



Effect of Eng-Hau medium of instruction on Upper-Basic students' achievement in Algebra

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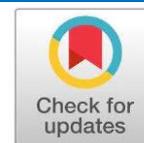
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Abstract: This study investigated the effect of Eng-Hau medium of instruction on Upper-Basic students' achievement in Algebra. Eng-Hau is a term for the fusion of English and Hausa languages. The study involved 244 students in the Upper Basic School II class from the Jalingo metropolis in Taraba state, Nigeria. Three research questions and hypotheses served as the study's guiding principles, and it employed a quasi-experimental design with a non-equivalent group, pretest and posttest treatment, and factorial designs. Data was collected using the Algebra Achievement Test, which has a reliability coefficient of 0.74 calculated using the KR-20 formula. The children were instructed using methodology instructional packages, which included algebraic topics translated into Hausa. The ANCOVA was used to test the hypotheses. One of the conclusions was that students who were taught in Eng-Hau performed better than those who were taught in English alone. There was no gender disparity among students taught in Eng-Hau. Indicating that achievement in mathematics is not based on gender but rather on the medium of instruction, the interaction effect of gender and medium of instruction on achievement was shown to be insignificant.

Keywords: Eng-Hau, English language only, Hausa language, students' achievement, gender difference, interaction effect.

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INTRODUCTION

Parents, the government, and other stakeholders in the education sector are concerned about the annual failure rate of students in mathematics. There is no denying that both mathematics educators and students are working to raise standards of performance at all levels. As a result, teachers are making an effort to adopt the many teaching techniques they believe might improve the situation. Despite these, it doesn't seem as though the degree of students' bad mathematics proficiency is improving. The results of the students in mathematics on the Senior School Certificate Examination, often known as the SSCE conducted by the West African Examination Council (WAEC), for the past 20 years are highly alarming. According to the results, just 27.31% of candidates who took the WAEC-administered SSCE between 1991 and 2016 passed, while 72.69% failed (Zalmon, & Wonu, 2017). These kinds of outcomes surely cannot be said to satisfy the nation's ambitions.

The reasons behind these students' appalling performance are varied. Failures or poor performance are sometimes attributed to the calibre of teachers, while on other hand, others blame the subject matter's complexity. Success or failure in mathematics could therefore depend on a variety of variables in addition to



just having a basic understanding of the topic. There hasn't yet been found a single component that is known to be completely to blame for poor math performance. Therefore, teachers must overcome the difficulties of providing effective instruction that will improve students' performance on both internal and external exams.

According to the research by [Setati, Chitera, & Essien \(2009\)](#), learning mathematics in a language other than the learner's native tongue is more challenging for the student to understand. Language guidelines that are universally or globally recognised and accepted serve as a guide for learning mathematics, particularly at the secondary level. This will make it possible for students to enroll in advanced mathematics courses ([Percy & Andrew, 2014](#)). The language of instruction must enable students to understand the literature or subject matter they are supposed to learn. As a result, effective teaching and learning depend on the learners understanding the language that is being used.

The choice of instruction language poses a risk to the development of high-quality education. The international lingua franca is thought to be the most effective for teaching any subject to any student, however, some teachers prefer teaching in students' mother tongues or in a bilingual setting. An instrument for fostering national development is educating in the language of the immediate community. This is best illustrated by the fact that countries like China and Japan have made technological advancements as a result of teaching in their native tongues.

The lack of use of the local language as a medium of teaching in schools may be responsible for Nigerian students' poor math performance. According to [Azurin \(2010\)](#), the countries where their mother tongue was employed as a medium of instruction for the teaching and learning of mathematics produced students with the highest scores in an international mathematics competition. Similar to what [Arzadon \(2010\)](#) said, teaching mathematics to students in their home tongue fosters their awareness, knowledge, competence, self-esteem, and confidence in their ability to solve mathematical problems. Students learn, retain knowledge, and comprehend, according to [Ekwue & Umukoro \(2011\)](#), when what they are taught is appropriately and meaningfully connected to their experiences and when real-life examples are used. The use of the mother tongue successfully has improved the understanding of mathematical concepts, particularly at the lower primary levels of education, according to [Feza-piyose \(2012\)](#).

The difficulty faced when using a foreign language to learn mathematical concepts is the ability to effectively communicate mathematical ideas, particularly whenever the teacher and learner may not share a first language ([Orton, 2012](#)). It becomes challenging when students don't get what is being taught and the teacher is unable to express complex ideas in terms that the students might easily understand. Children learn mathematics more effectively when they are taught in their mother tongue, according to [Israel & Thomas \(2013\)](#). It makes sense that every child should be taught in their mother tongue or the language of their immediate community, as stated in section 1 item 8g of the National Policy on Education ([FRN, 2013](#)). This may be the rationale [Abubakar, Umari, & Musawa \(2015\)](#) blamed the country's incapacity to employ the mother tongue for instruction in schools and to design an educational curriculum for the worrisome decrease

in the education system. Further emphasis was placed on the fact that nations like China and Japan can make enormous advances in science and technology by adopting their native tongues.

Studies such as [Dorgu & Igbojinwaekwu \(2016\)](#), [Wushishi, Ashafa, & Sadiq \(2016\)](#), [Bala & Apagu \(2017\)](#), including others have shown that students who are taught in their local language are more likely to perform well than those who are taught in a foreign language. Thus, it will not be out of place to say that language of instruction is a very significant and pivotal factor in teaching and learning. Nigeria is a multilingual community, and also has the English language as the official language. Therefore, the English language is taught at all levels of education as a second language ([Adah, & Sule, 2019](#)) and is also used to teach all other subjects. Because everyone speaks it, Hausa is the language of the immediate surroundings in Northern Nigeria. The second official language is Hausa. The language of instruction for students in this region of the country is English, which is not the local tongue (Hausa).

It is also worthy of note that before enrolling in school, the students have acquired and are very fluent in the language of their immediate community (Hausa). As a result, the majority of students struggle with the English language used to teach mathematics. This is because they hardly speak the English language at home or even in school. This makes it difficult for them to articulate their learning, discuss ideas and understand concepts that are communicated to them in the English language. This becomes more critical in mathematics lessons, where the concepts are known to be more abstract. This study investigated the impact of using Eng-Hau on students' algebra achievement within the context of the aforementioned observations, as well as additional observations about the language issue. The term "Eng-Hau" refers to the usage of both English and Hausa in the study's method of teaching mathematics. The problem of this study is therefore stated as "what is the effect of *Eng-Hau medium of instruction on Upper-Basic students' achievement in Algebra?* To resolve this question, *the following research hypotheses and research questions served as the study's compass:*

Research question one

What are the achievement scores of students at the Upper Basic School II level in the Jalingo metropolis who are taught algebra in English-Hau compared to those who are simply taught in English?

Research question two

What are the achievement scores of male and female students at the Upper Basic School II level in the Jalingo metropolis who are being taught algebra using the Eng-Hau method?

Research question three

What is the interaction between gender and language of instruction on students' mathematics achievement at the Upper Basic School II level in the Jalingo metropolis?

METHOD

The study used a quasi-experimental factorial design with non-equivalent pre- and post-test groups. The study explored the simultaneous effects of two independent factors (instruction medium and gender) on

achievement, hence a factorial design was chosen. The independent and dependent variables were crossed to provide the basis for $2 \times 1 \times 2$ factorial analyses. This means that the medium of instruction was used in two major groups (control; English language only and experimental; Eng-Hau) concerning achievement (dependent variable) in both gender (second independent variable) in two groups (male and female). The factorial analysis explains whether variations in a given set of scores can be attributed to a single source of variation or they represent the working of several underlying dimensions (Aggarwal, 2004). In essence, it made it possible to assess how gender and the type of training had an impact on the achievement of students in algebra. Since, complete randomization of the research subjects was almost impossible, where existing classes were used, this made the factorial design a quasi-type.

A pre-test and follow-up test were given on the dependent variable (achievement). In addition to this, since the study used intact (existing) classes, the equivalence of the groups could not be guaranteed, hence the non-equivalent group design. However, the pre-test was used for determining an equivalent group among the students. The post-test was used to obtain gain scores after treatment. According to Sambo (2005), quasi-experimental design is relatively more reliably carried out because it lends itself to the use of measurement processes and materials, which yield precision and objectivity. The students in their intact classes were assigned into groups namely the control group (C) and the experimental group (E). The study's sample consists of 244 Upper Basic School two (JSS II) students, that were selected from 5 schools in the Jalingo metropolis of Taraba State, Nigeria. The selection of schools and assigning them to groups (control and experiment) was through a method of random sampling. The groups were taught using a specially prepared methodology instructional Package (MIP).

The MIP are lesson plans, where that of the control groups was in English language only. The MIP for the experimental groups had a translated version in Hausa, for teaching Algebra using Eng-Hau (both English and Hausa Languages). Data on achievement was obtained through Algebra Achievement Test (AAT). The AAT consists of 55 multiple-choice items drawn from topics in algebra using the mathematics curriculum for JSS III. In the areas of mathematics education, educational measurement and evaluation, and the Hausa language, three experts completed the face and content validation of the MIP and AAT. The validation was followed by item analysis, of AAT, where a reliability index of 0.74 was obtained using the KR-20 formula. To make sure that the initial group differences are taken into account during data analysis, an analysis of covariance (ANCOVA) was performed.

RESULTS AND DISCUSSION

Result

Research question one

What are the achievement scores of students at the Upper Basic School II level in the Jalingo metropolis who are taught algebra in English-Hau compared to those who are simply taught in English?

Table 1. Average test results for the experimental and control groups

Group	Number of student	Pretest scores		Posttest score		Mean gain
		Mean	Std. dev	Mean	Std. dev	
Eng-Hau group	124	28.64	9.12	39.47	15.95	10.83
Conventional group	120	23.61	11.55	32.00	14.42	8.39
Mean difference		5.03		7.47		2.44

Eng-Hau = students taught using a combination of English language and Hausa language

Conventional Grp = students taught using English language only

According to [Table 1](#), the experimental group received instruction in Eng-Hau, and their pretest mean score was 28.64 with a standard deviation of 9.12, while the control group received instruction in English only, and their pretest mean score was 23.61 with a standard deviation of 11.55. The experimental group's pretest results differ from those of the control group by 5.03 points. The two groups' standard deviation scores differed by 2.43, indicating that the two groups' mean scores are equally distributed. Following statistical removal of the impact of the pretest, the posttest mean score of the students taught using Eng-Hau stands at 39.47, while that of their counterparts taught using English Language only is 32.00. The posttest standard deviation scores of the two indicate that the posttest scores of the groups are both homogeneous within the groups. The group that was taught algebra using Eng-Hau had a 7.47-point advantage over the other group on the posttest mean score. The mean gain (i.e., the difference between the pretest and post-test mean scores) for students who were taught in Eng-Hau was 10.83, compared to 8.39 for students who were solely taught in English. The experimental group outperformed the control group by 2.44 in terms of mean gain. This implies that students taught using Eng-Hau have higher achievement mean scores than their counterparts taught using the English language only.

Research question two

What are the achievement scores of male and female students at the Upper Basic School II level in the Jalingo metropolis who are being taught algebra using the Eng-Hau method?

According to [Table 2](#)'s findings, male students had a mean achievement score on the pretest of 27.63 with an 8.79 standard deviation, while female students had a mean score of 29.61 with a 9.39 standard deviation. The experimental group's pretest achievement results differ 1.98 points from those of the control group. Following statistical removal of the impact of the pretest, the posttest mean achievement score of male students stands at 41.22, while that of their female counterparts is 37.72. The achievement post-test mean score difference between male and female students is 3.50, favouring the male students.

Table 2. Average test scores for the Eng-Hau group's students, both male and female

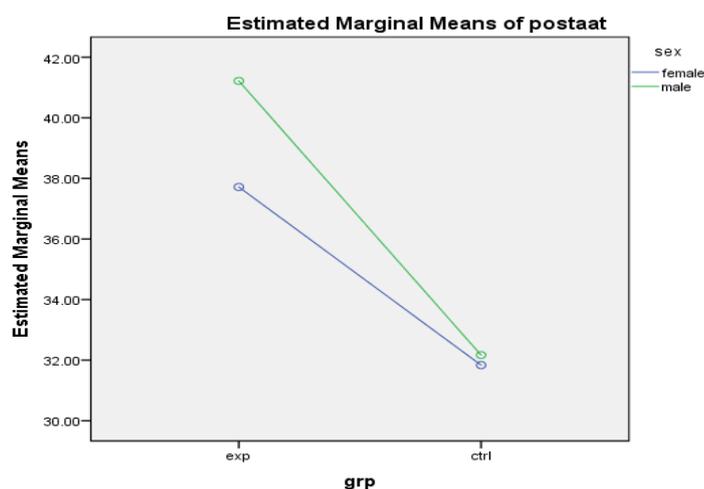
Gender	Number of student	Pretest scores		Posttest score		Mean gain
		Mean	Std. dev	Mean	Std. dev	
Male	61	27.63	8.79	41.22	16.44	13.59
Female	63	29.61	9.39	37.72	15.44	8.11
Mean difference		1.98		3.50		5.48

In a similar vein, male students' achievement mean score gains (13.59) are higher than those of female students (8.11). Thus, the male students gained 5.48 achievement mean scores higher than their female

counterparts. This suggests that when algebra was taught using Eng-Hau, male students performed better than female students.

Research question three

What is the interaction between gender and language of instruction on students' mathematics achievement at the Upper Basic School II level in the Jalingo metropolis?



Covariates appearing in the model are evaluated at the following values: preaat = 26.1673

Fig 1. Profile plot of interaction for the medium of teaching and gender

Figure 1 is a profile plot of the adjusted means for achievement test, split for male and female students and medium of instruction (Eng-Hau and English language only). The interactive pattern shows that the plots for both sexes do not intercept, though not parallel lines. This shows that there is no interaction effect of the medium of instruction and gender on students' achievement in algebra, especially when the two lines do not cross. The plot, however, shows that there is a likelihood of interaction in the long run since the lines are close to intercepting.

Hypothesis one

At the Upper Basic School II level in the Jalingo metropolis, there is no significant difference in achievement between students taught algebra in Eng-Hau and those who exclusively received instruction in English.

Table 3. Summary of One-way ANCOVA

Sources of Variation	Sum of squares	df	Mean Square	F	Sig.	Partial Eta squared
Corrected Model	6543.17 ^a	2	3271.59	14.75	.00	.11
Intercept	27474.02	1	27474.02	124.84	.00	.34
Pre-test	1802.42	1	1802.42	8.13	.01	.03
Medium of instruction	3238.24	1	3238.24	14.60	.00	.06
Error	53464.67	241	222.85			
Total	372193.16	244				
Corrected Total	60007.84	243				

a. R Squared = .109 (Adjusted R Squared = .102)

Table 3 compares the mean achievement scores of students who were taught algebra using Eng-Hau and English Language alone in a one-way between-groups analysis of covariance. After controlling for pre-test results, there is a minor effect size (partial eta squared = 0.06) but a significant difference between the two groups' post-test results $F(1,241) = 14.60, p = 0.00$. The effect size shows that 6% of the variance in achievement scores of the students is based on the medium of instruction used. A partial eta squared value of 0.03 also showed that there was little correlation between the students' accomplishment test scores on the pretest and posttest. Thus, the hypothesis that there is no significant difference in achievement levels between students who are taught algebra in Eng-Hau and those who are taught the subject in the English language only in the Jalingo metropolis is rejected. This means that, at the upper basic school level in the city of Jalingo, there is a substantial difference between the accomplishment scores of students taught algebra using Eng-Hau and those taught using simply the English language. This shows that students who were taught mathematics in English-Hau performed noticeably better than their English-only classmates.

Hypothesis two

At the Upper Basic School II level in the Jalingo metropolis, there is no significant difference in achievement between male and female students who are taught algebra using the Eng-Hau method.

Table 4. Summary of One-way ANCOVA

Sources of Variation	Sum of Squares	df	Mean square	F	Sig.	Partial Eta squared
Corrected Model	394.72 ^a	2	197.36	.77	.46	.01
Intercept	21014.64	1	21014.64	82.35	.00	.41
Pre-test	122.08	1	122.08	.48	.49	.00
Gender	231.41	1	231.41	.91	.34	.00
Error	30877.99	121	222.85			
Total	230721.29	124				
Corrected Total	31272.71	123				

Table 4's findings demonstrate a one-way between-groups analysis of covariance to compare the average achievement scores of male and female students who were instructed in algebra using the Eng-Hau method. After adjusting for the pre-test scores, $F(1,121) = 0.91, p=0.34 > .05$ indicates there is no statistically significant difference in the accomplishment scores of male and female students. The effect size demonstrates that no gender-related variation in the students' achievement scores exists. As a result, the claim that there is no significant different in the achievement levels of male and female students taking algebra in the Jalingo metropolis' upper basic school level utilising Eng-Hau was not disproved.

Hypothesis three

In the Jalingo metropolitan, there is no significant interaction between gender and the method of instruction that affects students' achievement in algebra at the Upper Basic School II level.

Table 5. Summary of One-way ANCOVA

Sources of Variation	Sum of Squares	df	Mean square	F	Sig.	Partial Eta squared
Corrected Model	6924.57 ^a	4	1731.14	7.79	.46	.01
Intercept	21014.64	1	21014.64	120.74	.00	.34
Pre-test	1892.34	1	1892.34	8.52	.00	.03
Gender	221.24	1	221.24	.99	.32	.00
Medium	3181.67	1	3181.67	14.33	.00	.06
Gender*medium	150.04	1	150.04	.68	.41	.00
Error	53083.26	239	222.11			
Total	372193.16	244				
Corrected Total	60007.84	243				

a. R Squared = .115 (Adjusted R Squared = .101)

Table 5 shows a 2 x 2 x 1 factorial analysis to investigate the interactive effect of the effect of medium of instruction (experimental and control) and gender (male and female) on students' achievement. After adjusting for the pre-test scores, $F(1, 239) = 0.68$, $p = 0.41 > 0.05$ show that the interaction between gender and the medium of instruction has no significant effect on students' achievement scores in algebra. The effect size also shows that neither the students' gender nor the medium of instruction was responsible for any variation in their achievement scores. Therefore, it is not rejected that there is no significant interaction between gender and the medium of instruction on students' accomplishment scores in algebra in the Jalingo metropolis.

Discussion

One aspect that affects academic accomplishment is the language of instruction because it facilitates learning and understanding when teachers utilise the learners' native tongues. This also helps the learners to have better memorizing and remembering abilities. Before the instruction, the students' pre-test results from the class taught using Eng-Hau were not statistically significantly different from that of the group taught algebra using English language only. This is a confirmation that the two groups of students entered the instruction on equal strength. This finding is necessary to show that any significant difference observed in the post-test scores would not be attributed to chance but to the effect of the intervention (Eng-Hau). Consequently, the post-test scores of the students taught algebra using Eng-Hau were found to be significantly higher than their colleagues in the group that was taught algebra using the English language only. This finding indicates that students taught using the combination of Hausa and English languages (Eng-Hau) perform better than those taught using the English language only. The results showed that combining the Hausa language, which is spoken in the nearby area, with English significantly increased students' performance in algebra.

The study's findings concur with earlier studies such as [Ogbonne \(2012\)](#), [Chinweokwu \(2013\)](#), [Oginni Omoniyi & Owolabi Olabode \(2013\)](#), [Abubakar, Umar & Musawa \(2015\)](#), [Dorgu & Igbojinwaekwu, \(2016\)](#), [Wushishi, Nasifa & Sadiq \(2016\)](#) as well as [Bala & Apagu \(2017\)](#) which found that when students taught using the English language combined with the language of the immediate environment achievement is

enhanced. The results are in line with a study by [Njoroge \(2017\)](#) from Kenya, which discovered that teaching mathematics and science in the home language is a successful method for raising students' proficiency in those subjects in Kenyan primary schools. The results also support those of [Sanda, Kida, & Okwute \(2018\)](#), who found that students who received social studies instruction in both Hausa and English performed better than those who received instruction only in Hausa or in English.

The study established that 6% of the variance in student test results for achievement is based on the medium of instruction used. The implication is that, if mathematical concepts are fully translated to the language used in the immediate area, there is a likelihood of better performance. The most likely causes of this result could not possibly be unrelated to the fact that teaching algebra using Eng-Hau, the combination of the English language with that of the immediate environment (Hausa) to explain concepts aided students to understand thereby making the learning smoother for them. In addition to this, using the local language (which in this case is Hausa) in combination with the English language as a language of instruction freed the students from timidity and thereby increase students' participation during lessons. The pedagogy: Eng-Hau also reduced rote learning and increased the assimilation of mathematical concepts. The results of this study also demonstrate that the mean achievement of male and female students who were taught algebra utilising Eng-Hau methodology did not significantly differ. The finding of this study contradicts the findings of [Busolo \(2011\)](#) in Kenya; [Asuquo & Onasanya \(2006\)](#) in Nigeria, who found gender differences in achievement. However, the findings of this study agree with [Oludipe \(2012\)](#), [Ogbonne \(2012\)](#), [Wushishi, Nafisa & Sadiq \(2016\)](#), [Onuoha \(2016\)](#), and [Yakubu \(2016\)](#) that discovered no significant differences between students who were male and female. The fact that male and female students perform equally well in class may have something to do with the fact that they are both capable of competing and working together. The use of Eng-Hau in instruction shows that gender has less of an impact on mathematic achievement than does the medium of instruction. This finding was further buttressed that the medium of instruction and gender does not have an interactive effect on students' achievement. This finding has affirmed that there is no gender difference in cognition and brain lateralization in the learning of mathematics.

CONCLUSION

The results of this investigation clearly show that Eng-Hau as a medium of instruction improved students' understating of algebra as well as their achievement. Thus, supplementing the use of English as a medium of instruction with the language of the immediate surroundings in teaching algebra and mathematics generally, is very potent, in enhancing students' understanding and achievement. Secondly, achievement in mathematics is not dependent on a student's gender, but on the method (the language of instruction) used by the teacher. The study suggests that when teaching mathematics, teachers should always make an effort to convey abstract ideas in the language of the immediate environment of the students. Conscious efforts should also be made by mathematics educators, and other relevant bodies and government agencies to translate

mathematical concepts into the major languages in Nigeria, to boost students' understanding and learning of mathematics.

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