be a very important factor in science achievement especially in non- western cultures (Cobern, 1996; Deniz, Donnelly & Yilmaz 2008). However, it is obvious that the effect of the global variable worldview on achievement is mediated by the more specific variable, ASC. Both variables are multidimensional in nature (Green et al. 2006; Guay, 2004) and play vital roles in organizing and directing reality. They influence the choices people make, and the efforts they are willing to expend; they also determine the level of anxiety or confidence people bring to any task, as well as how long they are willing to remain on a given task.

The violation of the specificity matching principle may be explained from the cognitive perspective. ASC does not alter the capabilities of the individual, it only determines what the individual does with his/her knowledge and skills. Worldview on the other hand, operates at the level of an individual's knowledge structures. Take for instance, many people with high afro-centric worldview believe in the presence of deities that directly interfere with natural phenomena (Mbajiorgu, 1999, 2000; Mbajiorgu & Anolue, 2000; Mbajiorgu et al., 2007). In this study we isolated four (4) items (items 1, 7,

13, and 39) that deal directly with God's role in nature and found the same evidence to be repeated (Fig. 1).
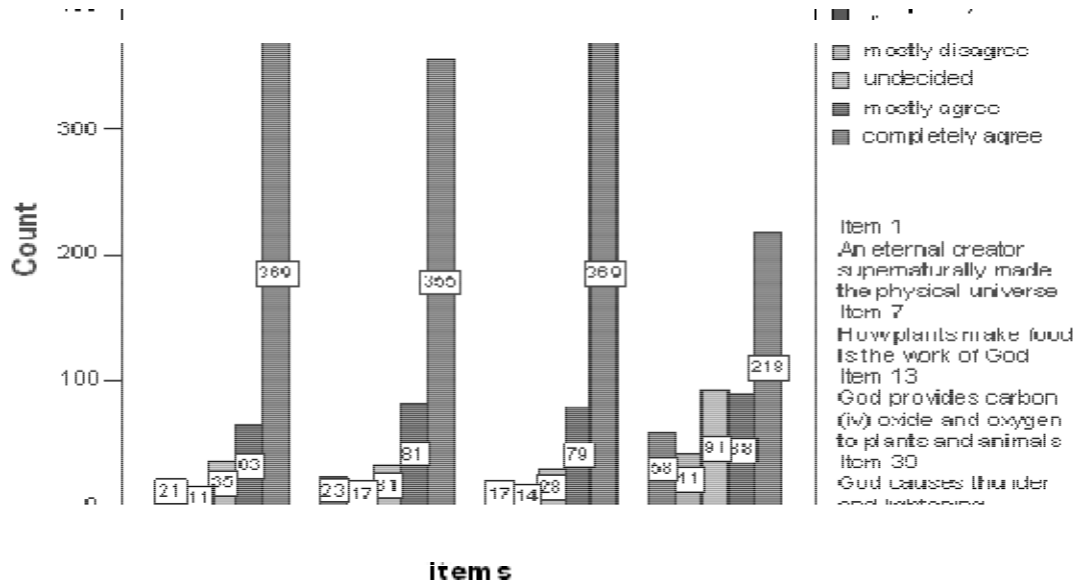
The student responses to items 1,7, 13, and 19 as depicted in Fig. 1 were revealing and have the potential to interfere with the use of evidence to make critical lifetime decisions—their knowledge structures include science schemata and contrasting schemata to science. Strict advocates of intelligent design and/or creationism are likely to respond in the same manner that has a leaning towards the same direction as the responses of the research sample.

It is believed (Deniz et al. 2008; Johnston & Southerland, 2000; Mbajiorgu, Ezechi & Idoko, 2007; Vosniadu et al. 2001) that students' presuppositions are entrenched and tenacious but direct individual ideas or conceptions (alternative conceptions) which in most cases are not coherent. Therefore, whereas the interpretation of individual phenomenon varies with context, it can be constrained by one or more entrenched worldview presuppositions (Vosniadu et al. 2001). In other words, whereas the presuppositions about the Self are theory-like, the explanation of individual phenomena are ad hoc and incoherent (Reynolds, 1988) albeit constrained by the theory-like worldview presuppositions. Take for instance, the presupposition of the presence of deities in nature by students from the Igbo tribe of South Eastern Nigeria has been found to influence their use of science knowledge (Mbajiorgu 2000), their views about the scientist (Mbajiorgu, 1999 and Mbajiorgu & Iloputaife, 2001), their views about the epistemology of science (Mbajiorgu & Anolue, 2000), as well as interpretation of genetic phenomena (Mbajiorgu, Ezechi & Idoko, 2007). This then forms a 'block' and impedes development of correct scientific schemata and therefore, achievement in science.

The theory of Vosniadu et al. (2001) is parsimonious in the explanation of difficulty in understanding as well as level of use of scientific conceptions. The studies done by Mbajiorgu and colleagues clearly corroborate this fact. In the 2000 study, she found that whereas students clearly understood the genetic concepts they were taught, they resorted to spiritist measures in proffering solution to genetic problems. Mbajiorgu and Anolue (2000) also demonstrated the place of culture and worldview by comparing a cohort of Nigerian students to an equivalent cohort from the study of Ryan and Aikenhead (1992). This paper, therefore, adds to the literature on the place of worldview in students' conceptions. If we believe that meaningful learning must lead to use of concepts in everyday life then bringing about learning must involve identifying the worldview presuppositions held by a community of students and challenging or reconciling these with scientific assumptions in order to enhance achievement. These presuppositions need not be more than one or two for each broad worldview category of Relationship, Classification, Time and Space, Causality, Self and Other.

Conclusion and Implications

The implication is that to handle alternative conceptions and enhance achievement, the worldview presuppositions must be identified and addressed. Before now, science education researchers (e.g. Cahyadi & Butler, 2004; Driver, Guesne & Tiberghien, 1985; Hokayem & BouJaoude, 2008; Taber, 2000
& 2001) have focused on identifying and challenging individual alternative conceptions. They have also found them difficult to relinquish. This is because to the extent the presuppositions that underpin them are revised or reconciled to science to that extent can these alternative conceptions change. This indicates, as in this study, worldview ranks very high in comparison to ASC and perhaps other factors such as motivation, in their effect on science achievement. Science education cannot, therefore, neglect the worldview of students if a major breakthrough is to be recorded in its research and provisions for the minority groups. This phenomenon may be better understood if societies like the USA can be studied since it provides opportunity to study and compare different cultures.

References

Aikenhead, G. S., & Jegede, O. J. (1999). Cross -cultural science education: a cognitive explanation of a cultural phenomenon. *Journal of Research in Science Teaching, 36*(3), 269-287.

Cahyadi, M. V. & Butler, P. H. (2004). Undergraduate students' understanding of falling bodies in idealized and real-world situations. *Journal of Research in Science Teaching*, *41*(6), 569-583.

Carroll, K. K. (2010). A genealogical analysis of the worldview framework in African-centered psychology. *The Journal of Pan African Studies*, *3*(8), 109-134.

Chiu, M. M., & Klassen, R. M. (2009). Relations of mathematics self-concept and its calibration with mathematics achievement: cultural differences among fifteen-year-olds in 34 countries. *Learning and* Instruction, doi:10.1016/j.learninstruc.2008.11.002.

Cobern, W. W. (1996). Worldview theory and conceptual change in science education. Science Education, *80*(5), 579-610.

Cokley, K., Komarraju, M., King, A., Cunningham, D. & Muhammad, G. (2003). Ethnic differences in the measurement of academic self-concept in a sample of African American and European American college students. *Educational and Psychological Measurement*, *63*(4), 707-722

Deniz, H., Donnelly, L. A. & Yilmaz (2008). Exploring the Factors Related to Acceptance of Evolutionary Theory Among Turkish Preservice Biology Teachers: Toward a More Informative Conceptual Ecology for Biological Evolution. *Journal of Research in Science Teaching*, *45*(4), 420–443.

Driver, R., Guesne, E. & Tiberghien, A. (1985). Children's ideas and the learning of science. In R. Driver, E. Guesne, & A. Tiberghien, (Eds.) *Children's ideas in Science* (pp. 1-9). Milton Keynes: Open University Press.

Ewing, K. M., Richardson, T. Q., James -Myers, L. & Russell, R. K. (1996). The relationship between racial identity attitudes, worldview, and African American graduate students' experience of the imposter phenomenon. *Journal of Black Psychology*,*22*, 53-66.

Ferla, J., Valcke, M., & Cai, Y. (2009). Academic self-efficacy and academic self-concept: Reconsidering structural relationships. *Learning and Individual Differences, 19*, 499–505.

Gonzales, P., Williams, T., Jocelyn, L., Roey, S., Kastberg, D., & Brenwald, S. (2008). *Highlights from TIMSS 2007: Mathematics and Science Achievement of U.S. Fourth and Eight-Grade Students in an International Context*. (NCES 2009 – 001) National Centre for Education Statistics Institute of Education Sciences, U.S. Department of Education

Green, J., Nelson, G., Martin, A. J. & Marsh, H. (2006). The causal ordering of self-concept and academic motivation and its effect on academic achievement. *International Education Journal, 7*(4), 534 – 546.

Guay, F., Larose, S., & Boivin, M. (2004). Academic self -concept and educational attainment level: a ten-year longitudinal study. *Self and Identity*, *3*(1), 53 – 68.

Hau, T. K. (2009). Cultural universality and differences in Asian students' self-concept. Paper presented in the Fifth SELF Biennial International Conference, 2009, 1-10 pgs.

Hokayem, H. & BouJaoude, S. (2008). College Students' Perceptions of the Theory of Evolution. *Journal of Research in Science Teaching*, *45*(4), 395–419.

IEA, SISS (2008). The second international study. Retrieved from http://www.iea.nl/siss.html#c234, on 8th January, 2008.

Johnston, A. T., & Southerland, S. A. (2000). A reconsideration of science misconceptions using ontological categories. A paper presented at the annual meeting of the National Association for Research I Science Teaching, April, 2000, New Orleans, Louisiana. Retrieved from http://physics.weber.edu/johnston/research/

Kearney, M. (1975). Worldview theory and study. *Annual Reviews*, 4, 247-270.

Kreitzer, D. (2010). A Review: *Transforming* Worldviews: *An Anthropological Understanding of How People Change* by Paul G. Hiebert (2008). Grand Rapids: Baker Academic. Retrieved from www.globalmissiology.org Review & Preview January, 2010.

Lyon, M. A. (1993). Academic Self-Concept and its Relationship to Achievement in a Sample of Junior High School Students. *Educational and Psychological Measurement,* 53: 201-210.

Marsh, H. W. and Craven, R. G. (2006). Reciprocal Effects of Self-Concept and Performance From a Multidimensional Perspective: Beyond Seductive Pleasure and Unidimensional Perspectives. *Perspectives on Psychological Science,* 1: 133-163.

Marsh, H. W., Köller, O. (2004). Unification of theoretical models of academic self-concept/achievement relations: Reunification of east and west German school systems after the fall of the Berlin Wall. *Contemporary Educational Psychology*, 29,(3), 264-282.

Marsh, H. W., Trautwein, U., Lüdtke, O., Köller, O. and Baumert, J. (2005). Academic Self-Concept, interest, grades and standardized test scores: Reciprocal effects models of causal ordering. *Child Development*, 76(2), 397-416.

Mbajiorgu, N. M. (1999). Pre-Service Science Teachers Perception of the Scientist. *Journal of Studies in Education,* 6(3): 95-108.

Mbajiorgu, N. M. (2000). Worldview Presuppositions Underpinning Genetic Phenomena among Some Secondary School Students in Enugu State. *African Journal of Information Technology (AJIT)*, 6(2): 167 – 176.

Mbajiorgu, N. M. (2003). *Science the teachers' perspectives: An introduction to science education*. Enugu: Institute for Development Studies, University of Nigeria.

Mbajiorgu, N. M. and Anolue, R. E. (2000). Students' Preconception About the Epistemology of Science: A Comparison of Some Nigerian and Canadian Students. *Journal of the Southern African Association for Research in Mathematics, Technology and Science Education*, 4(1):57-69.

Mbajiorgu, N. M., Ezechi, N. G. and Idoko, C. E. (2007). Addressing Non-Scientific Presuppositions in Genetics Using a conceptual change strategy. *Science Education*, 91, 419-438.

Mbajiorgu, N. M. and Iloputaife, E. C. (2001). Combating Stereotypes of the Scientist among Pre-Service Science Teachers. *Research in Science and Technological Education,* 19(1): 55-67.

Montgomery, D. E., Fine, M. A. and James-Myers, L. (1990). The Development and Validation of an Instrument to Assess an Optimal Afrocentric Worldview. *Journal of Black Psychology*, 17(1), 37-54.

Neblett, E. W., Seaton, E. K., Hammond, W. P., and Townsend, T. G. (2010). Underlying mechanisms in the relationship between Africentric worldview and depressive symptoms. *Journal of Counseling Psychology*, 57(1), 105-113.

Obasi, E. M., Flores, L. Y., and James-Myers, L. (2009). Construction and initial validation of the Worldview Analysis Scale (WAS). *Journal of Black Studies,* 39(6), 937-961.

Postlethwaite, T. N. (1991). Achievement in science education in 1984 in 23 countries. In Husen, T and Keeves, J. P. (Eds.). *Issues in Science Education.* Oxford: Pergamon Press, 35-59.

Reynolds, W. M., Ramirez, M. P., Magrina, A., and Allen, J. E. (1980). Initial development and validation of the Academic Self-Concept Scale. *Educational and Psychological Measurement,* 40, 1013-1016.

Reynolds, W. M. (1988). Measurement of academic self-concept in college students. *Journal of Personality Assessment,* 52(2), 223-240.

Ryan, A. G. and Aikenhead, G. S. (1992). Students' preconception about the epistemology of science. *Science Education*, 76(6), 559-580.

Swann Jr., W. B., Chang-Schneider, C., and McClarty, K. L. (2007). Do peoples' self views matter?: Self-concept and self-esteem in everyday life. *American psychologist*, 62(2), 84 - 94.

Taber, K. S. (2000). Multiple frameworks?: Evidence of manifold conceptions in individual cognitive structure. *International Journal of Science Education*, 22(4), 399-417.

Taber, K. S. (2001). Shifting sands: a case study of conceptual development as competition between alternative conceptions. *International Journal of Science Education*, 23(7), 731-753.

Vosniadu, S., Ioannides, C., Dimitrakopoulou, A. and Papademetriou, E. (2001). Designing learning environments to promote conceptual change in science. *Learning and Instruction*, 11, 381-419.

Yahaya, A. B. (2012). Self-concept in educational psychology. Downloaded from http://eprints.utm.my/6152/1/aziziyahaselfconcept.pdf on 6th July, 2012.

Yun, C., Farran, D. C., Lipsey, M. W., and Bilbrey, C. (2010). Academic self-concept and achievement in young children. Paper presented at the 2010 AERA Annual Meeting. Held at the Convention Centre in Denver, Collorado, between the 29th of April and 4th of May, 2010.