Teacher effectiveness in English-medium instruction and students' academic achievement: A value-added model in action

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Abstract

This study aimed to investigate the association between general science teachers' effectiveness in teaching through English and students' academic success in Debre Birhan City. In addition, it sought to determine which dimensions of English as a medium of instruction (EMI) accounted for the greatest variability. Furthermore, it examined whether demographic variables such as sex, qualification, and experience co-variated with students' academic achievement (SAA). A non-experimental correlational design was employed. The study sample included 45 randomly selected teachers and 1575 students in 45 classrooms. A teacher effectiveness questionnaire and an academic achievement test were used as data collection tools implementing the principle of the value-added model. The findings revealed a strong relationship between teachers' effectiveness in teaching science through English and SAA, with pedagogical knowledge being the highest contributor and experience co-variating with SAA. The unstandardized coefficient output also reveals that SAA increases by a certain percentage as every scale of EMI increases. The study recommends on-the-job training for EMI teachers. Additionally, experienced teachers should work in pairs with younger teachers and share fresh perspectives on teaching methods and effective language use. The introduction of EMI implementation policies is also recommended.

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Introduction

In education, scholars agree that the language of instruction significantly impacts students' academic success and overall learning outcomes (Bernhofer & Tonin, 2022; Husarida & Dollete, 2019). English as a Medium of Instruction (EMI) has become a rapidly growing area of interest for language scholars, decision-makers, and practitioners in the age of fast information spread around the world and increased connection among nations (Tang, 2020). Due to the belief that English is well-suited to the global lingua-franca, alongside the

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financial, linguistic, cultural, and informational capital the English language has accumulated over time (Jenkins, 2013), it is widely implemented .

The concept of EMI refers to “the use of the English language to teach academic subjects (other than English itself) in countries or jurisdictions where the first language of the majority of the population is not English” (Macaro et al., 2018, p. 37).This implies the role of English in teaching varied subjects in educational settings, aiming at the mastery of contents other than the language itself in areas where English is not the language of the majority. The trend to use EMI has increased in popularity, leading children to be exposed to learning in languages different from their first language at various educational levels worldwide (Dearden, 2014; Tri & Moskovsky, 2023).

Researchers present a compelling case for the pervasiveness of EMI, citing the perceived need for institutions to internationalize and attract global students, the pressure on government institutions to compete with private sectors, and the leverage of English as the dominant language for research publications (Knight, 2013). In addition, parents perceive EMI education as highly prestigious and agree to spend the required money to help their children acquire education through EMI (Tollefson, 2017).

However, in light of the growing popularity of EMI, particularly when students learn in a language different from their mother tongue, the issue of teacher effectiveness (TE) in using the language of instruction becomes a central area of discussion in academia. TE encompasses a teacher's ability to improve student learning as measured by standardized tests (Little et al., 2009). Stronge (2007) also contends that student achievement is the ultimate evidence of teacher effectiveness through the value-added model.

The Center for Educational Policy Research (CEPR) (2011) illustrates that the value-added model helps to determine students’ academic progress from one year to the next as the result of the impact of factors outside the teacher’s control such as the students' living standards, English language proficiency, teacher salary, etc. The CEPR denotes that the value-added model is important for two main reasons: first, it directly links teacher effectiveness to student learning, and second, it provides shared average findings for groups of teachers.

Chen et al. (2020) examine EMI effectiveness from three perspectives: proficiency in the English language use, EMI pedagogy or teaching strategies, and personal factors like teachers’ perceptions and attitudes towards EMI. Sah (2022) also accepts the value of English language proficiency and EMI pedagogy for teachers’ effectiveness and questions what could happen if teachers were challenged due to a lack of language proficiency and pedagogy. This study also gauges TE in using EMI in these three domains: language proficiency, EMI pedagogy, and the personal situation of science teachers in their lesson delivery. The domains served as the basis for the conceptual framework for this study.

English language proficiency is central for EMI teachers (Chen et al.,2020). According to the authors, English language proficiency encompasses a variety of skills, including but not limited to pronunciation, vocabulary acquisition, grammar use, sentence structures, and understanding of singular and plural nouns and conjunctions. Effective pedagogical practices in EMI classrooms prioritize students' understanding of scientific concepts. This fosters productive learning environments that significantly benefit students

(McComas, 2014). McComas adds that to ensure effective language pedagogy in science classrooms, teachers should identify their students' language resources in both the home language and English.

Teacher attitudes towards EMI are mixed. Some view it as a mandatory policy imposed by schools, while others see it as a preferred approach. This is supported by the review by Galloway et al. (2017), which highlights contrasting findings in research. While some studies show positive teacher attitudes, others indicate resistance due to challenges in explaining concepts through English (Galloway et al., 2017). Therefore, further research is needed to explore the attitude of teachers towards EMI and develop strategies to create a more positive and enabling environment for EMI implementation.

Problem Statement

Although EMI retains an international reputation and gets a wider promotion, some challenges deter its implementation. According to Bradford (2016), these challenges include learners' difficulties in comprehending content and teachers' inability to deliver lessons with the appropriate command of the English language (linguistic problems). Additionally, there can be a mismatch between the mode of delivery students are accustomed to in their local language and the new approach in EMI implementation (cultural challenge). Furthermore, structural challenges which include the limited number of EMI courses, teachers' lack of confidence in delivering courses through EMI, and insufficient support from institutions to maintain a high professional level for teachers daunt its implementation. Finally, identity-related challenges arise when the EMI program itself is perceived as a way to suppress local languages and threaten students' first language development and popularity (Bradford, 2016).

In addition, the impact of EMI on student achievement remains unclear. While some studies find no significant difference in achievement between EMI and non-EMI students (Dafouz & Camacho-Miñano, 2016; Yang et al., 2019) others suggest that students may face difficulties learning content through English (Kirkgoz, 2005; Sert, 2008). This inconsistency highlights the need for further research to understand the factors that influence the effectiveness of EMI for student learning.

Furthermore, there is a significant gap in research on EMI at the primary school level. In their state-of-the-art article, Macaro et al.(2018) tried to review research works on EMI. The researchers reviewed 285 articles in all educational phases: pre-primary, primary, secondary, and higher institutions, along with the main regions where EMI is practiced: Africa, Asia, Europe, the Middle East, and South America. The result indicates that there is paucity of research findings in the area. At the primary school level, out of 41 articles, the Middle East was represented only by one, Africa by two, Asia by eighteen, and Europe by twenty articles. It is tacit that Africa's representation in EMI, including Ethiopia, was scanty, when compared to Asia and Europe during the study period, 2017. Thus, the scarcity of research on primary schools in the study area triggers further investigation.

Low students' achievement in science subjects is a pressing concern in the Amhara Region of Ethiopia, particularly at the Grade 8 level. The baseline survey of the general science subject regional exam results from 2018/2019-2020/21 discloses the prevalence of problems in learners' achievement. The data from the Debre Birhan City Education Office affirms the situation. For instance, in 2018/19 among 1601 students who sat for the Grade 8 regional examination, 68.59% of the learners got below average in general science subject. Similarly, in the 2019/20 academic year, among a total of 1349 students who took the regional examination, only 23.74% achieved scores above the average. In a similar vein, in 2020/21, only18.56% obtained above average. Conversely, 81.44% of the students received below average in the same year. All these suggest the presence of the issue regarding success in general science subjects at the Grade 8 level in the study area when one of the contributing factors for lower academic achievement can be the use of EMI in science classes (McComas, 2014).

The prevalence of such problems makes the investigation of EMI teachers' effectiveness vital and timely because TE serves as a basis for students' academic success (Stronge, 2007). When English is used as a language of instruction, it is not only a tool for communication but also a gateway to the acquisition of knowledge (Hudson, 2009). Rose et al. (2019) argue that teachers need language proficiency, pedagogical strategies, and positive personal situations in addition to subject knowledge.

This situation highlights a critical gap in our understanding of how EMI effectiveness relates to student achievement in science subjects like general science. While research explores TE and SAA in general(Husarida & Dollete, 2019; Stronge et al., 2011), there is a lack of research investigating the specific relationship between TE in using EMI and student success in EMI science classes at primary level.

Thus, the purpose of the current study is to examine the nexus between TE in teaching science using EMI in the upper primary schools (Grade 8) and SAA, with particular goals of: (1) exploring the relationship between general science TE in using EMI and SAA, (2) determining which of the dimensions of EMI account for the greatest variability in SAA, and (3) analyzing whether demographic variables (sex, qualification, and experience) of teachers co-variate with SAA.

To achieve these objectives, the following hypotheses were formulated: (1) there will be a significant positive correlation between general science teachers' effective EMI use dimensions (EMI proficiency, EMI pedagogy, and personal situation) as measured by the TE questionnaire and SAA, as measured by an academic achievement test; (2) the general science teachers' effective EMI use dimensions can be used to predict SAA; (3) there will be a significant positive relationship between general science teachers' demographic variables (sex, qualification, and experience) and SAA.

Methods

Study Design

The present study sought to investigate the relationships between TE in using EMI and SAA using a non-experimental correlational design. Because TE in EMI and SAA involve many interacting factors, a correlational approach was preferred to an experimental design. Correlational techniques are useful in addressing real-world or intricate problems that cannot meaningfully be explored through experimental investigation (Tabachnick & Fidell, 2013).

Study Participants

The study was conducted in Debre Birhan City, Amhara, Ethiopia. The target population was Grade 8 science teachers and students. Grade 8 was chosen for two key reasons. First, EMI begins in Grade 7 in the Amhara regional state, and a second-year experience in Grade 8 could give more exposure to the students' learning in EMI. Second, students' Grade 7 average result in general science was intended to be used as baseline data to predict students' achievement at the Grade 8 level because the value-added model began by identifying a baseline result. General science (the mix of biology, physics, and chemistry) was chosen because it was one of the few subjects in which teachers delivered lessons in English in the study area.

In the 2022/23 academic year, Debre Birhan City had 54 general science teachers teaching 2107 Grade 8 students across 62 classrooms. The teachers were assigned to 35 government schools. A sample size was determined using Cohen et al. (2018) with a 95% confidence level and a 5% confidence interval. This resulted in the selection of 47 teachers out of the total. To align with the teachers' sections, a purposive sampling method was used to select 1645 students from 47 sections. To determine the actual participants, a systematic sampling was applied with every 'N' after receiving the list of all general science teachers from Debre Birhan City Administration Education Office. Hence, 47 teachers and their respective students in 47 sections were made to be part of the investigation. None the less, two teachers were not able to return the questionnaires. Therefore, only data from 45 teachers and their 1575 corresponding students was entered for analysis.

The descriptive analysis of the demographic variables indicated that among the participating primary school teachers, 21 (46.7%) were male and 24 (53.3%) were female. Regarding qualifications, 20 (44.4%) were diploma graduates, while 25 (55.6%) held first degrees in general science education. The sample teachers had three categories of teaching experience. 14 (31.1%) had 1–5 years of experience, 15 (33.3%) had 6–10 years of experience, and the remaining 16 (35.6%) had over ten years of teaching experience.

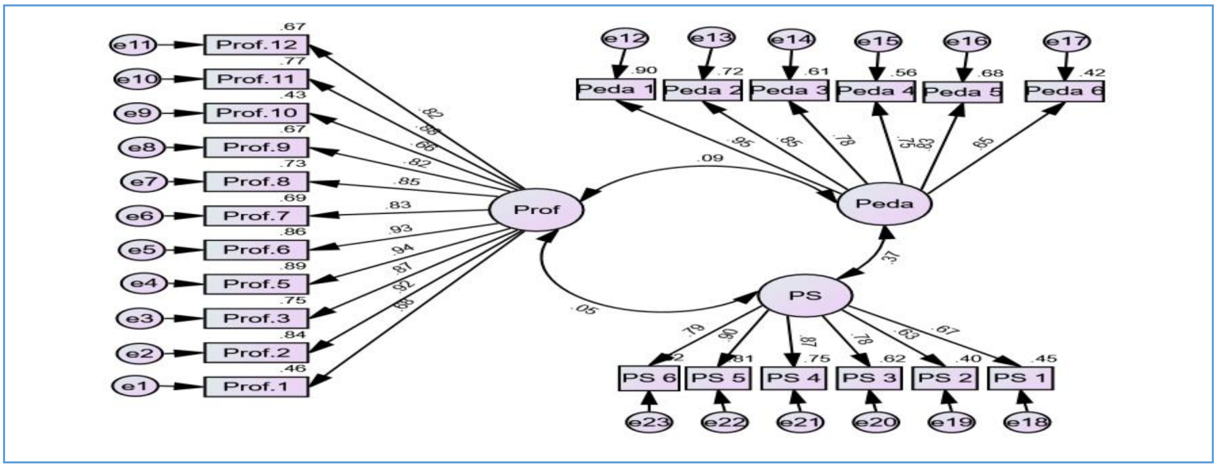
Instruments

Teacher Effectiveness Questionnaire

The purpose of the questionnaire was to determine the effectiveness of general science teachers in using EMI to deliver lessons in the upper primary schools. The questionnaire had two parts. Part one was about the background information of science teachers, whereas part two was made up of three major components: English language proficiency, EMI pedagogy, and the personal situations of teachers. The three dimensions received Cronbach Alpha values of.861, .846, and.844, respectively. The questionnaire was of the five-point Likert scale type, ranging from "very less" to "very high extent". The test was developed by the researchers themselves based on works of Bachman and Palmer, (1996), Chen et al. (2020), Sahan et al., (2021), and Shrestha, (2022).

Figure 1

The Factor Loading for all Items of EMI Constructs



To address issues in construct validity, confirmatory factor analysis (CFA), which helped to respond to convergent and discriminant validity, and analysis of moment structure (AMOS) of Version 26 was employed. Of the three latent variables (Figure 1), EMI proficiency had eleven observed items, EMI pedagogy had six, and personal situation had the other six. All the loading variables were found to be over 0.6, and similarly, all R^2 values were above 0.4, evidencing achievement in convergent validity, according to Byrne (2010). The output also indicated that the correlation among the latent variables was low and was later used to determine the discriminant validity.

The CFA report for every construct indicated that each loading factor was above 0.6 and every AVE value was above 0.50, indicating good convergent validity (Hu & Bentler, 1999). The results of CFA also indicate that the chosen model to measure TE in using EMI had good fit statistics (Table1), including Chi-square (X^2/DF) =1.244, RMSEA of 0.075, GFI of 0.949, and CFI of 0.956, all meeting Byrne's (2010) criteria for good fit.

Table 1

The Fitness Index for the Measurement

Name of Category	Name of Index	Index Value	Comments
Absolute Fit	RMSEA	0.075	The requirement is achieved
	GFI	0.949	The requirement is achieved
Incremental Fit	CFI	0.956	The requirement is achieved
Parsimonious Fit	Chisq/df	1.244	The requirement is achieved

Note. RMSEA=Root Mean Square of Error Approximation; GFI= Goodness of Fit Index; CFI= Comparative Fit Index; Chisq /DF= Chi Square/Degrees of Freedom

To assess discriminant validity, the average variance extracted (AVE) was calculated for each construct. Thus, the diagonal values in bold for EMI proficiency, EMI pedagogy, and personal situations (Table 2) were obtained. The remaining values refer to the correlation between the constructs. The values in Table 2 imply that discriminant validity for all constructs is achieved because the diagonal values in bold are higher than the values in rows and columns.

Table 2

The Discriminant Validity Index Summary for EMI Constructs

Construct	EMI Proficiency	EMI Pedagogy	Personal Situation
EMI Proficiency	**0.84**		
EMI Pedagogy	0.09	**0.80**	
Personal Situation	0.05	0.37	**0.78**

Students' Academic Achievement Test

The final instrument for the current research was the students' academic achievement test. Kubiszyn and Borich (2003) underline that test validity should be seen from three perspectives: content, criterion-related, and construct validity. However, they argue that for an achievement test, content validity evidence holds the most weight, as it demonstrates how well the test measures the intended content. Following this principle, the test was made to measure what it was supposed to measure, specify the contents to be included (content coverage), minimize guessing answers, and make the items measure instructional objectives given in the Grade 8 general science textbook. The textbook had seven chapters that dealt with the basics of scientific investigations: the composition of matter, classification of compounds, human body systems and health, ecosystems and conservation of natural resources, the solar system, and physical phenomena in the surrounding area**.**

To ensure that the test was well-developed, it underwent several stages and processes. For instance, the test developers received training from an expert in the area, created a table of specifications, wrote, and piloted the test. Moreover, other science teachers commented on the test items. After comments and piloting, an item analysis (for indices of item difficulty and discrimination) was carried out for each item, and the test was improved based on the analysis's findings.

Ultimately, during the second semester of 2022-2023, a sixty-item multiple-choice test based on Grade 8 general science curriculum materials was administered under supervision. It was noted that the major purpose of the test was not to test teachers' content knowledge but rather their language use in lesson delivery and how they used the instructional language for students' academic success. In this regard, each teacher was examined based on the mean results of students in their respective sections. The grand mean of the section was used to indicate the effectiveness of the teacher. This coincides with the basic conceptions of the value-added model.

Data Analysis

Descriptive statistics were used to analyze the demographic information of the participants. This included calculating frequencies, means, and standard deviations for the number of male and female science teachers, their educational backgrounds, and their teaching experience. Inferential statistics were employed in different phases of the analysis. First, the correlation between TE in using EMI and SAA was measured. Therefore, a Pearson product-moment correlation was computed. Second, to determine which teachers' EMI effective use sub-scales predicted SAA, a standard multiple regression was worked out. Finally, to examine the relation of the demographic variables to SAA, hierarchical multiple regressions were applied.

Before calculating the correlation between the variables, the normality of the data was assessed. This involved generating scatter plots to visually inspect the linear relationship and checking for outliers that could artificially inflate or deflate the correlation coefficient (r). For the results that passed the normality test, Pearson's product moment correlation was applied. The Z scores for Skewness and Kurtosis fell within the range of -1.96 to 1.96, suggesting the normality of the variables. Similarly, assumptions were checked for the multiple regressions using scatter plots to check the relationship between each independent variable and the dependent variable and to check the relationship among the independent variables using multicollinearity and the correlation matrix. During the normality check of hierarchical multiple regressions, a non-parametric Kruskal-Wallis was applied as experience in teaching Grade 8 was not normally distributed.

Results

Correlation Results

The Relationship between Teacher Effectiveness in Using EMI and SAA

Hypothesis one was developed to ascertain the relationship between the dimensions and the composite outcome of teachers' effectiveness in employing EMI and SAA and ultimately accomplish objective one. The relationship between the three dimensions of EMI (proficiency, pedagogy, and personal situation) and SAA was computed using the Pearson Product-Moment Coefficient. The total correlation between EMI and SAA was also calculated. The results are presented in Table 3. There was a statistically significant but weak positive relationship between the general science teachers' EMI proficiency and their SAA [$r = .28$, $n = 45$, $p < .05$]. Compared to the critical value of $r = .2428$ for 43 degrees of freedom (directional test), this correlation is significant at the .05 level.

The subsequent statistical analysis revealed a significant and strong relationship between teachers' EMI pedagogy and SAA [$r = .55$, $n = 45$, $p < .01$]. The obtained value $r = .55$ makes the correlation significant when compared with the critical value $r = .3384$ for 43 degrees of freedom at the.01 significance level for a directional test. The correlation between teachers' personal situation and SAA was moderate and significant ($r = .35$, $n = 45$, $p < .01$). Finally, a significant and strong positive relationship was found between the composite EMI score and SAA ($r = .59$, $n = 45$, $p < .01$) and helped to retain hypothesis one.

Table 3

Descriptive Statistics and Correlations between the Dimensions of EMI and SAA

Variable	M	SD	1	2	3	4	5
1. EMI Proficiency	3.02	.35	-	.138	-.222	.441**	.282*
2. EMI Pedagogy	2.90	.34		-	.234	.259**	546**

Variable	M	SD	1	2	3	4	5
3. Personal Situation	3.20	.67			-	.743	.351**
4. EMI Mean	3.05	.28				-	.585**
5. SAA	33.23	2.34					-

Note. n=45 (for each variable), EMI=English as a Medium of Instruction; SAA=Students' Academic Achievement

Multiple Regression Results

To determine which of the independent variables predicted the greatest amount in SAA (the relative contribution of each independent variable) and how much of the variance in SAA was explained by the scores of EMI, a standard multiple regression was employed. Thus, hypothesis two was formulated to achieve the second goal.

English Medium of Instruction for Predicting SAA

Table 4

ANOVA Table: EMI Predicting SAA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	103.735	3	34.578	10.266	.000[b]
	Residual	138.097	41	3.368		
	Total	241.833	44			

Note. a. Dependent Variable: Students' academic achievement
b. Predictors: Constant, personal situation mean, EMI proficiency mean, EMI pedagogy mean

Table 5

Model Summary EMI Predicting SAA

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.655[a]	.429	.387	1.83527

Note. a. Predictors: Constant, personal situation, EMI proficiency, EMI pedagogy
b. Dependent Variable: Students' academic achievement

The ANOVA results (Table 4) show a significant regression effect, F (3, 41) = 10.27, p <.001. In addition, the model summary table, Table 5, displays an R-value of.66 with a 95% confidence interval. The R-value suggests a high correlation between the predictors and the outcome. On the other hand, R^2 in our model, which includes EMI proficiency, EMI pedagogy, and personal situation, explains 42.9% of the variance in SAA, indicating that 57.1% of the variance in SAA is attributed to other non-EMI effective use variables. The adjusted R^2 value is .39. 95% confidence intervals were found for the three regression coefficients that differed significantly from zero. Consequently, the confidence intervals for EMI proficiency were found to be.287 to 3.619, EMI pedagogy to be 1.249 to 4.681, and personal situation to be.210 to 1.975.

Table 6 presents the standard multiple regression analysis. The standardized beta coefficients (β) and significance levels (p-values) of the three independent variables (IVs) indicate their relative contribution to SAA prediction. EMI proficiency ($\beta = 0.292$, $p < 0.05$), EMI pedagogy ($\beta = 0.432$, $p < 0.05$), and personal situation ($\beta = 0.315$, $p < 0.05$) all have significant beta values. This indicates that EMI pedagogy and the personal situation of the teachers contributed more for SAA than teachers' EMI proficiency. The intercept value in Table 6 also reveals the amount students can achieve if the issues related to EMI proficiency, EMI pedagogy, and personal situation are kept to zero.

Table 6

Standard Multiple Regression of EMI Proficiency, EMI Pedagogy, and Personal Situation on SAA

Variables and Values	SAA	EMI Proficiency	EMI Pedagogy	Personal Situation	B	β	Sr^2
EMI Proficiency	.28	-			1.96*	.292	.0778
EMI Pedagogy	.55	.14	-		2.97**	.432	.169
Personal Situation	.35	-.22	.23	-	1.10*	.315	.0870
					R^2= .43		
					Adjusted R= .39		
					R= .66**		
Constant/Intercept = 15.2							

Note. **P < .01; *P < .05

Demographic Variables in Predicting SAA

To see if demographic variables such as sex, qualification, and experience were able to predict a significant amount of variance in SAA, hypothesis three was formulated. This helped to achieve objective three.

The model summary for demographic variables (Table 7) shows Model 1 (including sex, qualification, and experience) explains 24% of the variance in SAA (R-squared). Adding the three EMI dimensions (Model 2) significantly increased the explained variance by 28.1% (to a total of 51.6%), $F(3, 38) = 7.35$, $p < .001$.

In the ANOVA table for demographic variables, Table 8, the results evidence that the entry of demographic variables in particular (Model 1) resulted in a significant prediction equation, $F(3, 41) = 4.19$, $P < .05$. The additional inclusion of the three dimensions of EMI variables (Model 2) resulted in an overall significant prediction equation, $F(6, 38) = 6.74$, $P < .001$.

Table 7

Model Summary Table for Demographic Variables in Predicting SAA

Model	R	R Square	Adjusted R Square	Change Statistics				
				R Square Change	F Change	df1	df2	Sig. F Change
1	.484[a]	.235	.179	.235	4.189	3	41	.011
2	.718[b]	.516	.439	.281	7.349	3	38	.001

Note. a. Predictors: Constant, sex, experience teaching in grade 8, educational qualification

b. Predictors: Constant, Sex, experience teaching in grade 8, educational qualification, EMI pedagogy, personal situation, EMI proficiency

c. Dependent Variable: Students' academic achievement

Table 8

ANOVA Table for Demographic Variables

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	56.737	3	18.912	4.189	.011[b]
	Residual	185.096	41	4.515		
	Total	241.833	44			
2	Regression	124.696	6	20.783	6.742	.000[c]
	Residual	117.136	38	3.083		
	Total	241.833	44			

Note. a. Dependent Variable: Students' academic achievement
b. Predictors: Constant, sex, experience teaching in grade 8, educational qualification
c. Predictors: Constant, sex, experience teaching in grade 8, educational qualification, EMI pedagogy mean, personal situation mean, EMI proficiency mean

Among the demographic variables, only respondents' experience significantly contributed to the prediction of SAA (β =.28, t = -2.22, P <.05). If teachers' experience was found to predict SAA, it is worth asking whether the three experience groups (G1, G2, and G3) had a significant difference. This needs one-way between-groups ANOVA. Before running the test, the normality assumptions were checked. The Shapiro-Wilk test result indicated that experience in teaching Grade 8 was not normally distributed, P =.000, indicating a violation of normality. Therefore, a non-parametric test, Kruskal-Wallis, was applied. The test result revealed a statistically significant difference in SAA across the three experience groups (Gp1, n = 14: 1–5 years, Gp2, n = 15: 6–10 years, Gp3, n = 16: 11 + years), x^2 (2, n = 45) = 7.43, P =.024. Among the three groups, the least experienced teachers group recorded the highest median score (Md = 30.71) compared to the other two groups, which obtained (Md = 21.07) for the middle group and (Md = 18.06) for the most experienced group.

Table 9 provides the unstandardized coefficient output that lets us interpret the relationship between teachers' EMI effectiveness and SAA. This means that as teachers' EMI proficiency increases by one scale (as measured by the Likert scale of 1–5 from strongly disagree to agree strongly), SAA increases by 2.29% (as measured by the SAA Test out of 100). This interpretation is true only if the other dimensions (EMI pedagogy and personal situation) are held constant. Similarly, as teachers 'EMI pedagogy increases by one scale, SAA increases by 2.19%. Finally, as the personal situation of teachers increases by one scale, SAA can increase by 1.16% when, in all cases, the other variables are held constant. This suggests that increasing teachers' EMI proficiency, EMI pedagogy, and personal situation increases SAA.

Table 9

Coefficient table for hierarchical multiple regression on demographic variables

Model		Unstandardized Coefficients	Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Beta			Tolerance	VIF
1	Constant	33.60		15.65	.00		
	Qualification	1.37	.293	1.70	.096	.629	1.589
	Experience	-1.25	-.438	-3.08	.004	.918	1.089
	Sex	.033	.007	.042	.967	.638	1.566
2	Constant	18.993		4.985	.000		
	Qualification	-.149	-.032	-.177	.860	.394	2.539
	Experience	-.790	-.278	-2.220	.032	.813	1.230
	Sex	-.579	-.124	-.756	.454	.471	2.124
	EMI Proficiency	2.291	.343	2.233	.031	.540	1.851
	EMI Pedagogy	2.189	.319	2.444	.019	.747	1.338
	Personal Situation	1.160	.334	2.407	.021	.661	1.513

Discussion

The Relationship between Teacher Effectiveness in using EMI and SAA

The study examined the relationships between SAA and the effectiveness of general science teachers' use of the English language for instruction in the Debre Birhan City. It also aimed to identify the aspects of EMI that most significantly contributed to variability. Additionally, it looked at the possibility of covariation between SAA and demographic factors such as sex, qualification, and experience. To achieve the objectives, three hypotheses were tested.

The links between the dimensions of EMI and the composite outcome of TE in implementing EMI and SAA were tested for hypothesis one. The result for H1 indicated a weak but positive relationship between teachers' EMI proficiency and SAA. The result suggests that as the EMI proficiency of general science teachers, such as their ability to pronounce scientific terms, define science words, use suitable grammatical rules, ask and answer questions, etc. increases, students' academic success also increases. Nonetheless, this weak correlation indicates the absence of important elements in teachers' proficiency in supporting their students using the language of instruction. The result also implies the inadequacy of sound and script knowledge, lexico-grammatical knowledge, and discourse-semantic knowledge, which are relevant to unfolding meaning in a text and giving scientific explanations, classifications, and descriptions, as Hao (2021) argues. Despite the weak effect size, the statistically significant correlation coefficient (r =.28) was obtained.

The correlation matrix showed a significant and strong relationship between teachers' EMI pedagogy and their students' success. This indicates that as general science teachers' pedagogical knowledge of using EMI increases (e.g., enhancing student participation through questioning, using demonstrations and hands-on activities, employing repetition for clarity, and fostering teacher-student interaction), SAA also increases. The result is in line with McComas's (2014) assertion that teachers with strong pedagogical practice value what they should do to help students understand science concepts and ultimately create effective learning settings from which students benefit a lot. The result supports the importance of making pedagogy part of TE as pedagogy cannot be separated from language use (Sahan et al., 2021). Chen et al. (2020) and Shrestha (2022) also recognize the strong role of EMI pedagogy in EMI classrooms which ultimately supports student success.

The correlation between teachers' personal situation and SAA was moderate and significant. This suggests that when teachers have a positive attitude towards EMI, are motivated, and believe in its effectiveness for their science classes, student achievement in general science also increases. The result supports Dearden's (2014) argument that when teachers perceive EMI positively, it helps to share ideas with others, facilitate communication, and enhance the personal and professional development of their own and their students. The outcome is consistent with Shrestha's (2022) findings about teachers' positive sentiments regarding the use of EMI. She believes that EMI may improve students' and teachers' English language skills, as well as SAA, if teachers are enthusiastic and driven to use it in the classroom. Unlike Dearden and Macaro (2016), whose findings indicate that teachers' attitudes toward EMI are ambiguous, exhibiting both support and opposition, the results of this study demonstrated a moderate and positive association.

A significant and strong positive relationship was found between the composite EMI score and SAA.This indicates a strong overall correlation between TE in using EMI (an independent variable) and SAA (a dependent variable). Consistent with this finding, a study conducted by Heck (2009) found that TE was related to student achievement in both reading and math. Student outcomes, in Stronge's opinion (2007), are the best evidence of a TE and suggest strong relationships between their effectiveness and SAA. Odden et al. (2004) also indicate that TE has a significant influence on student achievement. In sum, the results of the current study point out that hypothesis one is upheld, accepting a significant relationship between TE in using EMI and SAA.

The Relative Contribution of Each Independent Variable

To find out which independent variable predicted the most in SAA (the relative contribution of each independent variable) and how much of the variance in SAA was explained by the EMI scores, we evaluated hypothesis two. Initially, there was a high correlation between the predictors and the outcome. It was also identified that EMI dimensions explained 42.9% of the variance in SAA. The adjusted R^2 value of.39 also indicated that more than a third of the variability in SAA was predicted by teachers’ EMI proficiency, EMI pedagogy, and personal situation.

The standard multiple regression analysis results suggest that all three variables contributed to predicting SAA, with EMI pedagogy having the strongest effect, followed by personal situation, and then EMI proficiency. This implies that teachers’ EMI proficiency contributed less to SAA when compared to the other two IVs. This suggests the inadequacy of what Bachman and Palmer (1996) term as grammatical knowledge (e.g. producing grammatically acceptable sentences, asking well-structured questions, constructing passive sentences, pronouncing words correctly, etc.), textual knowledge(e.g. knowledge of cohesion), functional knowledge (e.g. explaining meaning, interpreting meaning, giving commands and suggestions, etc.) and heuristic knowledge (e.g. using language for teaching).

Demographic Variables in Predicting SAA

In testing the potential of demographic variables such as sex, qualification, and experience in predicting a significant amount of variance in SAA, hierarchical multiple regression results indicated that among the demographic variables, only respondents' experience significantly contributed to the prediction of SAA (β =.28, t = -2.22, P <.05). The result is consistent with Francisco's (2020) finding, which revealed that personal characteristics such as sex and qualification, along with other characteristics of the population (age, civil status, academic rank, and performance rating), were not able to predict students' achievement in English. A previous study by Tella (2008) on teacher variables as predictors of academic achievement of primary school pupils in mathematics found that teacher variables such as attitude, qualification, and experience were not able to predict students' achievement in mathematics subject. A similar study conducted in Kenya, by Kimani et al. (2013)on teacher factors influencing SAA in secondary schools found that teachers' age, gender, professional qualification, and teaching experience were not significantly related to SAA. Zhang (2008) also found that years of teaching experience in science did not directly influence student science achievement. However, experience seems to play a different role in this study. Nonetheless, Hypothesis three was partially accepted.

In analyzing which group of teachers contributed more to the academic success of students (G1, G2, and G3), the less experienced teachers group (1-5 years) achieved the highest median score (M=30.71). This implies that younger teachers contributed more to the success of the students than their senior teachers. This could be due to the teachers' nearing graduation from college and their potency in making use of what they learned. However, the outcome deviates from the conception held. According to Huang and Moon (2009), a teacher should be more effective the more years of experience they have. Similarly, Strong (2006) argues that the effectiveness of more seasoned teachers is greater than that of recently hired new teachers.

Conclusions and Recommendations

Conclusions

Numerous study results attest to the growing tendency of educational institutions and schools to use EMI at different levels. Although there are a number of reasons why EMI is so popular in Africa and other parts of the world, there hasn't been enough talk on how students are affected when primary school teachers are effective in using English to raise students' academic achievement levels.

The findings revealed a positive and significant relationship between the three EMI dimensions and SAA. These dimensions explained 42.9% of the variance in SAA, while the remaining 57.1% is likely attributed to other factors beyond effective EMI use. The results obtained here support the view that TE is positively and significantly aligned with students' academic gains, as noted under the discussions section. The findings were validated by statistically significant coefficient outcomes for every EMI dimension and the combined EMI and SAA output.

In addition to determining the correlation coefficients, regression analysis was also run to explore which of the dimensions of the independent variable (EMI) was responsible for the greatest variance in SAA. The Standardized Coefficient Beta values (β) revealed a strong correlation between EMI predictors and outcomes. This is evident from the model summary. EMI could also be used to predict more than one-third of the variability in SAA. However, EMI proficiency (as a dimension of EMI) was found to be the least in its relative contribution.

In analyzing the moderating effect of the demographic variables of the respondents (sex, qualification, and experience) between EMI dimensions and SAA, the correlated and regressed independent variables (the demographic characteristics) were computed. Although the demographic variables could predict SAA significantly in sum, it was only partial because sex and educational qualification could not moderate between EMI and SAA. Younger teachers with less experience appeared to be associated with higher SAA.

Overall, our findings suggest a positive correlation and regression between TE in using EMI and SAA, implying that enhancing this effectiveness can significantly improve student achievement. The unstandardized coefficient output suggests that increases in any of the EMI dimensions contribute equally to increases in SAA. However, further investigation is needed to understand the specific reasons behind the association between younger, less experienced teachers and higher SAA.

Recommendations

The current research sought the association between teachers' EMI competence in teaching general science and their contribution to the academic success of students in Grade 8. From the research findings identified, the following recommendations are made:

The results obtained from regression coefficients indicated that TE in using EMI could explain about 42.9% of the variance in SAA. This implies that if teachers vigorously work on teachers' effective use of EMI, students' achievement can be improved in a meaningful way. Therefore,

First, primary schools, making use of the continuous professional development programs in their schools, should organize targeted training workshops that can enhance teachers' EMI use competence and help teachers share experiences on best practices in using EMI effectively. The schools can provide training in collaboration with teacher education colleges and universities.

Second, primary schools should develop supportive materials and resources that can be used as guidelines while delivering lessons in English. A good example can be "classroom English" templates to assist teachers in their everyday classroom interactions. This can again be achieved by working with teacher education colleges and universities because they can align the target language use with the needs of the EMI teachers.

Third, the demographic characteristics of teachers revealed that less experienced teachers contributed more to SAA. Thus, seasoned teachers should work in pairs with younger teachers and share fresh perspectives on teaching methods and effective language use. The school should also encourage a system of peer observation where teachers can learn from each other's practices, fostering a culture of continuous improvement. The school can also promote collaborative teaching and foster a regular feedback mechanism through which teachers receive suggestions on their performances and SAA.

Finally, to enhance the effective use of EMI and SAA, it is essential for policymakers, school administrators, teacher education colleges, education universities, and researchers to assess the current status of EMI and its impact on SAA, while also introducing comprehensive implementation policies for EMI. Furthermore, to deepen the exploration of EMI in science teaching, future research should consider incorporating additional variables to covariate the independent and dependent variables. Expanding the sample size and employing a canonical correlation design would enable a more nuanced understanding by allowing for multiple independent and dependent variables, thereby enriching the overall analysis of EMI's effectiveness in educational contexts.

Limitations

The following restrictions are recognized to initiate further research from different perspectives: For instance, it had a small sample size, particularly focusing on general science teachers at a specific study site. It would have been better if wider areas had been included and other disciplines, such as mathematics, could be added. Similarly, other teacher attributes like teachers' workload, salary, and performance rating could be incorporated. Likewise, using a qualitative method to support outcomes creates more chances and enhances the result. Ultimately, a correlational study that examines associations fails to assess causal relationships between variables and paves the way for further investigations.

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References

Bachman, & Palmer. (1996). *Language testing in practice: Designing and developing useful language testso*. UniversitOxford y Press.

Bernhofer, J., & Tonin, M. (2022). The effect of the language of instruction on academic performance. *Labour Economics*, *78*, 102218.

Bradford, A. (2016). Toward a typology of implementation challenges facing English-medium instruction in higher education: Evidence from Japan. *Journal of Studies in International Education*, *20*(4), 339–356. https://doi.org/10.1177/1028315316647165

Byrne, B. M. (2010). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (2nd ed.). Routledge Taylor & Francis Group.

Center For Educational Policy Research. (2011). *Value-added measures : How and why the* *strategic data project uses them to study teacher effectiveness*. Harvard University. http://www.gse.harvard.edu/~pfpie/pdf/

Chen, H., Han, J., & Wright, D. (2020). An investigation of lecturers' teaching through English medium of instruction—A case of higher education in China. *Sustainability*, *12*(10), 4046.

Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.). RoutledgeFalmer.

Dafouz, E., & Camacho-Miñano, M. M. (2016). Exploring the impact of English-medium instruction on university student academic achievement: The case of accounting. *English for Specific Purposes*, *44*, 57–67. https://doi.org/10.1016/j.esp.2016.06.001

Dearden, J. (2014). English as a medium of instruction – a growing global phenomenon: phase 1. *Going Global 2014, Interim Report, Oxford: Department of Education, University of Oxford.*, *April*, 1–8. https://www.britishcouncil.org/sites/default/files/english_as_a_medium_of_instruction.pdf

Dearden, J., & Macaro, E. (2016). Higher education teachers' attitudes towards English medium instruction: A three-country comparison. *Studies in Second Language Learning and Teaching*, *6*(3), 455–486. https://doi.org/10.14746/ssllt.2016.6.3.5

Francisco, A. R. (2020). Teachers' personal and professional demographic characteristics as predictors of students' academic performance in English. *International Journal of Management, Technology, and Social Sciences*, *5*(2), 80–91. https://doi.org/10.47992/ijmts.2581.6012.0105

Galloway, N., Kriukow, J., & Numajiri, T. (2017). *Internationalisation, higher education and the growing demand for English: An investigation into the English medium of instruction (EMI) movement in China and Japan*. The British Council. https://www.teachingenglish.org.uk/sites/teacheng/files/H035 ELTRA Internationalisation_HE_and the growing demand for English A4_FINAL_WEB.pdf

Hao, J. (2021). Building taxonomies: A discourse semantic model of entities and dimensions in biology. In K. Maton, J. R. Martin, & Y. J. Doran (Eds.), *Teaching Science: Knowledge,language,pedagogy* (pp. 134–161). Routledge.

Heck, R. H. (2009). Teacher effectiveness and student achievement: Investigating a multilevel cross-classified model. *Journal of Educational Administration*, *47*(2), 227–249. https://doi.org/10.1108/09578230910941066

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Huang, F. L., & Moon, T. R. (2009). Is experience the best teacher ? A multilevel analysis of teacher characteristics and student achievement in low performing schools. In *Educ Asse Eval Acc* (Vol. 21). https://doi.org/10.1007/s11092-009-9074-2

Hudson, P. (2009). Learning to teach science using English as the medium of instruction. *Eurasia Journal of Mathematics, Science and Technology Education*, *5*(2), 165–170. https://doi.org/10.12973/ejmste/75268

Husarida, H., & Dollete, R. (2019). Perceived effectiveness on the use of English language in teaching mathematics and science. *Indonesian Research Journal in Education| IRJE|*, *3*(1), 177–198.

Jenkins, J. (2013). *English as lingua-franca in the international university: The politics of academic English language policy* (1st ed.). Routledge Taylor & Francis Group. https://doi.org/. DOI: 10.4324/9780203798157o

Kimani, G. N., Kara, A. M., & Njagi, L. W. (2013). Teacher factors influencing students' academic achievement in secondary schools in Nyandarua County, Kenya. *International Electronic Journal of Elementary Education*, *1*(1), 16–33.

Kirkgoz, Y. (2005). English language teaching in Turkey: Challenges for the 21st century. In G.Braine (Ed.), *Teaching English to the world: History , curriculum, and practice* (pp. 159–175). Rutledge.

Knight, J. (2013). The changing landscape of higher education internationalisation - for better or worse? *Perspectives: Policy and Practice in Higher Education*, *17*(3), 84–90. https://doi.org/10.1080/13603108.2012.753957

Kubiszyn, T. and, & Borich, G. (2003). *Educational testing and measurement: Classroom application and practice.* (7th ed.). John Wiley & Sons,INC.

Little, O., Goe, L., & Bell, C. (2009). *A practical guide to evaluating teacher effectiveness* (Issue April). https://eric.ed.gov/?id=ED543776%0Ahttps://www.wested.org/wp-content/uploads/teacher-effectiveness-guide.pdf

Macaro, E., Curle, S., Pun, J., An, J., & Dearden, J. (2018). A systematic review of English medium instruction in higher education. *Language Teaching*, *51*(1), 36–76. https://doi.org/10.1017/S0261444817000350

McComas (Ed.). (2014). *The language of science education*. Sense Publishers.

Odden, A., Borman, G., & Fermanich, M. (2004). Assessing teacher, classroom, and school effects, including fiscal effects. *Peabody Journal of Education*, *79*(4), 4–32. https://doi.org/10.1207/s15327930pje7904_2

Rose, H., Curle, S., Aizawa, I., & Thompson, G. (2019). What drives success in English medium taught courses? The interplay between language proficiency, academic skills, and motivation. *Studies in Higher Education*, *0*(0), 1–13. https://doi.org/10.1080/03075079.2019.1590690

Sah, P. K. (2022). English medium instruction in South Asian's multilingual schools: Unpacking the dynamics of ideological orientations, policy/practices, and democratic questions. *International Journal of Bilingual Education and Bilingualism*, *25*(2), 742–755. https://doi.org/10.1080/13670050.2020.1718591

Sahan, K., Rose, H., & Macaro, E. (2021). Models of EMI pedagogies: At the interface of language use and interaction. *System*, *101*(August), 102616. https://doi.org/10.1016/j.system.2021.102616

Sert, N. (2008). The language of instruction dilemma in the Turkish context. *System*, *36*(2), 156–171. https://doi.org/10.1016/j.system.2007.11.006

Shrestha, K. (2022). English as a Medium of Instruction: Pedagogical Practices and Perceptions of Public-School Teachers and Students. *NELTA ELT Forum*, *April*, 0–6. https://neltaeltforum.files.wordpress.com/2022/01/ms.-kalpana-shrestha.jpg

Strong, M. (2006, January). Does new teacher support affect student achievement? *New Teacher Center*.

Stronge, J. H. (2007). *Qualities of effective teachers*. ASCD publications.

Stronge, J. H., Ward, T. J., & Grant, L. W. (2011). What makes good teachers good?: A cross-case analysis of the connection between teacher effectiveness and student achievement. *Journal of Teacher Education*, *62*(4), 339–355. https://doi.org/10.1177/0022487111404241

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (J. Mosher (Ed.)). Pearson.

Tang, K. N. (2020). Challenges and importance of teaching English as a medium of instruction in Thailand international college. *English as an International Language, 15*(2), 97–118.

Tella, A. (2008). Teacher variables as predictors of academic achievement of primary school pupils mathematics. *International Electronic Journal of Elementary Education*, *1*(1), 16–33.

Tollefson, J. W. (2017). Language planning in education. In T. L. McCarty & S. May (Eds.), *Language policy and political issues in education* (3rd ed.). Springer.

Tri, D., & Moskovsky, C. (2023). Language use in English-medium instruction programs in Vietnamese higher education: From policy to practice. *Asian Englishes*, *25*(3), 326–342.

Yang, M., O'Sullivan, P. S., Irby, D. M., Chen, Z., Lin, C., & Lin, C. (2019). Challenges and adaptations in implementing an English-medium medical program:a case study in China. *BMC Medical Education*, *19*(1), 1–8. https://doi.org/10.1186/s12909-018-1452-3

Zhang, D. (2008). *The effect of teacher education level , teaching txperience , and teaching behaviors on student science achievement* [Utah State University]. https://doi.org/https://digitalcommons.usu.edu/etd/155