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The Dilemma of English as a Medium of Instruction Policy in Science College Programs

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Abstract

Achieving science undergraduate programs learning outcomes relies on the students' proficiency in the language of instruction, a challenge that many policymakers ignore. This study is to understand the influence of English as a medium of instruction (EMI) policy in four undergraduate science programs, namely, Biology, Chemistry, Physics, and Mathematics, in Saudi Arabia. The data were collected from the following groups of participants: 1461 science alumni records, 769 current undergraduate science students' surveys, and 111 science university instructors' surveys. The results of alumni records indicated that grades of the intensive English program in the first year predict the alumni cumulative grade point average (GPA) once they finish their four-year program. The results demonstrated that the higher is the alumni's English proficiency, the better is their cumulative GPA. The results of the current science students' questionnaire showed their preferred language of instruction could be predicted by their attitudes and society's attitudes. Most of these students preferred to learn sciences in their native language (Arabic), which contradicted the policy of the current program. The instructors' questionnaire results showed that instructors held divergent perspectives on the usage of EMI and students' native language in the undergraduate science programs. To conclude, educationists and programs policymakers need to locate more attention and interventions toward the language of instruction. It is also recommended that universities provide science students with more English courses. Science students should also have

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English for science purposes courses to familiarize them with the science terms and prepare them to read science materials.

Keywords: Arabic, English, language, medium of instruction, science program policy.

1. INTRODUCTION

As the language of science and technology (Crystal, 2003), English has been chosen by non-English speaking countries to be used in the teaching of science subjects at different educational levels. In the era of globalization and internationalization, scientists need to communicate in English given that most of the online science resources and publications are in English. Hence, universities in Arab countries and around the globe have implemented a policy of English as a medium of instruction (EMI) in science university programs. Policymakers and curriculum designers believe that EMI would benefit students more than the policy of Arabic as a medium of instruction (AMI). Opting for a certain directive, policymakers consider the viewpoints of various stakeholders, such as students, teachers, employers, publishers, and government officials. The relationship between the language of instruction policy and stakeholders' frequent attitudinal beliefs might result in drastic learning outcomes that do not lead to the purposes of the specified program.

Around the globe, Science instructors might not obtain the correct impression when assessing the depth of acquired scientific knowledge of students who speak English as a foreign language as a result of the effect of EMI. Thus, the influence of proficiency in the language of instruction on students' performance must be understood by university curriculum designers and policymakers, particularly in cases when students speak a foreign language. Each undergraduate science program has distinguishing characteristics that might not be applicable in other contexts, such as students' mother tongue, students' high school science education, instructors' educational background, and students' future objectives and social identities. International studies on the scope of influence of the language of instruction could inform international educationalists and curriculum designers of the image and broad understanding of the phenomenon (Macaro et al., 2018).

This study aims to examine the influence of EMI on science undergraduate alumni in the Biology, Mathematics, Chemistry, and Physics departments in Saudi Arabia. In addition, the study examines the current science students' frequent attitudes toward the preferred language of instruction and the students' attitudes toward the use of their native language. Moreover, this study presents the perspectives of science instructors about the use of English and students' mother tongue (i.e., Arabic) in teaching science subjects at the university undergraduate level.

1.1 Significance of the Study and Research Questions

This study contributes to the literature by examining the influence of medium of instruction in science as indicated in the alumni's GPA. Previous studies have not examined the influence of language proficiency on the students' final GPA in science undergraduate programs. This study has a large sample to examine alumni's learning

outcomes based on their proficiency in the medium of instruction. The correlation between proficiency and GPA will assist researchers and educationists to design effective curricula that value the influence of the medium of instruction. Furthermore, the study analyzes the influences of students' attitudes, attitudes of the society around them, and their self-efficacy beliefs toward the preferred language of instruction. The views of students and their society on the preferred medium of instruction will help researchers and educationists to predict students' choice of medium of instruction in science education. Furthermore, interventions can be done to change such attitudes when mismatches occur between the frequent attitudes and preferred language of instruction. Moreover, this study explores the challenges that learners face when they study science in a foreign language and clarifies science instructors' attitudes and beliefs about teaching sciences in students' mother tongues or a foreign language. It also compares students' frequent attitudes and instructors' frequent attitudes toward the language of instruction policy in one study. These unique contributions of the current study will answer the following research questions.

1. Is science undergraduate English proficiency in the first year affect their achieved cumulative GPA once they finish the four-year program in Chemistry, Biology, Physics, and Mathematics departments?
2. How do science undergraduate students' attitudinal, self-efficacy, and attitudinal beliefs of social groups around them affect their preferred medium of instruction?
3. What are the current science undergraduate students' attitudes toward the current policy of medium of instruction?
4. What are the perspectives of science instructors regarding the medium of instruction policy in four undergraduate science programs: Chemistry, Biology, Physics, and Mathematics?

2. LITERATURE REVIEW

Educationists and curriculum designers have debated on the medium of instruction policy. Policymakers in science education have different perspectives based on varied research outcomes. Only a limited number of researchers worldwide have investigated the language of instruction policy in science education despite its important role in the learning process. Policymakers face the decision of the language of instruction at universities (Carroll, 2016; Evans & Morrison, 2017). They rely on scientific investigations to obtain a clear image of the scope of the advantages and disadvantages of the chosen language of instruction. Alhamami (2019) emphasized that this debate is ongoing, and no consensus has been reached. Different stakeholders, such as science instructors, science program designers, and government officials, user experience in making their stand on the issue.

Macaro et al. (2018) examined 83 studies that focused on EMI in higher education in different disciplines. They claimed that EMI in higher education leads to serious challenges for students who have sufficient English proficiency. Researchers are thus encouraged to investigate to analyze this phenomenon further given the various contexts of outcomes. For example, research outcomes in teaching medicine might be different from those of teaching computers. Moreover, research on students who speak Arabic as the first language might lead to different results from students who speak Russian as the first language in science undergraduate programs. EMI

policy in undergraduate science programs is a global issue that led to divergent views among applied linguists, policymakers, and students in different countries. It would be challenging to have the same outcomes of EMI policy in Hong Kong and Algeria. Hong Kong was colonized by Britain. Algeria was colonized by France. Colonization is another factor that influences the choice of medium of instruction in previously colonized countries (Alhamami 2015).

2.1 Emi Policy and Student Academic Success

Correlations between English language proficiency and student academic success in universities that use EMI have been reported (Berman & Cheng, 2010; Evans & Morrison, 2011; Schoepp, 2018). However, the results of the investigation on the influence of language proficiency on alumni's cumulative grade point average (GPA) have not been thoroughly examined. Alhamami (2015) examined the views on the medium of instruction in a Saudi university of 27 scientists who are native Arabic speakers. Arab scientists believe that EMI in Saudi universities presents serious academic and social challenges in science undergraduate education. Similarly, Belhiah and Elhami (2015) surveyed students and instructors in six universities in the United Arab Emirates. They found that students struggling to learn English and suggested a bilingual curriculum, whereby teaching is conducted in English and Arabic to tap into the linguistic and biliteracy skills of students. Nonetheless, diverse benefits and drawbacks of using EMI in a foreign country have been reported.

2.2 Attitude Toward EMI Policy

Using a sample of 186 science students in Saudi University, Alhamami (2019) investigated the current use of EMI and reported that a negative attitude toward the English language prevailed among the respondents. The researcher stressed that contradictions existed between the objectives of the current policy and student attitudes. In a different context, Wanphet and Tantawy (2018) found a positive attitude toward the English language. They investigated the views of 100 students from several science courses in the United Arab Emirates. Most of the students advocated English-only science instruction. Alhamami (2019) realized that most advantages and disadvantages are directly related to students. Instructors, parents, and policymakers are not concerned with these advantages and disadvantages. This result indicates that students' opinions should be considered in analyzing if the language of instruction influences science programs.

2.3 Disadvantages of EMI Policy

Negative outcomes of teaching sciences in a foreign language have been reported. Lee (2005) stressed the unfairness of assessment practices in science programs toward students who are not fluent in the medium of instruction. Hence, assessment of learners based on their non-native language could result in underestimating the scientific knowledge and achievement of learning outcomes because students cannot read and write fluently in the target language. Hengsadeeikul et al. (2014) reported students who have a good grasp of a foreign language are more participative in classes in a Thai university. Subsequently, learners who lack language

skills will hardly discuss and share their knowledge during classroom discussions. In developing countries, [Carroll, et al. \(2017\)](#) indicated that the influence of the national language and its status among its native speakers, especially the young generations, decrease due to the use of foreign language as a medium of instruction. The use of a national language will promote nationalism and preserve the national identity and local culture.

2.4 Advantages of EMI Policy

Meanwhile, several advantages have been raised in favor of EMI in the teaching of science. [Rogier \(2012\)](#) found that students who attended Emirati universities and use EMI have improved their English proficiency significantly when they completed their courses. [Dearden and Macaro \(2016\)](#) studied the views of teachers on EMI in Austria, Italy, and Poland. They claimed EMI provided more opportunities to study abroad and access to advancements and learning resources in the field of the learners. [Hu et al. \(2014\)](#) claimed similar positive outcomes of using EMI in Chinese universities. EMI has increased communication and publication in English, as well as joint partnerships of local and foreign scientists for research, conference presentations, and publications in scientific journals, given that most scientific journals are in English. Moreover, many readers and researchers subscribe to these journals ([Fuentes & Soler, 2018](#)). Many universities have implemented policies for publications in English due to internationalization. [Hillman and Eibenschutz \(2018\)](#) stated that using foreign languages, such as English, molded Qatar to become a global country and reform its educational system.

3. METHODOLOGY

3.1 Context

Four departments, namely, Biology, Mathematics, Chemistry, and Physics, of the College of Sciences of a public university in Saudi Arabia, were involved in the study. The mother tongue of all students is Arabic, most are Saudi, and study the same subjects in high school. In Saudi Arabia, science subjects in elementary education are taught in Arabic. In the university, the medium of instruction in science colleges of most Saudi universities is English. Students are admitted to science departments based on their high-school GPA and the results of their national comprehensive exams. Students are not required to sit for an English proficiency test. If the level of English proficiency does not meet the university requirements, then the students undergo an intensive English learning program in their first year. The intensive English university program has six credit hours and 12 contact hours. The program covers four English learning skills of reading, writing, listening, and speaking. The students study using several textbooks. Unfortunately, the program does not focus on scientific terms because general English is taught. Several sections are taught by different instructors. The instructors come from different countries and have finished education in different parts of the world, such as the United Kingdom, the United States, India, Australia, Bangladesh, Pakistan, Jordan, Egypt, Saudi Arabia, Sudan, and Yemen.

3.2 Instruments

The researchers use several instruments for data collection. To obtain the College of Science alumnus data, the researchers sent a request to the Deanship of Admission and Registration at the university to obtain the data of alumni's CGPA and their grades in the intensive English course during their first year. The Deanship of Admission and Registration sent the data in an Excel sheet to the researchers after receiving approval from the university authorities. The Deanship provided the researchers with the alumni's data in the last five years.

The researchers constructed two questionnaires, one for students and the other for instructors. First, the researchers examined the literature and used questionnaires from previous studies that tackle the research issue as a guide. Next, the researchers designed the draft of the two surveys in Arabic and English. The questionnaires were sent to six reviewers to validate the questionnaire items. The reviewers are university professors and they hold Ph.Ds. in Applied Linguistics and Linguistics. The reviewers checked the validity of the questionnaire items in Arabic and English. Based on the reviewers' suggestions and comments, the researchers revised the questionnaire items. The researchers then sent a request to the Deanship of E-Learning to post the student questionnaire online in the students' Blackboard accounts. The researchers also sent the instructor questionnaire via email to the college instructors at the same university. Details about the items of the questionnaire are found in Appendix A (Student Questionnaire) and Appendix B (Instructor Questionnaire). Also, the researchers checked the reliability of the questionnaires' items using Cronbach's alpha test. Cronbach's alpha test shows the reliability of the survey items. Statistical analysis was done in analyzing the data.

Ethical issues were considered during this study. The researchers obtained approval from university authorities for the alumnus data and administration of questionnaires to students and instructors. An online consent form was also used to inform the students and the instructors that their participation is voluntary before they answer the questionnaire and that their responses would remain confidential.

4. RESULTS

4.1 Alumnus Data Results

Table 1 presents the alumni's backgrounds. The alumni graduated from four science undergraduate programs with a Bachelor of Sciences in Biology, Chemistry, Mathematics, and Physics. The female alumni are slightly more than the male alumni.

Table 1. Descriptive Statistics of Science Alumni (n = 1461)

Major	Male	Female	Total	%
Biology	294	165	459	31.4
Chemistry	180	253	433	29.6
Mathematics	122	192	314	21.5
Physics	78	177	255	17.5
Total	674 (46.1)	787 (53.9)	1461	100.0

4.1.1 Alumnus regression test results

We analyzed the potential correlation between alumni's first-year English intensive program grade and their cumulative GPA using Pearson's r . The two variables correlated at $r(1459) = 0.50$, $p < 0.01$, $r^2 = 0.25$. Alumni's cumulative GPA rating ranged from 1 to 5 ($M = 3.20$, $SD = 0.73$, $n = 1461$). The number of EFL grade ratings ranged from 1 to 5 ($M = 3.41$, $SD = 0.97$, $n = 1461$). Linear regression analysis allowed us to predict alumni's cumulative GPA from their first-year English intensive course grades, $F(1,1459) = 491.22$, $p < 0.01$, with a slope of 0.38 and a Y-intercept of 1.914. The variable of EFL intensive program grades significantly predicted the alumni's CGPA ($p < 0.01$). When predicting the alumni's cumulative GPA from their English proficiency grades, we erred by 0.63 happiness-rating points. Figure 1 and Table 2 illustrate the alumni's cumulative GPA mean based on their English course grades. Figure 1 shows the correlation between alumni's cumulative GPA mean based on English intensive course grades in the first year.

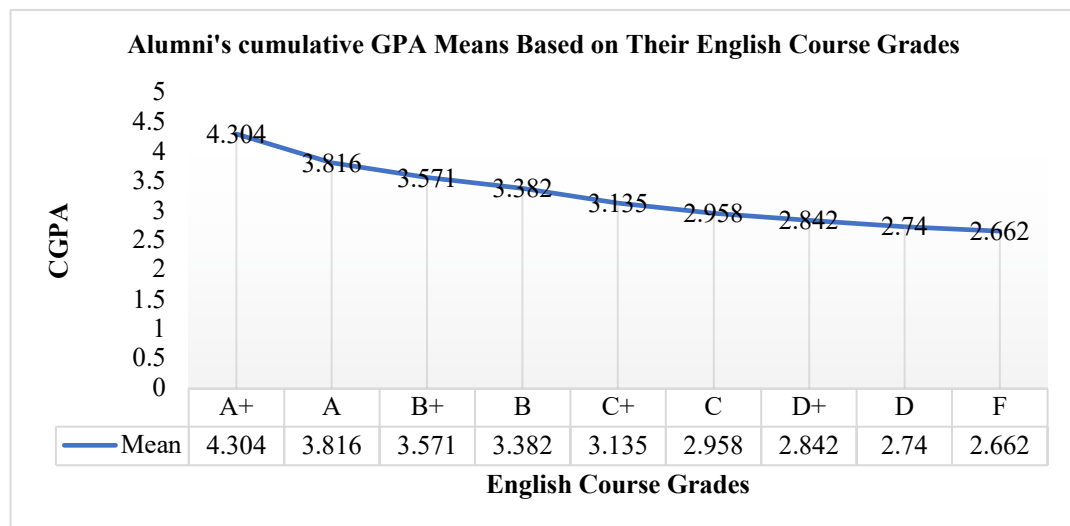


Figure 1. Correlation line between alumni's CGPA and EFL grades.

Table 2. Alumni's GPA mean based on first-year English course grades ($n = 1461$).

Grade	CGPA Mean	N	Std.
A+	4.304	56	0.59
A	3.816	101	0.65
B+	3.571	179	0.65
B	3.382	257	0.68
C+	3.135	244	0.62
C	2.958	251	0.64
D+	2.842	169	0.60
D	2.740	161	0.50
F	2.662	43	0.43

The result of the alumni data indicate they graduated from Biology, Chemistry, Mathematics, and Physics departments. Female alumni slightly outnumber the males in science departments, as illustrated in Table 1. The critical finding from the alumni results demonstrates that science alumni's English proficiency correlated with their GPA. Moreover, by examining first-year science students, educationists can predict

students' future GPAs. As shown in Table 2 and Figure 1, the higher is the alumni grades in the intensive English program, the higher is their CGPA.

4.2 Current Science Students' Questionnaire Results

Table 3 illustrates the descriptive statistics of current science undergraduate students who responded to the survey. The respondents are completing their degrees in Bachelor of Science in Biology, Mathematics, Physics, or Chemistry.

Table 3. Descriptive Statistics of Current Students' Questionnaire (n = 769).

Major	Male	Female	N	%
Biology	109	115	224	29.1
Mathematics	59	107	166	21.6
Physics	42	150	192	25.0
Chemistry	56	131	187	24.3
Total	266	503	769	100.0

4.2.1 Regression of attitudes

Using linear regression, we predicted the current undergraduate science students' choice for the medium of instruction from the mean scores of their attitudes, the attitudes of their society, and self-efficacy (N = 769). The three variables considered together significantly predicted the preferred medium of instruction, $F(3,765) = 274.25$, $p < 0.01$, with a 52% overlap between the three predictors and the outcome of the medium of instruction. When predicting the preferred medium of instruction, we erred by approximately 0.21 preferred language of instruction-rating points based on a scale of 1–2. Specifically, students and society's attitudes remained significant with a slope of 0.052 ($p = 0.00$) and 0.091 ($p = 0.00$), respectively. Students' self-efficacy was not a significant predictor ($p = 0.14$). A value of 1.07 quantified the Y-intercept for our regression equation.

The regression test demonstrates that understanding students' attitudes and the attitudes of those around them can predict their preferred medium of instruction. Their self-efficacy beliefs, on the other hand, are not significant predictors of their preferred mode of instruction.

4.3 Frequency

In preference for the medium of instruction (i.e., Which do you think is better to teach science courses in, Arabic or English?), 77 (10%) of the respondents chose English, and 692 (90%) chose Arabic. The next questionnaire items asked the participants' views of the correlation between their CGPA and AMI (Do you think that your CGPA would be higher than your current CGPA if you studied science courses in the Arabic language?). Of the respondents, 337 (43.8%) chose "no," and 482 (56.2%) chose "yes."

The next closed-ended questionnaire item asked the participants about their experiences in science exams according to the medium of instruction (i.e., Have you ever had an exam question that you could not answer because it was difficult to understand, as the question was in English and you had to write the answer in English?). A total of 94 (12.2%) respondents chose "no," and 675 (87.8%) chose "yes."

Hence, the frequency results of students' responses show a preference for the Arabic language (their mother tongue) as the language of instruction for science subjects in undergraduate science programs. The respondents believe that their GPA and performance in the exams will improve if Arabic is the medium of instruction.

4.4 Current Science Instructors' Questionnaire Results

A total of 111 science instructors participated in the survey. The participants were from Biology (n = 41, 36.9%), Mathematics (n = 25, 22.5%), Physics (n = 24, 21.6%), and Chemistry (n = 21, 18.9%). Table 4 presents the instructors' views of students' English proficiency.

Table 4. Instructors' views of students' proficiency in FLMI (n=111).

No.	Items	Strongly Yes	Quite Yes	Slightly Yes	Slightly Yes	Quite No	Strongly No
1	Most of the science students at the undergraduate program understand everything I say in English.	5 (4.5%)	23 (20.7%)	17 (15.3%)	24 (21.6%)	21 (18.9%)	21 (18.9%)
2	Most of the science students in the undergraduate program can read and understand course materials and related textbooks in English.	5 (4.5%)	23 (20.7%)	17 (15.3%)	24 (21.6%)	21 (18.9%)	21 (18.9%)
3	Most of the science students in the undergraduate program can read and understand examination instructions in English.	5 (4.5%)	22 (19.8%)	23 (20.7%)	17 (15.3%)	20 (18.0%)	24 (21.6%)
4	Most of the science students in the undergraduate program can answer examination questions in English.	5 (4.5%)	15 (13.5%)	20 (18.0%)	21 (18.9%)	18 (16.2%)	32 (28.8%)
5	Most of the science students in the undergraduate program can speak English.	3 (2.7%)	10 (9.0%)	17 (15.3%)	18 (16.2%)	29 (26.1%)	34 (30.6%)
6	Most of the science students in the undergraduate program can participate in science discussions in English.	1 (0.9%)	9 (8.1%)	12 (10.8%)	19 (17.1%)	25 (22.5%)	45 (40.5%)
7	Do you think the students may fail in science subjects because of their low level of proficiency in English?	Yes 47 (42.3%)		Maybe 36 (32.4%)		No 28 (25.2%)	

The responses of the instructors imply that a language barrier is causing problems. According to Table 4, the majority of instructors believe that students'

limited English proficiency impedes understanding scientific oral and written content. The perspectives of instructors are consistent with those of students. The majority of instructors believe that their students will fail science classes due to language barriers rather than their ability to learn science.

5. DISCUSSION

This paper contributes to the complex discussions around policies about the language of instruction, particularly in countries where it differs between high school and tertiary education. Importantly, the study provides the perspective of the students in terms of their attitudes and experiences. The correlation between literacy and academic success is a well-established one. While difficulties associated with undertaking higher education in a second language is certainly substantial, it should be acknowledged that the relationship between first language proficiency and academic success is not a straightforward one, as all students grapple with academic literacy, and access is not equally distributed among all speakers of a language (c.f. [Bourdieu et al., 1994](#)). In that sense, it is unwarranted and unhelpful for instructors to simply assume that learners are fluent in the language of instruction because apart from second-language speakers, the challenges of academic literacy also affect those of lower socioeconomic status, mature aged students, and the first in the family generation. Assuming that language support is not necessary for first language speakers imposes a form of ‘class ethnocentrism’ on higher education. [Sah and Li \(2018\)](#) found that EMI policy leads to linguistic marginalization and educational inequality with injustice for children from a lower socioeconomic status in Nepal.

Understanding of a subject area is intricately related to the language of instruction used to construct that understanding, which goes beyond translating ‘complicated terms and new words’ (see [Bruna et al., 2007](#)), so in light of this growing awareness, it is no longer viable to treat Arabic and English as merely interchangeable containers of scientific content (c.f. conduit metaphor of language). Not exposing students to scientific English will restrict their access to conferences and research, not least because academic literacy involves learning to participate as members of academic communities ([Green, 2020](#)).

The results of the alumni data indicated that they graduated from Biology, Chemistry, Mathematics, and Physics departments, with female alumni slightly outnumbered the males. In terms of correlations between the science alumni’s English proficiency to their GPA, it showed that the higher was the alumni grades in the intensive English program, the higher was their CGPA. This result is in line with those of previous research ([Berman & Cheng, 2010](#); [Evans & Morrison, 2011](#); [Schoepp, 2018](#)). The current study supports the finding that proficiency in the English language plays an important role in the learning outcome achievements of science students in a context where they speak English as a foreign language.

The results of the current students’ questionnaire indicate that participants came from the Biology, Mathematics, Physics, and Chemistry departments. Female participants outnumber males, which is similar to the alumni results (see Table 3). The regression test demonstrates that students’ preferred medium of instruction can be predicted by understanding their attitudes and the attitudes of people around them. Their self-efficacy beliefs, however, are not significant predictors of their preferred

choice of medium of instruction. This result demonstrates the importance of the attitudinal beliefs of students. The students are influenced by the attitudinal beliefs of surrounding social groups, such as their parents, classmates, friends, and teachers. Policymakers and curriculum designers should consider the attitudinal beliefs of social groups in designing educational curriculum. Negative attitudinal beliefs of social groups toward the medium of instructions influence students' engagement in the learning environment.

According to the frequency results of students' responses to the undergraduate science programs, they preferred Arabic (their mother tongue) as the language of instruction for science subjects. The respondents believed that if Arabic is used as a medium of instruction, their GPA and exam performance will improve. These findings support [Alhamami's \(2019\)](#) qualitative results. Similarly, [Hengsadeeikul et al. \(2014\)](#) found that Thai university students were not interested to join discussions when English is the medium of instruction. In other Arabic-speaking countries, [Wanphet and Tantawy \(2018\)](#) reported different results, as most students opted for English-only science instruction. This finding implies that research outcomes might have been affected by surrounding environments and high-school educational backgrounds, among others.

There are several factors that educationists should give attention to when designing science education programs such as the causes of students' low proficiency. Low proficiency can be caused by weak high-school English background, the contradiction between the policy of instructions in high school and university, ineffective learning outcomes of the university English learning program, and negative attitude toward the English language. Educationists and policymakers should implement interventions to improve the English proficiency of students. Science colleges should provide ongoing language learning courses to enable students to acquire scientific terms and understand the scientific texts in English.

Also, policymakers should consider the challenges students have to overcome in acquiring and processing scientific knowledge and then presenting their reports in oral or written output. These barriers are crucial and affect learning outcomes. Moreover, the assessment of students who study in a foreign language might not be fair, and their performance in exams might be affected by their level of proficiency in English. The alumni results highlight the influence of the English learning course on alumni's GPA. [Lee \(2005\)](#) and [Carroll et al. \(2017\)](#) emphasized that using English in developing countries might decrease the status of the national language and lead to unfair assessment practices in science programs. [Evans and Morrison \(2011\)](#) stressed that for students to meet the university foreign language proficiency requirements, students need strong motivation, hard work, active learning strategies, and supportive peer networks.

In addition, instructors must consider the level of proficiency of their classes and rethink their teaching methods and evaluation tools to match the students' level of proficiency. Teachers should use more visual materials for students to become familiar with texts, especially for learners who are not proficient in the language of instruction. Teachers can code-switch to translate complicated terms and new words into the students' native language. [Alhamami \(2019\)](#) emphasized that when instructors use the students' native language, they can cover the required learning outcomes because most science programs assume that learners are fluent in the language of instruction. [Belhiah and Elhami \(2015\)](#) suggested implementing a bilingual curriculum in which instruction

is delivered in English and Arabic to enhance linguistic and biliteracy skills, given that most students are not proficient in English.

The instructors' responses imply that the language barrier causes difficulties. Table 4 indicates that the majority of the instructors believe that the low proficiency in English of students is the obstacle to understanding scientific oral and written content. Instructors' perspectives are in line with students' perspectives. The majority of the instructors believe that their students might fail science subjects due to language barriers rather than based on their ability to learn sciences. Previous studies show similar results. [Alhamami \(2015\)](#) found that most Arabic-speaking scientists believe that their students do not achieve the learning outcomes due to low English proficiency in science university programs that use EMI. This study recommends that educationists and policymakers should implement interventions and provide ongoing language learning courses. An example of this has already been successfully implemented in Hong Kong under very similar conditions where there is a conflict between the language of instruction in high schools and the university ([Dreyfus et al., 2016](#)). The students' negative attitudes have to be addressed, and one way to do this is to better integrate the language support program with the subject content and students' shared understanding, as has been done in Australia ([Tann & Scott, 2020](#)).

Although there are several advantages of using students' native language, several studies (e.g., [Alhamami 2015](#)) mentioned limitations. For example, there are few references written in Arabic and most of these science references are outdated. There are also difficulties caused by low proficiency in English such as cooperation with international universities, attending conferences, and publishing research. These disadvantages might not be major obstacles for undergraduate science students because most of them will not travel to participate in international conferences or publish in international journals yet. However, these findings are critical to graduate students who are doing their Master's or Ph.D. programs. The instructors' views about the advantages of English as a medium of instruction in this context confirm previous studies' findings. For example, [Dearden and Macaro \(2016\)](#) conducted their study in Austria, Italy, and Poland contexts, and [Hu et al. \(2014\)](#) conducted their research in the Chinese context. EMI increases international collaboration, publications, communication, and job opportunities. Moreover, EMI results in improved English proficiency of students ([Rogier, 2012](#)).

6. CONCLUSION

The effect of the medium of instruction can be observed in the cumulative GPA of the alumni of the science college. The importance of providing fair assessment for science students who speak the medium of instruction as a foreign language should be considered. Policymakers and science instructors should consider the consequences of the chosen medium of instruction on students' grades and learning outcomes. For current science students, understanding the attitudes of science students and social groups around them regarding the medium of instruction is crucial. Meanwhile, instructors revealed awareness of the negative influence of EMI in the context. However, instructors should prevent these negative outcomes and provide interventions to help students improve their English proficiency. For example, the current intensive English program can be revised to meet science needs, more ongoing

English learning courses can be provided, and students' language proficiency when designing assessment tools should be considered.

More studies should fill the gap in the analysis of the influence of the medium of instruction in science programs. Future studies might examine the perceptions of social groups, such as students, teachers, and parents, about the use of Arabic to teach science subjects in high schools. However, varied findings on EMI might be found in graduate studies, as well as different countries. Each country has unique social and educational characteristics. Future studies could examine the perspectives of science textbooks publishers and government officials regarding the use of national language as a medium of instruction in science colleges. Perspectives of alumni's experiences can be investigated as well. Examining employers of science university graduates, such as companies, international organizations, and government institutions, is necessary to understand this phenomenon in a deeper context.

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APPENDICES

Appendix A

Current Science Undergraduate Students' Questionnaire Items.

Themes	Statements of the Survey Items	Scale 1	Scale 2	Scale 3	Scale 4	Scale 5	Scale 6
Students' Attitudinal Beliefs	Studying science courses in English at the College of Science is...	Very Good	Quite Good	Slightly Good	Slightly Bad	Quite Bad	Very Bad
Social Groups' Attitudinal Beliefs	Most people, whose opinions I value, think that I should study science in English at the College of Science	Strongly Yes	Quite Yes	Slightly Yes	Slightly No	Quite No	Strongly No
Students' Self-efficacy Beliefs	I am confident that I can study science courses in English at the university if I want to	Strongly Yes	Quite Yes	Slightly Yes	Slightly No	Quite No	Strongly No
Students' Attitudinal Beliefs	Studying science courses in English at the university is...	Very Useful	Quite Useful	Slightly Useful	Slightly Useless	Quite Useless	Very Useless
Social Groups' Attitudinal Beliefs	I feel the social motivation to study science courses in English at the university	Strongly Yes	Quite Yes	Slightly Yes	Slightly No	Quite No	Strongly No
Students' Self-efficacy Beliefs	For me to study science courses in English at the university is...	Very Easy	Quite Easy	Slightly Easy	Slightly Difficult	Quite Difficult	Very Difficult
Students' Attitudinal Beliefs	Studying science courses in English at the university is...	Very Enjoyable	Quite Enjoyable	Slightly Enjoyable	Slightly Unenjoyable	Quite Unenjoyable	Very Unenjoyable
Social Groups' Attitudinal Beliefs	People who are important to me want me to study science courses in English at the university	Strongly Yes	Quite Yes	Slightly Yes	Slightly No	Quite No	Strongly No
Students' Self-efficacy Beliefs	I am sure that I can study science courses in English at the university if I want to	Strongly Yes	Quite Yes	Slightly Yes	Slightly No	Quite No	Strongly No
Preferred Language of Instructions	Which do you think is better to teach science courses at the science college, in Arabic or English?		Arabic			English	

Appendix A continued...

Preferred Language of Instructions	Do you think that your GPA would be higher than your current GPA if you studied science courses in the Arabic language?	Yes	No
Preferred Language of Instructions	Have you ever had an exam question that you could not answer because it was difficult to understand the question in English and write the answer in English?	Yes	No

Appendix B

Science Instructors' Questionnaire Items

Statements of the survey items	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Most of the science students at the undergraduate program understand everything I say in English.	Strongly Yes	Quite Yes	Slightly Yes	Slightly No	Quite No	Strongly No
Most of the science students in the undergraduate program can read and understand course materials and related textbooks in English.	Strongly Yes	Quite Yes	Slightly Yes	Slightly No	Quite No	Strongly No
Most of the science students in the undergraduate program can read and understand examination instructions in English.	Strongly Yes	Quite Yes	Slightly Yes	Slightly No	Quite No	Strongly No
Most of the science students in the undergraduate program can answer examination questions in English.	Strongly Yes	Quite Yes	Slightly Yes	Slightly No	Quite No	Strongly No
Most of the science students in the undergraduate program can speak English.	Strongly Yes	Quite Yes	Slightly Yes	Slightly No	Quite No	Strongly No
Most of the science students in the undergraduate program can participate in science discussions in English.	Strongly Yes	Quite Yes	Slightly Yes	Slightly No	Quite No	Strongly No
Do you think the students may fail in science subjects because of their low level of proficiency in English?	Yes		Maybe		No	