USE OF FLIPPED CLASSROOM MODEL TO ENHANCE ENGAGEMENT AND PROMOTE ACTIVE LEARNING AMONG PRIMARY SCHOOL PUPILS IN ALGEBRA

Eugene Chukwuemeka Unamba
Department of Primary Education Studies,
Alvan Ikoku University of Education Owerri,
Imo State.

Dr Ngozi. J. Izuagba
Department of Educational Foundations & Foundations,
Alvan Ikoku University of Education, Owerri,
Imo State.

And

Dr Comfort N. Ogbonnaya
Department of Educational Foundations & Foundations,
Alvan Ikoku University of Education, Owerri,
Imo State.

Abstract
The study investigated the use of flipped classroom model in enhancing engagement and active learning among primary school pupils in Algebra. Based on the purpose of the study one research question and two hypotheses guided the study. Analytical research design was adopted. The population of the study consisted of all primary (6) pupils in Owerri Educational zone of Imo State with population size of 3,032 pupils. A Sample size of 85 pupils was drawn through purposive simple random sampling technique involving one class from each of the selected schools. Researchers made four point rating scale was used for data collection. The questionnaire had reliability c0-efficient of 0.72 determined through Cronbach -Alpha method. Data generated was analyzed using mean and standard deviation for the research question while Z-test was used to test the hypotheses at 0.05 level of significant. Results of the study showed that the use of flipped classroom model enhance behavioural, emotional, cognitive and agentic engagement and promotes active learning among pupils in algebra and there is no significant difference between male and female pupils, urban and rural pupils on extent of behavioural, emotional, cognitive and agentic engagement. It was recommended among other things that teachers should adopt flipped learning model in teaching algebra in primary school to enhance and promote active learning.

Mathematics is one of the subjects that are taken very seriously in the school system, irrespective of country or level of education. It has been described as a model of thinking (Iji 2008), which encourages learners to observe, reflect and reason logically about a problem and in communicating ideas, making it the central intellectual discipline and a vital tool in science, commerce and technology (Imoko and Agwagah, 2006). In the works of Salman (2005), mathematics is a precursor of scientific discoveries and inventions. It is the foundation for any meaningful scientific endeavour and any nation that must develop in science and technology must have a strong mathematical foundation for its students. In terms of curriculum relevance, mathematics is compulsory at the primary school level and a pre-requisite for moving from the primary to secondary school education just as at the tertiary level of education, a sound background in mathematics is a necessary condition for the study of all science, technology and social science based course, as required by the Joint Admission and Matriculation Board (JAMB).Mathematics has branches which include trigonometry, geometry, numbers and numeration and algebra.

Algebra is a branch of mathematics that uses mathematical statements to describe relationship between things that vary over time. It involves putting real life problems into equations and solving them. The most important outcomes in the study of algebra include ability to think logically to use principles to see relationships to analyze and to organize (Oriji & Anaduka2010). Moris (2009) cited in Adani, Esky and Onu(2012) stated that algebra as one of the major branches of mathematics concern itself with the study of the operations, relations ,constructions and the concepts arising from them including terms of equations and algebraic situations. Despite the recognition accorded to mathematics due to its relevance, Elekwa (2010) remarked that students exhibits non-chalant attitude towards mathematics, even when they know that they need it to forge ahead in their studies and in life. Such students who have already conditioned their minds that mathematics is a difficult subject are usually not serious in the learning of mathematics and therefore perform poorly in mathematics test and examination. Analysis of school common entrance examination result shows that student's performances in mathematics are consistently poor. Uwadiae (2010) reported that less than 42% of registered candidate in unity common entrance examination obtain credit pass in mathematics. According to Olunloye (2010), this ugly trend of high failure rate in mathematics is a national disaster. Therefore, feasible ways of improving the performance has remained an area of great concern for researchers. The deplorable state of mathematics achievement is attributed to a number of factors such as attitude of students (Uhumaobi and Umoren 2005), lack of instructional resources (Yara and Ofieno, 2010), instructional technique (Olulonye 2010) among others. Although many factors affect student's mathematics learning and

achievement, one factor over which schools have the immediate control is the choice of mathematics program to be implemented by teachers, administrations and curriculum developers; instructional technique adopted by the teacher can be manipulated to bring about improvement in performance of students. Several studies have shown that good instructional strategies are capable of improving the achievement of students in mathematics and other subjects (Iji, 2005, Ihendinihu, 2008) and one of such instructional technique is the use of educational technology known a flipped classroom model.

Flipped classroom model is an educational environment that promotes discovering learning, problem-based learning, experimental learning and student-centered learning. The flipped classroom is an instructional model, developed and popularized by Colorado Science Teachers Jonothan Bergman and Aaron Sams (Bergmann and Sams, 2012). Flipped classroom are educational software, video recordings, screen casting software, demonstrations, and slide presentations with animations for the students to watch and read (Hamdan, Mc. Knight, Mcknight, & Arstam, 2013). In the flipped classroom, students learn new content by watching web-based instructional video lectures outside the classroom and then develop depth of knowledge by applying those mathematical concepts or relevant hands-on activities in the classroom. Yapici (2012) suggests that flipped classroom learning, which combines the advantages of the web-based learning with face-to-face hands on activity enrich learning and can lead to a successful learned-centered environment. Herreid and Schiller (2013) reflect that flipping the classroom has the ability to engage students and help develop critical thinking skills, among other benefits. Strayer (2012) found that, in general, students in a flipped class were more willing to work together and engage in activities in the classroom. The advantages cited by Morgan were; when the flipped classroom is implemented effectively, students are allowed to learn at an appropriate and differentiated pace. Teachers have more opportunities to help individual students that find the conduct difficult to understand, a reduced cost of education as consequence of providing instruction on a video platform, students have fewer textbooks to purchase, and benefits the students that may not get much help with homework (Morgan 2014). When students miss class learning the flipped classroom provides a means for students to access school materials any time from multiple locations. Students can remain up to date as per the curriculum calendar by viewing and reviewing the web-based instructional material. Herreid and Schiller (2013) asserted that a flipped classroom enhance engagement and promote active learning.

Engagement refers to the behavioral intensity and emotional quality of a person's active involvement during a task (Connell, 1990, Concell & Wellborn, 1991, Fiedler, 1975, Koengna, Fiedler & Declains, 1977; Wellborn, 1991). It is a broad construct that reflects a person

enthusiastic participation in a task. Researchers measure engagement either through a person's active involvement such as effort and positive emotion or through person in active in trying to take personal responsibility of their behaviour. In school settings engagement is important because it functions as a behavioural pathway by which students' motivational process contribute to their subsequent learning and development (Wellborn 1991) for instance, engagement enhance student's achievement (Skinner, Zimmer-Cyembak, & Connell, 1998). Engagement is important because teachers rely on it as an observable indicator of their students' underlying motivation during instruction. Furrer & Skinner, 2003, Partrick, Skinner, & Comwell, 1993, Skinner & Belmont, 1993). Engagement is important because it predicts important outcomes (eg learning development). Engagement represents the range of action students take to advance from not knowing, not understanding, not having skill, and not achieving to knowing, understanding, having skill and achieving (Reeve 2013). According to (Reeve 2013) Engagement features four aspects namely behavioural engagement, emotional engagement, cognitive engagement and Agentic engagement.

Behavioral engagement describes, making a judgment of how actively involved, the student was in the learning activity would enhance assessment of her concentrations, attention and effort. According to Cothran and Ennis (2000) and Pociask and Seltles (2007) cited in Sherab, 2013, showed that effective communication, the exhibition of a caring attitude towards students learning, provision of active learning opportunities and the use of co-operative learning approaches enhances behavioural engagement. Therefore, with the support of the learning environment, high behavioural engagement will lead to active learning.

Emotional engagement deals with the presence of task-facilitating emotions such as interest and the absence of task-withdrawing emotions such as distress. According to Taylor and Staler (2013), there is a relationship between emotions and learning. Less emotions means less learning and more emotion mean more learning. This means that the students who receivers no feedback in class or on discussion board will not learn through that material post about that on a particular topic. Emotional engagement will help students to assure responsibility towards one another, which in turn, will motivate them to complete the task (Jones, 2012). Therefore, discussion boards and problem solving in a flipped classroom could create emotional engagement, which will then lead to active learning.

Cognitive Engagement a study conducted by Reeve (2013) shows that student willingness to engage was impacted by teacher attitudes and actions. Teachers who questioned using lower order questions in class did not allow discussion of problem-solving strategies and mental activities (Smart & Marshall, 2013). However, according to Chin (2007) as cited in Smart Marshall (2013), when teachers questioned using higher order questions characterized by complexity,

students have the opportunity to explain, justify and rationalize with others in the classroom. When questions were asked, students were cognitively engaged and had the confidence to answer the questions in class (Barr. 2013). Therefore, this reveals that cognitive engagement by asking questions, either on the discussion board or in class, is a pathway to achieve active learning in class.

Agentic Engagement is a new pathway for student engagement in which students try to create a more motivational and supportive learning environment for themselves and which enables educators to support students' efforts to engage themselves (Reeve, 2013). There is a need for a self-regulated learning environment for agentic learners to engage with supportive educators, who encourage students to seek feedback and help them to learn from their mistakes (Richards, Sweet & Billett, 2013). Agentic engagement requires staff and students to have the capability to deal with new and challenging situations (Peach & Matthews, 2011) and is likewise fostered through peer collaboration that is mutually supportive (Richards et al 2013). Agentically engaged students will gain increased levels of learning and greater motivational support (Reeve, 2013).

Different studies in educational field that have direct or indirect relations to the present study, the following represent a brief summary for the most important researches: Rothman (2000) investigates the impact of the computerized book compared with the traditional one on the specific outputs, the students were divided into three groups and treated each group one of the following areas: teaching using flipped learning, teaching using non-traditional method that depend on computerized subject only and traditional teaching based on the book only as a basis for teaching. The result showed that teaching using flipped learning method impact positively and improves of the critical thinking skills. Bailey (2003) investigated the effects of learning strategies on the interaction of the student with the student, and the interaction of the student with the teacher and it measures student satisfaction. The results showed no differences in the level of student satisfaction, but, it show that using flipped learning strategy has positive effects to increase awareness of the student to student-student interaction. Magurie (2005) investigated the effect of flipped learning method in the student's achievement in mathematics. Results showed that flipped learning method helps students to perform and score better than the others. Also Toth & Ludvico, (2009) aimed to identify the effect of the experiences gained by flipped learning to the development of mental and visual skills. The study results indicated that the educational experiences of educational method flipped learning lead to the acquisition of skills, mental and visual such as reading data, calculations, and interpretation of results, report writing, and pointed out that the knowledge gained was satisfactory.

Statement of Problem

The traditional ways of teaching mathematics in some Nigerian public primary schools are teacher-centred approach. This method sometimes involves repetition and memorization of previously taught material by filling the student's with knowledge of mathematics without explaining in details the process of analyzing, evaluating and arriving at a conclusion. In addition, these processes may not make the student to be critical in thinking, promote active learning and engagement because some of them might find it difficult to apply the knowledge. Flipped classroom model was adopted in Nigeria educational sector as one of the teaching methods to make students active learners. However, it has not been fully incorporated and given more recognition as one of the major strategies in the school curriculum. Therefore the study aims to investigate to what extent flipped classroom model can enhance engagement in learning algebra among primary school pupils.

Purpose of the Study

The main purpose of the study is to investigate the use of a flipped classroom model to enhance engagement and promote active learning in Algebra. Specifically it seeks to;

i. Ascertain the extent behavioural engagement, Emotional engagement, Cognitive engagement; Agentic engagement promote active learning in algebra through a flipped classroom.

Research Question

1. To what extent does behavioural engagement, Emotional engagement, Cognitive engagement, Agentic engagement will promote active learning in algebra through a flipped classroom

Research Hypothesis

1. There is no significant difference between the mean rating scores of male and female pupils on extent of behavioural engagement, emotional engagement, cognitive engagement and agentic engagement in promoting active learning in algebra through a flipped classroom.
2. There is no significant difference between the mean rating scores of urban and rural school pupils on extent of behavioural engagement, emotional engagement, cognitive engagement and agentic engagement in promoting active learning in algebra through a flipped classroom.

Methodology

The researchers adopted analytical research design in determining the use of flipped classroom model to enhance engagement and active learning in Algebra among primary school pupils. The population of the study consisted all the primary six (6) pupils in Owerri educational zone of Imo-State with population of three hundred and thirty-two (3,032) pupils. A sample of eight-five (85) primary six pupils from two (2) local Government Areas within Owerri educational zone (1urban and 1rural schools) was selected using purposive and simple random sampling technique. The

instrument for data collection was researchers structured questionnaire title flipped classroom model in Algebra (FCMA). It was designed based on the four features of engagement Reeve (2013) namely behavioural engagement, emotional engagement cognitive engagement and Agentic engagement. The instrument was a modified likert four (4) point type of questionnaire. The validity of the instrument was determined by two experts in educational psychology, one expert in measurement and evaluation and two experts in mathematics education. A trial-test was carried out on primary schools pupils outside the sample for the study using Cronbach Alpha method, reliability co-efficient of 0.72 was established. Mean and standard deviation were used to analyze the research questions while Z-test statistical tool were used to test the hypotheses at 0.05 level of significant using SPSS version 17.0 mean utilization of 2.50 and above was accepted below was not accepted.

Results

Research Question one: To what extent does behavioural engagement, Emotional engagement, Cognitive engagement, Agentic engagement promote active learning in algebra through a flipped classroom.

Table 1 : Mean and standard deviation on behavioural, Emotional ,Cognitive, Agentic engagement

	Items	Mean $\bar{x}$	SD
1	When I'm in the class, I listen very carefully.	5.48	0.8
2	I pay attention to maths class.	5.65	0.7
3	I try hard to do well in the class	5.78	0.8
4	In the class, I work as hard as I can.	5.61	0.9
5	When I'm in the class, I participate in class discussions.	5.61	0.7
	Cumulative Mean	**5.62**	**0.6**
	Agentic Engagement		
6	let my teacher know what I need and want.	5.04	1.0
7	let my teacher know what I am interested in.	5.17	0.7
8	During this class, I express my preferences and opinions.	5.09	1.2
9	During class, I ask questions to help me learn.	5.00	1.6
10	When I need something in this class, I'll ask the teacher for it.	4.83	1.5
11	I adjust whatever we are learning so I can learn as much as possible.	5.04	1.5
12	I try to make whatever we are learning as interesting as possible.	5.52	0.9
	Cumulative Mean	**5.09**	**0.9**
	Cognitive Engagement		
13	When I study for this class, I try to connect what I am learning with my own experiences.	5.56	1.3
14	I try to make all the different ideas fit together and make sense when I study for this class.	5.57	1.1
15	When doing work for this class, I try to relate what I'm learning to what I already know.	5.86	0.8
16	I make up my own examples to help me understand the important concept I am studying for this class.	5.43	1.2
	Cumulative Mean	**5.79**	**1.0**
	Emotional Engagement		
17	When we work on something in this class, I feel interested.	5.43	1.1
18	This class is fun.	5.86	1.2
19	I enjoy learning new things in this class.	5.86	1.1
20	When I'm in this class, I feel good.	5.91	1.1
21	When we work on something in this class, I get involved.	5.87	0.8
	Cumulative Mean	**5.79**	**1.0**

Table 2 Summary of the Cumulative Mean and Standard Deviation

	Behavioural	Agentic	Cognitive	Emotional
Mean	5.62	5.09	5.60	5.79
Std. Deviation	0.6	0.9	1.0	1.0

Results in table 2 shows that the use of a flipped classroom on the four aspects of engagement promotes active learning. Table 2 shows that the mean of emotional engagement is the highest (x =5.79), followed by behavioral engagement (x =5.63) and cognitive engagement (x =5.61), and agentic engagement (x = 5.1) is the lowest. Therefore, behavioral, emotional, cognitive and agentic engagement promotes active learning. Students are most engaged emotionally and less engaged agentically. The degree of consistency between the highest and lowest means shows nearly the same response among the means for emotional engagement (sd=1.0) and agentic engagement (sd=0.9), although emotional engagement had the highest mean compared to agentic engagement.

Hypothesis Testing

Hypothesis One: There is no significant difference between the mean ratings of male and female pupils on extent of behavioural engagement, emotional engagement, cognitive engagement; agentic engagement will promote active learning in algebra through flipped classroom.

Table 3: Z-test analysis on gender

Gender	N	X	SD	z-cal	∝	z-crt	Decision
Male	21	2.8	0.8	1.56	0.05	1.96	Accept H_o
Female	64	3.4	0.9				

The result in table 3 shows that z-cal value (1.56) is less than table value (1.96) at 0.05 level of significant. Based on the result the null hypothesis is up held this implies that no significant difference that exist between the male and female pupils on the extent of behavioural engagement, emotional engagement, cognitive engagement, agentic engagement will promote active learning in algebra through flipped classroom.

Hypothesis Two: There is no significant difference between the mean rating scores of urban and rural pupils on extent of behavioural engagement, emotional engagement, cognitive engagement, agentic engagement will promote active learning in algebra through flipped classroom model.

Table 4: Z-test analysis on location.

Location	N	X	SD	z-cal	∝	z-crt	Decision
Urban pupil	43	2.3	10.7	0.184	0.05	1.96	Accept H_o
Rural pupils	42	2.0	9.2				

The result in table 4 shows that, z-cal value (0.184) is less than the table value (1.96) at 0.05 level of significant. Based on this null hypothesis is upheld. This implies that no significant difference exists between the mean response of urban and rural pupils on extant of behavioural engagement, emotional engagement, cognitive engagement, agentic engagement will promote active learning in algebra through flipped classroom model.

Discussion

Results in the study shows that pupil's behavioral, emotional, cognitive and agentic engagement helps them to make academic progress and to have a more motivationally supportive learning environment. Magurie (2005) investigated the effect of flipped learning method in the student's achievement in mathematics. Results show that flipped learning method helps students to perform and score better than the others.

Also irrespective of gender and location there is no significant difference among the pupils behavioural engagement, emotional engagement, cognitive engagement, agentic engagement will promote active learning in algebra through flipped classroom model.

Conclusion

This study concluded that, the use of flipped classroom model effectively enhances pupils engagement and promotes active learning during activities.

Recommendations

Based on the results of this study, I recommend the following for further research and development.

1. Workshops and seminars should be organized for teachers as to be abreast with innovative approach of teaching that will enhance pupils learning and promote active learning.
2. Teachers should adopt flipped learning method in teaching mathematics especially algebra in primary schools as to enhance engagement and promote active learning.

References

Adani , A , Eskay, M. & Onu , V.(2012). Effect of self – instruction strategy on the achievement in algebra of students with learning difficulty in mathematics. *Us- china Education Review A(12)1006-1021*.

Bailey, K., D. (2003). The Effects of Learning Strategies on Students Interaction and Student Satisfaction. Dissertation Abstract International, 63 (7). UMI No 3060010).

Barr, M. L. (2013). Encouraging college student active engagement in learning: The influence of response methods. *Innovative Higher Education.* doi: 10.1007/s10755-013-9276-x. Retrieved on November 15, 2013, from http://download.springer.com /static/pdf/841/art%253A10.1007 %252Fs10755-013-9276-x.pdf?auth66=1390012601_7e055 8ef51d5433b38f64da3a957a61e& ext=.pdf

Bergman, J. & Sams, A. (2012). Flip your Classroom; Reach every Student in every Class every day. *International Society for Technology in Education*.

Connell, J.P & Wellborn, J.G (1991). Competence, Autonomy, and Relatedness: A Motivational Analysis of Self-Esteem Processes. In M.R Guner & L.A Sroufe (Eds), Self Processes in Development. Minnesota Symposium of Child Psychology 23, 167-216.

Connell, J.P. (1990). Context, Self and Action: A Motivational Analysis of Self-Esteem Process Across the Life-Span. *In D. Cicchetti (Ed), the Self in Transition. From Intendancy to Childhood (pp 61-67).* Chicago: University of Chicago Press.

Elekwa, U.C.C. (2010). Effect of collaborative teaching and learning strategies on the mathematics achievement of senior secondary school students in Abia State of Nigeria. Unpublished PhD theises submitted to faculty of Education, university of Port Harcourt.

Fiedler, M.L. (1975). *Bidirectionally of Influence in Classroom Interaction. Journal of Educational Psychology*, 677-735-744.

Furrer, C. & Skinner, E.A (2003). Sense of Relatedness as a Factor in Children's Academic Engagement and Performance. Journal of Educational Psychology, 92, 148-182.

Hamdan, N., McKnight, P., McKnight, K., & Arfstorm, K. M. (2013). *A review of flipped learning. Flipped Learning Network.* Retrieved November 2, 2013, from *http://researchnetwork.pearson.com/wpcontent/uploads/ExecSummaryFlippedLearnig.pdf*

Herreid, C. F., & Schiller, N. A. (2013). *Case study and the flipped classroom. Journal of College Science Teaching.* 42(5), 62-66.

Ihendinihu, U.E. (2008). Effect of guided-scorning instructional strategy on the performance of secondary school in mathematics sin Abia State. Unpublished M.ED Dissertation submitted to the faculty of Education, Abia State University Uturu.

Iji, C .O. (2005). Effect of logo and Basic programs on the achievement and retention in geometry of junior secondary students. Unpublished PhD thesis University of Nigeria Nsukka.

Iji, C.O. (2008). Reforming School mathematics curriculum in line with global challenges proceedings of the 49th Anunal conference of STAN ,226-230.

Imoko, I., B. & Agwagha , U. N. (2006). Improving students' intrest in mathematics through the concept mapping technique. A focus on gender. *Journal of research in curriculum and teaching 1 (1),30-31*.

Jones, T. (2012). Community in the classroom: An approach to curriculum and instruction as a means for the development of student cognitive, social and emotional engagement in a high school classroom. Doctoral Dissertation. Retrieved on November 12, 2013, from http://search.proquest.com/docview/1267150757/fulltextPDF/142FE568590EF363FA/1?accountid=14645

Koenigs, S.S., Fiedler, M.L, & Dechrms, R. (1997). *Teacher Beliefs, Classroom Interaction and Personal Causation.* Journal of Applied Social Psychology, 7, 95-114.

Morgan, H. (2014). Focus on Technology. Flip your Classroom to Increase Academic Achievement Childhood Education, 90(3), 239-241.

Olunloye, B., T. (2010). Mass Failure in mathematics: A national Disaster : Tribune of 07/02/2010. Retrived from http/www.tribune.com.ng on 08/05/2016.

Orji, A . B. & Anaduaku, U. (2010). Effect of webbing instruction strategy on students achievement in algebraic word problems. *Journal of research in National Development 8 (2) 34-42.*

Partrick, B.C., Skinner, E.A. & Connell, J.P. (1993). What Motivates Children's Behaviour and Emotion? Joint Effects of Perceived Control and Autonomy in the Academic Domain. Journal of Personally and Social Psychology 65, 781-791.

Peach, D., & Matthews, J. (2011). Work integrated learning for life: Encouraging agentic engagement. Research and Development in Higher Education, 34 , 227– 237. Pierce, R., & Fox, J. (2012). Vodcasts and active-learning exercises in a "flipped classroom" model of a renal pharmacotherapy module. American Journal of Pharmaceutical Education, 76 (10), 1-5.

Reeve, J. (2013). How students create motivationally supportive learning environments for themselves: The concept of agentic engagement. Journal of Educational Psychology, 105 (3), 579–595. doi: 10.1037/a0032690 Reeve, J., & Tseng, M. (2011). *Agency as a fourth aspect of student engagement during learning activities.* Contemporary Educational Psychology, 36 , 257-267.

Richards, J., Sweet, L., & Billett, S. (2013). *Preparing medical students as agentic learners through enhancing student engagement in clinical education.* Asia-Pacific Journal of Cooperative Education, 14 (4), 251-263.

Salmon, M.F. (2005). Teacher identification of the difficulty levels of topics in the primary school mathematics curriculum in Kwara State. *ABACUS 30,20-29*.

Sherab, K. (2013). Strategies for encouraging behavioural and cognitive engagement of pre-service student- teachers in Bhutan: An action research case study. *Educational Action Research, 21 (2), 164-184*. doi: 10.1080/09650792.2013.789710

Skinner, E.A. & Belmont, M.J. (1993). Motivation in the Classroom: Reciprocal Effects of Teacher Behaviour and Student Engagement across the School Year. *Journal of Educational Psychology, 85, 571-581*.

Skinner, E.A., Zimmer-Gyembak, M.J & Connell, J.P (1998). Individual Differences and the Development of Perceived Control. *Monogaphe of the Society for Research in Child Development, 63(2-3) 204*.

Smart, J. B., & Marshall, J. C. (2012). *Interactions between classroom discourse, teacher questioning, and student cognitive engagement in middle school science*. Journal Science Teacher Education, 24 , 249–267. doi: 10.1007/s10972-012-9297-9

Strayer, J. F. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environment Research, 15 , 171–193. doi: 10.1007/s10984-012-9108-4*

Taylor, S. S., & Statler, M. (2013). Material matters: Increasing emotional engagement in learning. *Journal of Management Education*. XX (X), 1-22. doi: 10.1177/1052562913489976

Uhumuavbi ,P.O. & Umoru , G. E. (2005). Relationship between interest in mathematics and science among polytechnic students. A case study of Auchi polytechnic.

Uwadiae , I. (2010). WAEC Releases May/June WASSCE results Thursday newspaper of 20/08/2010. Retrieved from allafrica.com Nigeria.nig on 06/05/2016.

Wellborn, J.G. (1991). Engaged and Disaffected Action: The Conceptualization and Measurement of Motivation in the Academic Domain. *Unpublished Doctoral discretion, University of Rochester, Rochister, NY.*

Yapici, I.U. (2012). *High School Students' Views on Blended Learning. Turkish Online Journal of Distance Education, 13(4), 125-139.*