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Abstract

The present study aims to determine the efficacy and relevancy of the two foreign language courses required for preparing elementary prospective teachers to teach Science and Mathematics in English or French. The study is a mixed one relying on quantitative data collected from the rating scales and the 5-point Likert-type Scale Questionnaires while the qualitative data is collected from the open-ended questions. Data was collected from: a) a questionnaire addressed to professors and instructors who teach the two language courses: "Language of Teaching" (FCE) and "Techniques of Expression" (TE), b) a questionnaire administered to science and mathematics trainers, c) a questionnaire addressed to students in the 2nd and 3rd semesters majoring in science and mathematics Education, d) a questionnaire addressed to a purposeful sample—3rd year students majoring in science and math education, and e) a questionnaire addressed to the science and mathematics coordinators. The objective of the questionnaires is to determine the participants' conceptions of the efficacy of the foreign language courses, and whether those courses meet the needs of the science and mathematics students. Results indicate that students were not satisfied with the language courses. Recommendations for teaching foreign languages to Science and Mathematics students are also highlighted.

Introduction

Language plays a central role in the teaching and learning of content subjects at schools and universities. Teachers and instructors use language to deliver the content to students. Those students are expected to learn the scientific concepts in the foreign language and are supposed to use the language to demonstrate the knowledge that they have developed (Lucas, 2011, pp. 3-17). Hudson (2009) claims that a scientifically literate public needs to be raised and nurtured in order to boost a country's economy on the one hand, and keep abreast with scientific and technological development that is mostly written in a foreign language (English and French), on the other hand. For that reason those countries had to adopt the foreign language, English or French, as the medium of instruction for mathematics and science (Saat & Othman, 2010, Bin Yahaya et al., 2009).

Several research studies indicated that academic achievement and educational attainment are lower for students who grow up in a setting in which the predominant language (the native language) is not the language used for instruction in the institutions (Gogolin & Lange, 2011; Klein, Bugarin, Beltranena, & McArthur, 2004, as cited in Kalinowski, et al. 2019). In other words, students' linguistic proficiency level in the target language influences their academic success. The higher their language proficiency level, the better their achievement in the content areas is. Martinez et al. (2011, p. 2) assert that *the difference between the academic performance of English-proficient and ELL students is substantial*. Martinez, et al, support their claim by mentioning that the *National Assessment of Educational Progress (NAEP) math results in 2005 revealed that nearly half (46%) of ELL 4th graders scored below basic in math while 72% of those students scored below basic level in science and 88% of 8th graders scored below basic level in science* (p. 2).

Beal et al (2010) research indicated that English proficiency is a strong predictor of English Language Learners' (ELL) mathematics scores. This finding is consistent with Abedi and Lord's (2004) findings that students who read English very well achieved higher mathematics scores than students who do not. Additional studies (Denfield et al., 2014) affirmed that English proficiency precedes mathematics proficiency, especially when the language of instruction is English. They claim that *multiple studies propose that English proficiency dictates English language learners' (ELL) performance on mathematics assessments* (p. 11). In other words, proficiency in second or foreign language greatly influences mathematical competence.

Blackburn (2019) believes that school and college students studying math content in a foreign language need to improve their language proficiency in order to understand and participate in mathematical reasoning discussions. Blackburn (2019) adds that teachers need to use language in order to explain mathematical concepts, while students need to build academic language proficiency and have an advanced level of linguistic competence in order to develop and test hypotheses, as well as grasp the concepts and engage in mathematical discussions. The development of language and content knowledge is considered to be interrelated (Schleppegrell, 2009). However, little is known about the effectiveness of programs that integrate the teaching of the English language with the teaching of the subject area (Kucharz et al., 2014, as cited in Kalinowski, 2019). The opposite also holds true, that is, little is known about the integration of content materials in the teaching of English or French as a second language (ESL or FSL).

Luo (2019) claims *that the interdisciplinary models (STEAM) contribute to language education by suggesting that language or ESL teachers expand their repertoire of techniques, tools, and strategies beyond the typical linguistic ones traditionally used in classrooms*. S*tudents demonstrated positive responses to the increased variety of instructional strategies used in their language classrooms* (p.1). Stapleton (2014 as cited in Luo 2019, p. 1) states that *research into how languages are best taught requires a more interdisciplinary approach that includes methods and instruments from the sciences*. Luo's (2019) study revealed *the need to strengthen its integration into teaching in the classroom. The application of natural sciences to language teaching not only has the potential to enrich our inventory of ideas, but it also presents methods to discover which of them are most likely to be correct* (p. 6).

To successfully support the language acquisition of university students, language instructors need to possess some basic scientific knowledge, while content area professors need to possess some linguistic skills (Bunch, 2013). However, most content area teachers are not well-prepared to address students' language proficiency (Bunch, 2013; Darling-Hammond, 2009; Gunduz, 2016; Gurgenidze, 2018; Samson & Collins, 2012). On the other hand, most ESL (English as a second language) or FSL (French as a second Language) teachers are not well prepared to address the requirements of content area courses. Most foreign language teachers know very little about the topics raised in content areas. For those reasons, the effectiveness of intensive courses has recently been a matter of controversy and debate. The results of the studies conducted by Mukundan et al. (2012) and Nasiri and Shokrpour (2012) are not consistent with those who believe that intensive programs are inefficient (Bateson 1990 & Henbery 1997, as cited in Nasiri & Shokrpour, 2012) or ineffective (Bédard & Thomas 2010, as cited in Mukundan et al. (2012). Contrary to those claims, Nasiri and Shokrpour (2012) in their study have revealed that *real gains are achievable in intensive programs that stretch to 120 hours* (p. 6).

The results of that study are not consistent with the opponents of intensive teaching formats (Bateson, 1990; Henbery, 1997) who believe that intensive programs are inefficient. Bateson (1990), who is one of those opponents, compared intensive courses with traditional regular programs and found the regular courses more beneficial. Henbery's (1997) theoretical view is also inconsistent with the findings of that study. He questions the success of intensive teaching programs in helping students to learn new materials. He claims that the pace of teaching in this kind of program hampers the process of learning since the students are not given enough time to review the old materials before moving to the new ones. Inconclusive and contradictory results were reached by the numerous studies that researched the effectiveness of the intensive foreign language courses offered at the university level in different countries. However, those studies were undertaken in contexts where only one foreign language was stressed. No studies were undertaken in the Lebanese context where two foreign languages are taught (one as a first foreign language and another as a second foreign language) and where the first foreign language (be it French or English) is used as the medium of instruction for science and mathematics. The purpose of this study is to explore the opinions of foreign language professors, instructors, coordinators, trainers, prospective teachers (students) of mathematics and science regarding the effectiveness and relevancy of the language courses.

Research Questions

1. Do the professors, coordinators and trainers believe the language courses to be effective and relevant?
2. Do the students majoring in science and math education consider the language courses to be effective and relevant?
3. Are there any differences in the opinions of science and mathematics students towards the two language courses (FCE & TE)?
4. To what extent do the syllabi of the FCE and TE courses prepare science and mathematics students for their future careers as teachers?

Preparation of the Science and Mathematics Pre-service Teachers at the Faculty of Education, Lebanese University

The Lebanese University began implementing a three year cycle structure (LMD) in 2005, despite the fact that implementation was not uniformed among all faculties. The Lebanese University *utilizes three progressive cycles: bachelors level (3 years), masters level (2 years) and doctoral level (3 years), or the French model, license , mater, and doctorate (LMD)* that are in line with the *American and the 1991 Bologna-reformed European Systems of higher education* (Ayoubi, 2011 as cited in El Takach, et.al., 2018). The new educational system (LMD) delineated by the Lebanese University (Decree 14840) was applied at the Faculty of Education during the academic year 2008-2009 (Ayoubi, 2011 as cited in El Takach, et.al., 2018). Based on the new educational program, the prospective teachers of science and mathematics at the Faculty of Education have to take two English or French language courses to help them improve their foreign language proficiency, since they have to teach science and math in English or French.

The first course, the Language of Instruction (FCE) or Langue d'Enseignment (in French), is given in the second semester of the first year of study. It is a 6-credit course. The English version of the syllabus provides a description of the course, "*This is an English language course which aims to equip the students with advanced reading/writing and improve their oral/aural communication skills. İn addition, students will be trained on a variety of test items to improve their test-taking skills regarding FCE (a standardized test). This course will provide students with an appropriate language baggage to be able to present the First Certificate English (FCE), a Cambridge ESOL exam given to the upper-intermediate level or B2. Students should be able to write formal letters, skim, scan and paraphrase reading texts, practice discussing, debating, note-taking and note completion. The course will also review various grammatical points and develop certain vocabulary acquisition skills*" (Faculty of Education, LU, 2008).

The second language course is "Techniques of Expression" (TE) which is given in the 3rd semester, that is, in the second year. Students must pass the FCE course in order to be able to enroll in TE. It is a 3 credit course. The course description of TE states its learning outcomes as, "*This is a technical course on oral and written expression. Practice includes using a variety of presentation skills, verbal and non-verbal communication competencies, note-taking, paraphrasing and summarizing, writing CVs and various letters of complaints, petitions, recommendations, attestations, memos and a cover letter, as well as, delivering effective presentations by means of PowerPoint"* (Faculty of Education, LU, 2008).

Theoretical Background

Second Language Acquisition

English as a second language (ESL) or English as a foreign language (EFL) classroom practice is based on the theories suggested in the fields of psychology, linguistics and education. ESL/EFL educators are guided by the theoretical tenets and beliefs of foreign language acquisition. In the 1970s, the American linguist Stephen Krashen proposed a theory of "second language acquisition", which is referred to as "the natural approach" (Krashen &Terell 1983). That theory refers to the process in which a learner learns another language, other than his mother tongue, without its social environment. According to this theory, learners mainly learn their native language by implicitly acquiring it, while they learn a second language by explicitly learning it. Here the former means that a learner does not need to exert effort to acquire and use a language—his mother tongue. It is *identical, to the way children develop their ability to learn a first language* (Krashen, 2003, p. 10). The latter means that there is a conscious effort to study a language (Krashen 1982), as is the case in the ESL classrooms. The first way is language acquisition, a process similar to the way children acquire their native language. Language acquisition is a subconscious process; language acquirers are not usually aware of the fact that they are acquiring language, but are only aware of the fact that they are using the language for communication.

Krashen (2003) believes that the process of acquisition is of greater importance than the process of learning. Krashen further elaborates that understandable language input or i + 1 is the key to language acquisition since the input hypothesis *relates to acquisition, not learning* (Krashen, 2003, p.21). The (i) of the input hypothesis refers to one's basic knowledge or proficiency level in a language, while the (+ 1) refers to the level of input to be offered to second language learners for learning to take place (Krashen, 2003, p. 21). Changyu (2009), in his study of second language acquisition and college English teaching asserts that the intensive second language courses offered at universities need to provide college students with a large amount of understandable language input in order to enable those students to learn a second or a foreign language. Intensive English programs are

courses in which students participate in a higher number of classes in a shorter period of time (Mukundan, et al. 2012).

Proficiency in English as a Second Language (ESL)

Studying English as a foreign language is not a simple and straight forward issue. In fact, ESL learners *have problems with different areas in the use of the language* (Al Othman & Shuqair, 2013). As a result, those learners have to take intensive as well as extensive language courses in order to become proficient in the English language (Al Othman & Shuqair, 2013). Language proficiency as delineated by the American Council on the Teaching of Foreign Languages (ACTFL) proficiency guidelines consists of five main levels ranging from novice low to superior (Omaggio-Hadley, 2001, p. 13). Omaggio-Hadley (2001) defines proficiency as *the expertise, ability or competence* (that implies) *implying a high level of skill, well-developed knowledge, or a polished performance* (pp. 2-3). Proficiency level is skill specific; it varies from one language art skill to another. That is, the level of proficiency might vary from one skill (speaking, writing, reading, & listening) to another. Several factors contribute to the development of language proficiency. Intensive language courses, for one, can lead to the development of the language proficiency of students. Mukundan et al (2012) conducted a study on the effectiveness of intensive English language courses in Malaysian secondary schools. The results of that study revealed that in the case of the low scoring learners, intensive English courses could be of great help in enhancing language proficiency. Those results support the findings of the previous studies which proved the efficiency of intensive teaching and learning formats (Bédard & Thomas, 2010; Burton & Nesbile, 2002; Grant, 2001; Spurling, 2001, as cited in Mukundan, et al., 2012; Turunen, 2019).

Another factor that helps yield those positive results is learners' beliefs. The beliefs that ESL Learners hold is among the important factors that contribute to the development of language proficiency. Mokhtari, in 2007, affirms that *individual language learners hold different beliefs about how language is learned. Individual beliefs about language learning may consciously or unconsciously influence learners' approaches to language learning* (Mokhtari, 2007, as cited in Bagherzadeh 2012, p. 784). Motivation plays another important role in second language learning. Research revealed that proficiency level had a significant effect on the motivation of students (Bagherzadeh, 2012). Research has also indicated that the stronger learning motivation is, the more passionate learners would be to learn and the more lasting the learning activity would be. It is believed, therefore, that teachers have to encourage their ESL students to use their creative thinking skills in order to boost their motivation for that would definitely help them acquire a foreign or a second language more effectively (Pica, 2005, as cited in Bagherzadeh, 2012).

Using a Second Language: Preparation of Science and Math Pre-Service Teachers

Science and math teacher education programs should address the needs of prospective teachers to help develop their foreign language proficiency (Saat & Othman 2010). Syahril (2019) suggests that countries need to invest in teacher education programs that prepare "quality teachers" who would be able to think and teach in an interdisciplinary manner. Those pre-service educational programs can be "very strategic not only in improving and transforming a country's education but also in accelerating its social and economic development" (p. 33). According to Syahril (2019), quality teacher preparation should address three types of knowledge: 1) content knowledge or knowing about the content of science/math and/or language, 2) pedagogical content knowledge or knowing how to teach the language and/or the subject area, and 3) pedagogical knowledge or knowing what it entails to be an effective teacher. The latter kind of knowledge equips teachers with the necessary characteristics and skills that would help them increase their self-efficacy. One way of integrating scientific subjects and English as a second language is referred to as content-based instruction or CB-ESL (Oxford, 1993). "In CB-ESL, the primary goal is communicative competence in the target language, and an associated aim is content knowledge, such as mathematics…or science" (Oxford, 1993, p. 75). Oxford delineates 5 main methods that are related to content-based instruction at the tertiary or postsecondary level. Some of those methods are: 1) English for specific purposes (ESP) where English is to be used in particular situations for specific needs, 2) theme-based CB-ESL, in which language is used in the study of a theme (e.g. global warming), and 3) adjunct CB-ESL, in which separate content and language courses are linked through the coordination of the instructors and the curricula (Oxford, 1993).

However, irrespective of the method or methods used in the foreign language classroom, instructors of EFL or ESL might face a difficulty in teaching scientific concepts to students majoring in Science or Mathematics. Teaching ESL or EFL to university students majoring in science or math education is not an easy task. The first

difficulty lies in the fact that the majority of ESL and EFL instructors are non-native speakers of English who need to teach scientific content and terms to their learners who themselves are non-native speakers of English and whose language proficiency might not exceed the low advanced or high intermediate level (Ruzlan Md-Ali, 2014). Most of those scientific words are usually technical and are unfamiliar to language teachers. Scientists often use scientific words for familiar objects. For example, a scientist will say 'aqua' instead of 'water', 'photo' instead of 'light', 'macro' instead of 'on a large scale' or 'micro' when they mean 'small'. Many of these words are then put together to make complicated, compound words, like 'aquaculture' and 'aquacade', 'macrocosm', photosynthesis or microscope". In addition to the technical terms, many others are specialized vocabulary words which have specific scientific meanings in addition to their everyday meanings. Examples of such words are conductor, file, and alum (Stutchbury, et al., 2016).

Second Language Instruction: English for Specific Purposes (ESP) vs. English for Academic Purposes (EAP) and English for General Purposes (EGP) Programs

While English for General Purposes (EGP) and English for Academic Purposes (EAP) aim at facilitating English learners to achieve English proficiency for general communication purposes and academic purposes simultaneously, ESP is learner-centered and content/context-based specific. This primarily involves professional and practical English, studied to meet learners' specific needs in utilizing English in their specific fields such as science and technology. It is particularly used to teach English to engineers, businessmen, doctors, hotel managers and other professions. It is also used in universities and technical schools to teach students majoring in science, math, and other content area majors (Sulaiman, et al., 2018). For this reason, competent ESP teachers must possess related content knowledge, skills or experiences, in addition to the English language itself, in order to provide learners with a successful and beneficial course. While a language teacher with an expertise in a particular subject area is seldom found in a regular university, it is beneficial to rely on collaborative teaching in the ESP class (Ching-ning Chien et al., 2008). According to Luo and Garner (2017, p. 85). *The aim of training teachers of ESP is not to make them subject experts, but to maximize their linguistic knowledge and skills. Teachers must acquire an essential general grasp of the subject with the co-operation and/or collaboration of subject teachers. They further need to supplement their linguistic expertise with socio-cultural understandings and pedagogical competences to fulfill a variety of roles. Only through programs that incorporate these elements can the ultimate goal of ESP be achieved: the capacity of learners to engage in real communication in English.*

According to Hutchinson and Waters (1987), ESP is not just a matter of teaching specialized varieties of English; ESP courses include common linguistic features, although certain technical and specialized terms are specific to a given context or subject area. It is worthy of note that in ESP classes, the language instructor does not need to master the scientific subject matter but should accept the fact that he or she is learning about the subject matter along with the students; this prevents the teacher from becoming overwhelmed by technical content. ESP teachers should let students know initially that they (the language instructors) are not experts in the subject area; so that students will not be surprised when they discover that perhaps they know more than their instructors (Sulaiman et al., 2018). ESP courses need to be designed according to learners' needs. Such courses are more motivating and thus educationally more effective (Hutchinson & Waters, 1987). Hence, a successful ESP course should start with the needs of the learners. As long as learners' needs are satisfied, the goals of ESP courses are more likely to be achieved. Compared with EGP and/or EAP courses which tend to focus on core structures and linguistic elements to form the base of language competence, an ESP program addresses the learners' need to function effectively in the English language at the workplace (as cited in Ching-ning Chien et.al., 2008). Hutchinson and Waters (1988) emphasized that ESP teaching should target developing learners' content knowledge in addition to promoting their linguistic knowledge. This objective is fundamental to the whole teaching-learning process of scientific core courses and the English language.

Language of Instruction (FCE) and Techniques of Expression (TE)

The course FCE (First Certificate Examination) is an English language course which aims to equip the students with advanced reading/writing skills and improve their aural/oral communication skills. In addition, students will be trained on a variety of test items to improve their test-taking skills regarding FCE (a standardized test). This course will provide students with an appropriate language baggage to be able to present the First Certificate Examination in English (FCE) which is a Cambridge ESOL exam given to the upper-intermediate level or B2. Presenting (sitting for) the FCE Exam is *not* a university requirement. However, students should be able to meet the objectives of the FCE course whether they want to take the FCE or not.

FCE Course Objectives: By the end of the FCE course, students will be able to:

> *In Reading* • Skim and scan various reading texts • Practice different test items: multiple choice questions, multiple matching, gapped texts Writing • Write formal letters: letter of complaint & letter of supplication • Write paragraphs inside letters using the writing process • Use properly various linking expressions (reasons, results, and examples) • Use different ways of making suggestions and giving personal opinion
> *In Listening* • Practice note taking and note completion • Practice the test items: True or False, matching, multiple choice questions, multiple matching, and sentence completion.
> *In Speaking* • Practice discussing films, debating various issues, asking for and reacting to opinions, discussing advantages and disadvantages, expressing uncertainty, prioritizing and advertising a product
> *In Vocabulary* • Guess meaning from context • Use appropriately: adjectives of feeling, negative prefixes, suffixes, collocations, modifiers/intensifiers, general nouns, prepositions, prepositional phrases , phrasal verbs, word formation
> *In Grammar* • Review past and present tenses- Future forms • Make comparisons • Review parts of speech - Countable and uncountable nouns • Review indirect speech- Reporting verbs • Review conditionals –Passive - Gerunds & infinitives • Express certainty, obligation, necessity, permission, ability & possibility • Practice the following test items for grammar & vocabulary: key word transformation, word formation, error correction & multiple choice cloze

The course TE (Techniques of Expression) is a technical course on oral and written expression. Practice includes using a variety of presentation skills, verbal and non-verbal communication competences, note taking, paraphrasing and summarizing, writing various letters and CVs as well as delivering effective oral presentations by means of PowerPoint.

TE Course Objectives: By the end of this course, students will be able to:

> present an article on education using a PowerPoint presentation, use polite expressions to take turns and justify a point, take notes and summarize them, paraphrase and summarize texts, write a CV (Curriculum Vitae), and write letters of complaint, petition, recommendation, and cover letters (attestation letters and memos are given as extras).

The duration of the FCE course is 60 hours in the 2nd Semester (first year), while TE is taught for 40 hours in the 3rd Semester (second year). Both courses are taught in French or English depending on the prospective teachers' first foreign language.

Method

This research is a mixed study relying on quantitative as well as, qualitative data tools to enhance the reliability of the results. The quantitative data was collected from rating scales and 5-point Likert-type scale questionnaires, while the qualitative data consisted of open-ended questions typed and stapled to the questionnaire sheet. Another purposeful sample consisted of the Science and Math students, who had already taken those two courses during their first and second years of study. The purposeful sample is used to collect students' feedback on those courses while doing their science and math practicums at schools.

Variables

Students' major whether science or math is a variable. Both foreign language courses FCE and TE are variables. However, gender and age are not variables since all the participants are females and mainly belong to the same age group.

Tools

Nine questionnaires were administered to determine the efficacy and relevancy of the foreign language courses—the FCE and TE that are compulsory for the Science and Mathematics Education majors. The first and second questionnaires, administered to the English and French professors and instructors who teach the FCE course to science or mathematics students, consisted of 10 items and 4 open-ended questions. The third and

fourth questionnaires, administered to the English and French professors and instructors of the TE course to science or mathematics students, also consisted of 10 items and 4 open-ended questions. The fifth questionnaire that was distributed to the French and English coordinators of science and mathematics included 11 statements and 5 open-ended questions. The sixth and seventh questionnaires, distributed to the trainers of the science and mathematics practicum courses that are offered in English and French, consisted of 10 statements and 5 open-ended questions. The eighth and ninth questionnaires that were filled by the students majoring in science or math education consisted of 15 statements and 3 open-ended questions. The answers of the items of each questionnaire were coded, analyzed, interpreted and triangulated with the qualitative data.

Sample

The sample consisted of science and mathematics education students enrolled in their first, second, and third years of study at Branch One of the Faculty of Education at the Lebanese University. The number of 1st and 2nd year students who participated in this research was 197. Third year students that made up the purposeful sample consisted of 47 science and mathematics students. All the students, including those in the purposeful sample, were females since all the students who usually major in elementary science and mathematics education at the Faculty of Education, at the Lebanese University are females. Those prospective teachers had taken a first foreign language for 12 to 15 years at school. The first foreign language is used as the medium of instruction for learning/teaching science or mathematics.

The sample also consisted of 4 coordinators—two coordinators for English science & math education and two coordinators for French science & math education. The sample also included 9 professors or instructors, 3 for the TE course (2 for English and 1 for French) and 6 for the FCE (4 for English & 2 for French). The sample also included 10 science and math trainers (6 for English and 4 for French). The total number of the sample is 267 (244 students & 23 professors, coordinators and trainers).

Results and Discussion

Results Related to Research Question 1: Do the Professors, Coordinators and Trainers Believe the Language Courses to be Effective and Relevant?

Beliefs of the Language Professors and Instructors

Four statements (quantitative data) and one open-ended question (qualitative data) investigated the opinions of the language professors and coordinators about the effectiveness of the courses in helping science and mathematics education students improve their language proficiency, while six questionnaire items and one open-ended question investigated their beliefs about the relevancy of the two compulsory language courses to students' majors (mathematics and science education).

Beliefs of Professors/Instructors about the Effectiveness of the Language Courses

Analysis of the data, depicted in Table 1, revealed that most of the instructors/professors (62.5%) believed that the language courses do not help students become fluent in a foreign language (item 4). All of the professors and instructors (100%) believe that students of science and mathematics need more language courses to help improve their foreign language (item 6). Most of those professors/instructors (68.8%) believe that students will refer to Arabic to compensate for any linguistic deficiency when communicating in the foreign language (item 9). More than half of them (56.3%) believe that the courses do not prepare students to explain scientific lessons without using Arabic (item 2), and only a quarter of them (25.00%) believe that the language courses enable students to write error-free scientific tests in a foreign language (item 10). İn other words, the majority of the professors/instructors believed that the language courses do not help raise students' foreign language proficiency to an advanced level that is expected of science and mathematics teachers who have to use English or French rather than Arabic as the medium of instruction.

Those findings are congruent with the attestations provided by professors/instructors in the open-ended questions: "*Students should be given special instructions in scientific vocabulary to encourage them participate meaningfully and strive to learn the English language so they can use it in the future*." "*More time need to be given to promoting students' oral/aural communication skills.*" "*I recommend that instructors inspire their*

students by helping them develop the habit of reading just for the sake of reading. In other words, students should be more urged to read texts for enlightenment and amelioration of their English language." "*Different core courses need to be taught in French/English to help improve their language competency.*"

Beliefs about the Relevancy of the Language Courses

Analysis of the data, shown in Table 1, revealed that around half of the professors/instructors (56.3%) believe that the courses are compatible with students' majors (item 1), yet the majority (75%) believe that the content of the courses does not meet the needs of Math and Science Education students (item 5), and the majority (75%) consider the textbooks to be insufficient (item 7). Only a very limited number of the professors/instructors (12.5%) consider the vocabulary of the courses to be relevant to students' scientific majors (item 8), and very few of them (25%) believe that the courses help build the vocabulary of students majoring in science or math (item 3). The researchers, thus, conclude that most of the professors and instructors consider the language courses to be not tailored to students' needs as future teachers of science and mathematics. Most of the professors/instructors admit that the textbooks used, the vocabulary provided and the content implemented need to be modified to suit students' needs.

Attestations of the professors for the open-ended questions revealed that language professors/instructors consider that the language courses are not so relevant and that additional material that is major specific is needed to provide students with scientific terms: "*The themes discussed in class should expose Math education students more to the language of mathematics in order to make them feel fully involved and motivated*." "*I would recommend Sciences and Mathematics Education students be given extra handouts covering Scientific glossary*." "*Reading texts should be pertinent to their major so that they can acquire vocabulary words related to science and math education especially that they need to elucidate concepts while teaching*." "*We must not rely solely on their books. Instead, we have to provide them with several educational websites from which they could choose appealing research-based articles related to their major.*", and "*Integrate the discipline with the study of the language.*"

Table 1. Evaluation of the Statements by the Language Professors and Instructors

Items	Mean	SD	D	UN	A	SA
1. The content of the language courses suits the scientific majors of the students.	3.38	0.0%	43.8%	0.0%	31.3%	25.0%
2. The language courses prepare students to explain a scientific lesson without using Arabic.	2.94	6.3%	50.0%	0.0%	31.3%	12.5%
3. The courses help build the vocabulary of students majoring in science or math.	2.63	0.0%	62.5%	12.5%	25.0%	0.0%
4. The language courses do not help students majoring in science and math become fluent in a foreign language.	3.69	0.0%	18.8%	18.8%	37.5%	25.0%
5. The contents of the courses meet the needs of math/science education students.	2.88	0.0%	62.5%	12.5%	0.0%	25.0%
6. Science and math students need more foreign language courses for their future careers.	4.88	0.0%	0.0%	0.0%	12.5%	87.5%
7. Textbooks used in the language courses are insufficient for science and math students.	3.88	0.0%	0.0%	25.0%	62.5%	12.5%
8. Vocabulary of the language courses is relevant to students' majors.	2.38	18.8%	37.5%	31.3%	12.5%	0.0%
9. Students will use Arabic when explaining a scientific lesson in the future.	3.75	6.3%	18.8%	6.3%	31.3%	37.5%
10. The courses enable students to write error-free scientific tests and tasks in a foreign language.	3.00	6.3%	37.5%	31.3%	0.0%	25.0%

(Legend: SD: Strongly Disagree, D: Disagree, UN: Unsatisfied, A: Agree, SA: Strongly Agree)

Beliefs of Professors/Instructors about each Course

In order to determine whether or not there was any variance in professor'/instructors' beliefs about FCE and TE, the P-value for each item was calculated. The results are shown in Table 2. Results illustrated in Table 2 indicated that for all the items of the questionnaire, there was no significant difference in the P-value between their opinions on FCE and TE. Based on the results illustrated in Tables 1 and 2, the researchers can thus conclude that the language professors/instructors hold the same opinion towards the two language courses; they tend to question the efficacy and relevancy of each of those foreign language courses.

Table 2. Evaluation of the Beliefs of the Language Professors/Instructors by Course

Items	Course	P-value
1. The content of the course suits the scientific majors.	FCE TE	0.659
2. The course prepares students to explain a scientific lesson without using Arabic.	FCE TE	0.785
3. The course helps build the scientific vocabulary of the students.	FCE TE	0.611
4. The course helps students majoring in science or math education become fluent in a foreign language.	FCE TE	0.835
5. The content of the course meets the needs of students in scientific majors.	FCE TE	0.522
6. Science & math students need more foreign language courses for their future careers.	FCE TE	0.341
7. Textbook of the course is insufficient for science or math students.	FCE TE	0.164
8. Vocabulary of the course is relevant to students' major.	FCE TE	0.244
9. Students will use Arabic when explaining a scientific lesson in the future.	FCE TE	0.632
10. The course enables students to write error-free scientific tests and tasks in a foreign language.	FCE TE	1.000

Beliefs of the Coordinators of Science and Mathematics

The questionnaire distributed to the 4 science and mathematics coordinators (2 for English and 2 for French) included two types of 5-Likert point items, as well as, a rating scale questionnaire. The first one with a scale ranging from strongly disagree to strongly agree includes two items, while the second one with a scale ranging from never to always includes 5 items. The rating scale included 3 items.

Analysis of the data collected from the questionnaire administered to coordinators of science and mathematics and depicted in Table 3 indicated that all of them agree that students will definitely use Arabic when explaining a scientific lesson in the future (item 1), and that their sentence structures sound like Arabic (item 7), and tend to refer to Arabic when explaining a scientific lessons (item 4). All four coordinators agree that their students will not write error-free scientific articles, tests, and activities in a foreign language (item 2). And three of them assert that their students can rarely explain a scientific lesson in a foreign language without making mistakes (item 3). All of the coordinators affirm that students have problems in sentence structure (item 6), while three of them confirm that their students have problems in spelling scientific terms (item 5). All of the coordinators believe that their students' oral and vocabulary competencies are not good (items 8 & 10). Only one coordinator believes that students' writing skill is good (item 9); the rest believe that students' written communication skill is not so good.

The coordinators' open-ended attestations support those results. *"By large our students make major mistakes." "Lately, we noticed an improvement in the quality of students, but the majority of them have a weak language." "The problem is embedded in the school curriculum that does not enable them to speak and write fluently in a foreign language." "We need to address the areas of weaknesses in their communication skills and tailor language courses accordingly." "The areas that need improvements are speaking, listening and academic writing." "Make the language course compulsory for every student in the faculty."*

Table 3. Evaluation of the Statements by the Coordinators (Means and Frequencies)

	SD	D	UN	A	SA
1. I believe that despite our efforts, students majoring in science/math education will definitely use Arabic when explaining a scientific lesson in the future.				4	
2. I believe FCE and TE taken during their 2nd and 3rd semesters enable students to write error-free scientific articles, tests, & activities in a foreign language.	3	1			
	NV	RY	ST	OF	A
3. My science/math students can fluently explain a science or math lesson in a foreign language.		3	1		
4. My science/math students tend to use Arabic when explaining a lesson in science or math.			3	1	
5. My science/math students have problems in correctly spelling scientific terms.		1	2	1	
6. My science/math students have problems in sentence structure when devising exercises.			2	2	
7. My science/math students' sentence structure sounds like Arabic (as if literally translated from Arabic).			2	2	
	W	NG	G	VG	EX
8.My science/math students' oral fluency is:		4			
9. My science/math students' written fluency is:		3	1		
10. My science/math students' vocabulary repertoire is:		4			

(Legend: SD: Strongly Disagree, D: Disagree, UN: Unsatisfied, A: Agree, SA: Strongly Agree)
(Legend: NV: Never, RY: Rarely, ST: Sometimes, OF: Often, A: Always)
(Legend: W: Weak, NG: Not so good, G: Good, VG: Very Good, EX: Excellent)

Beliefs of the Science and Mathematics Trainers

Trainers are the instructors of the practicum courses who observe their students at schools and who meet with them to discuss issues related to the teaching process. The trainers' questionnaire consisted of 6 statements on a 5 Likert-point continuum (never, rarely, sometimes, often & always) that investigated the efficacy of the foreign language courses. The questionnaire also included 4 items that helped them rate the linguistic performance of the students on a 4-point scale (weak, not so good, very good, & good). For the qualitative data, the trainers were asked 5 open-ended questions.

Analysis of the data collected from the trainers, illustrated in Table 4, indicated that more than half of the trainers (58.33%) believed that their students can sometimes and often fluently use a foreign language to explain a science lesson (item 1), and can sometimes and often clearly express themselves in a foreign language (83.33% - item 6) . However, the vast majority (91.67%) of the trainers asserted that their students tend to sometimes and often use Arabic when explaining scientific lessons (item 2). And most of the trainers (75%) declared that their students' sentence structure sounded like Arabic (item 5). Around two-thirds (66.66%) of the trainers admitted that their students have problems with sentence structure (item 4), and spelling of scientific terms (75% - item 3). The majority of the trainers (75.00%) describe their science and mathematics students' oral fluency and vocabulary repertoire to be weak and not so good (items 1 & 3 respectively). As for grammar and the written communication skill, those percentages drop. Thus only 41.67% of the trainers believe that students' grammar is not good and 33.33% believe that students' writing is not so good.

Those results were supported by the trainers' responses to the open-ended questions where they asserted that the language of the science and math students at the faculty of education was not so good. Only very few students could present lessons that were almost error-free: "*In general, their language is not so good*." "*Very few of them could deliver lessons without mistakes.*" "*I think rare are the students who are capable of doing so*." "*They make major mistakes because of their weakness in a foreign language, or because they do not have adequate or sufficient scientific background. In fact, sometimes students fail to present a lecture without making more or less serious mistakes*." "*All areas need improvement, but the major areas of concern are oral language, vocabulary, sentence structure, and comprehension*." *Provide listening sessions and have them watch videos about foreign teachers giving lessons and let them compare those to their own micro lessons*." "*Improving the foreign language of the students majoring in is the responsibility of all the staff.*" "*One or two students would be*

capable, in the future, of making a presentation in a foreign language in front of a wide audience." "They have difficulties in expressing their thoughts in a foreign language." "Their vocabulary is rather poor and limited."

The results of the quantitative and qualitative data indicate that trainers who closely observe students' linguistic performance are aware that their language proficiency needs to be further developed to help them become competent teachers of science or mathematics in the future. Thus trainers, coordinators and foreign language professors /instructors hold the same beliefs regarding the language proficiency of science and math education students.

Table 4. Evaluation of the Statements by the Trainers

Items	Mean	NV	RY	ST	OF	A
1. My science/math students can fluently explain a science or math lesson in a foreign language.	2.83	0.00%	41.67%	33.33%	25.00%	0.00%
2. My science/math students tend to use Arabic when explaining a scientific lesson.	3.33	0.00%	8.33%	50.00%	41.67%	0.00%
3. My science/math students have problems in correctly spelling scientific terms.	2.83	8.33%	16.67%	58.33%	16.67%	0.00%
4. My science/math students have problems in sentence structure when devising scientific exercises, activities and test items.	3.00	0.00%	33.33%	33.33%	33.33%	0.00%
5. My science/math students' sentence structure sounds like Arabic (as if literally translated from Arabic).	3.25	0.00%	25.00%	25.00%	50.00%	0.00%
6. My science/math students can clearly express themselves.	3.17	0.00%	16.67%	50.00%	33.33%	0.00%
	Mean	W	NG	G	VG	EX
1.My science/math students' oral fluency is:	2.33	16.67%	58.33%	0.00%	25.00%	0.00%
2. My science/math students' written fluency is:	2.67	0.00%	33.33%	66.67%	0.00%	0.00%
3. My science/math students' vocabulary repertoire is:	2.25	25.00%	50.00%	0.00%	25.00%	0.00%
4. My science/math students' grammar is:	2.92	0.00%	41.67%	25.00%	33.33%	0.00%

(Legend: NV: Never, RY: Rarely, ST: Sometimes, OF: Often, A: Always)
(Legend: W: Weak, NG: Not so good, G: Good, VG: Very Good, EX: Excellent)

Results Related to Research Question 2: Do the Students Majoring in Science and Mathematics Education Consider the Language Courses to be Effective and Relevant?

Beliefs and Opinions of Students

Seven statements (quantitative data) and one open-ended question (qualitative data) investigated the effectiveness of the courses in helping students improve their language proficiency, while eight questionnaire items and one open-ended question investigated students' opinions as to whether or not they considered the courses to be relevant to the majors. Results of those items are depicted in Table 5 below.

Students' Beliefs on the Efficacy of the Language Courses

Results of students' responses to the questionnaire statements of Table 5 indicate that around two thirds of the students believed that the foreign language courses help them improve their foreign language (65.3% - item 1), enable them to become fluent in the foreign language (64% - item 2), and improve their sentence structure (655% - item 13). However, only around half of the students believe that the language courses help develop their vocabulary repertoire (56% - item 3), correctly spell (50.60% - item 14) & pronounce (50.8% - item 15) words that are not related to major, and only less than half of the students believed that the language courses could help them overcome the problem of translation (44.1% - item 12). That is why, more than half of the students (53.2%) when responding to the open-ended question stated that those courses are not sufficient; they believed that they need more foreign language courses, as Figure 1 shows.

Table 5. Evaluation of Students' Responses about TE and FCE Courses in English and French

Items	Mean	SD	Not at all	Very little	Somehow	Much	A lot
1. I believe the course helps improve my foreign language	3.73	1.14	3.60%	14.50%	16.60%	35.80%	29.50%
2. I believe the course enables me to become fluent in the foreign language.	3.76	1.23	5.20%	14.10%	16.70%	28.10%	35.90%
3. I believe the course increases my vocabulary.	3.50	1.25	8.80%	13.40%	21.80%	30.60%	25.40%
4. I believe the content of the course is suitable to my major.	3.18	1.24	10.40%	22.40%	22.40%	28.60%	16.20%
5. I believe the course helps improve my skill in writing scientific essays	3.20	1.24	9.90%	20.80%	26.60%	25.00%	17.70%
6. I believe the course helps improve my skill in writing scientific lessons, activities and tests	2.99	1.28	14.90%	23.90%	21.30%	26.60%	13.30%
7. I believe the course enables me to correctly spell scientific words.	3.53	1.25	8.40%	14.70%	17.90%	33.20%	25.80%
8. I believe the course enables me to correctly pronounce scientific words.	3.76	1.25	6.80%	12.50%	15.10%	29.70%	35.90%
9. I believe the content of the course overlaps with the extensive foreign language course.	3.23	1.28	9.80%	22.00%	26.20%	20.00%	22.00%
10. I believe the course enables me to fluently use a foreign language to teach science in the future.	3.35	1.20	7.50%	20.30%	18.70%	36.40%	17.10%
11. I believe the course does not prepare me to teach science in a foreign language.	2.22	1.27	39.10%	25.00%	17.40%	11.40%	7.10%
12. I believe the course helps me overcome the problem of translating from Arabic.	3.26	1.15	7.00%	20.20%	28.70%	28.70%	15.40%
13. I believe the course helps improve my sentence structure of my foreign language.	3.74	1.02	2.10%	11.50%	20.90%	41.40%	24.10%
14. I believe the course enables me to correctly spell words that are not related to my major.	3.41	1.22	8.80%	13.50%	27.10%	29.20%	21.40%
15. I believe the course enables me to correctly pronounce words that are not related to my major.	3.30	1.29	13.10%	14.10%	22.00%	31.40%	19.40%

(Legend: SD: Strongly Disagree, D: Disagree, UN: Unsatisfied, A: Agree, SA: Strongly Agree)

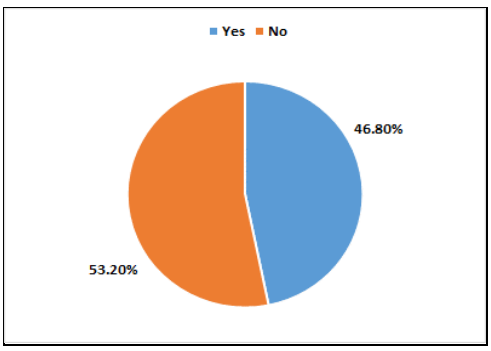

Figure 1. Efficacy of the Foreign Language Courses

The computed P-values of items 5 and 6 as depicted in Table 6 below show that students emphasize the importance of those courses in helping them improve their writing skills, rather than their oral communication skills. It is obvious, thus, that most of the students believe that the language courses are effective in developing certain language skills and not all, particularly vocabulary building and translation. That is why they consider that more courses are needed to help improve their linguistic competency, in general, and disparity of vocabulary, in particular, which urges students to either translate verbatim from their native language or use Arabic (their native language).

Table 6. Evaluation of the Statements about TE and FCE Courses

Items	Course	N	Mean	SD	t	P-value
5. I believe the course helps improve my skill in writing scientific essays	FCE	37	3.14	1.27	-2.437	0.017
	TE	38	3.79	1.04		
6. I believe the course helps improve my skill in writing scientific lessons, activities and tests	FCE	36	2.78	1.22	-2.296	0.025
	TE	37	3.43	1.21		

Students' Beliefs on the Relevancy of the Language Courses to Major

Based on the results depicted in Table 5 above, many students believed that the language courses help them spell scientific terms (59 % - item 7), enable them to teach science in a foreign language in the future (53.5% - item 10). On the other hand, some believe that the content of the language courses overlaps with the extensive (preparatory) courses (42.00% - item 9) which focus on English or French for general purposes (EGP/FGP) rather than English or French for specific purposes (ESP/FSP). Also only few students believed that the foreign language courses are suitable to their majors (44.8% - item 4), help them write scientific essays (42.7% - item 5), enable them to write scientific tests, activities & lessons (39.9% - item 6), correctly pronounce scientific terms (19.3% - item 8), and prepare them to fluently use the foreign language to teach science (18.5% - item 11). Students' responses to the open-ended questions support those findings for a substantial number of the students (44.20%) admitted that the texts and articles used in the language courses are not relevant to their scientific majors (Figure 2). The researchers thus conclude that the content of the syllabi and the materials used need to modified to make them more compatible with students' majors. And hence they indirectly assert that the language courses are not so relevant to their majors.

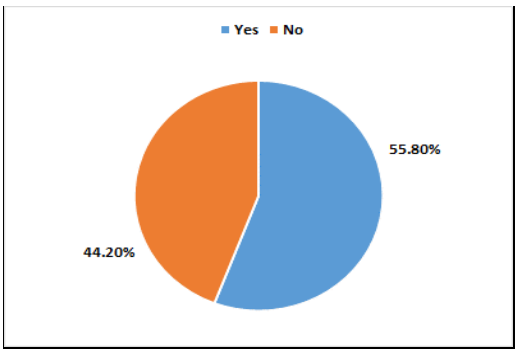

Figure 2. Relevancy of Foreign Language Courses

Results Related to Research Question 3: Are There any Differences in the Opinions of Science and Mathematics Students towards the Two Language Courses (FCE & TE)?

Beliefs about the Efficacy of the Language Courses

Analysis of the responses of students regarding the overall efficacy of the two language courses (TE & FCE) revealed that science and math education students tend to hold similar opinions, as Table 7 illustrates. Around two thirds of the students in science (65.79%) and in math (64.96%) believe that the language courses help them improve their foreign language (item 1), and enable them to become fluent (item 2: 67.11% & 62.07% respectively). Almost the same number of students in both majors concur that the language courses prepare them to teach scientific topics in a foreign language (item 11: 64.38% & 63.96% respectively). However, the language courses help science students more than the mathematics students in improving their sentence structure (item 13: 73.68% & 60.00% respectively), in developing their vocabulary (item 3: 60.53% & 52.99% respectively), in pronouncing general words (item 15: 62.16% & 43.59% respectively), in spelling general or

unscientific words (item 14: 52.63% & 49.14% respectively), and in overcoming the problem of translating from Arabic (item 12: 46.58% & 42.61% respectively).

Beliefs about the Relevancy of the Language Courses

The variance in opinion regarding the relevancy of the language courses to major (science or mathematics) is apparent in the statistical computations of the data illustrated in Table 7. Results revealed that, according to the prospective teachers, the language courses are more relevant to science than mathematics. Analysis indicated that the language courses (item 4) are more suitable to science (57.33%) than to mathematics (36.75%), enable them to spell (item 7: 63.51% vs. 56.03%), and pronounce scientific terms (item 8: 71.05% vs. 62.07%), use the foreign language in their future careers (item 10: 63.89% vs. 46.96%), help them write scientific essays (item 5: 54.67% vs. 35.04%). Those percentages drop to less than half (43.84%) for science and a third (37.39%) for mathematics for students who believe that the language courses help them write scientific lessons, tests and activities (item 6).

Table 7. Evaluation of the Statements about the Language Courses by Major

Items	Major	Not at all + Very little	Somehow	Much + A lot
1. I believe the course helps improve my foreign language.	Science	17.11%	17.11%	65.79%
	Math	18.80%	16.24%	64.96%
2. I believe the course enables me to become fluent in the foreign language.	Science	18.42%	14.47%	67.11%
	Math	19.83%	18.10%	62.07%
3. I believe the course helps increases my vocabulary.	Science	21.05%	18.42%	60.53%
	Math	23.08%	23.93%	52.99%
4. I believe the content of the course is suitable to my major.	Science	24.00%	18.67%	57.33%
	Math	38.46%	24.79%	36.75%
5. I believe the course helps improve my skill in writing scientific essays.	Science	21.33%	24.00%	54.67%
	Math	36.75%	28.21%	35.04%
6. I believe the course helps improve my skill in writing scientific lessons, activities and tests.	Science	34.25%	21.92%	43.84%
	Math	41.74%	20.87%	37.39%
7. I believe the course enables me to correctly spell scientific words.	Science	16.22%	20.27%	63.51%
	Math	27.59%	16.38%	56.03%
8. I believe the course enables me to correctly pronounce scientific words.	Science	15.79%	13.16%	71.05%
	Math	21.55%	16.38%	62.07%
9. I believe the content of the course overlaps with the extensive foreign language course.	Science	33.33%	26.98%	39.68%
	Math	30.69%	25.74%	43.56%
10. I believe the course enables me to fluently use a foreign language to teach scientific topics in the future.	Science	25.00%	11.11%	63.89%
	Math	29.57%	23.48%	46.96%
11. I believe the course does not prepare me to teach scientific topics in a foreign language.	Science	64.38%	12.33%	23.29%
	Math	63.96%	20.72%	15.32%
12. I believe the course helps me overcome the problem of translating from Arabic.	Science	17.81%	35.62%	46.58%
	Math	33.04%	24.35%	42.61%
13. I believe the course helps improve my sentence structure of my foreign language.	Science	6.58%	19.74%	73.68%
	Math	18.26%	21.74%	60.00%
14. I believe the course enables me to correctly spell words that are not related to my major.	Science	21.05%	26.32%	52.63%
	Math	23.28%	27.59%	49.14%
15. I believe the course enables me to correctly pronounce words that are not related to my major.	Science	17.57%	20.27%	62.16%
	Math	33.33%	23.08%	43.59%

Results related to Research Question 4: To What Extent do the Syllabi of the FCE and TE Courses Prepare Science and Mathematics Students for their Future Careers as Teachers?

Analysis of the Syllabuses of the FCE and TE Courses

The FCE course stresses skimming and scanning of various reading texts without specifying that those texts need to be related to science and mathematics. Many students, in the why section of the open-ended questions, clearly stated that those texts are incongruent with their major: *"We did not get enough information out of the*

courses because the texts should be more related to science and mathematics education." "We read more about unrelated topics." "This course includes texts from various domains." "We read stories." "The texts are not related to our major; they are mostly literary texts." "We discuss topics that are not relevant to our major." "We need to write essays about scientific topics." "They need to coordinate between the language courses and the scientific courses."

The FCE and the TE courses require them to write letters of complaints, letters of supplication, cover letters, petitions, recommendations or letters that encourage them to make suggestions and give personal opinion. These are definitely not related to scientific majors. Some 1st & 2nd year science & math students openly expressed the need to modify and improve the syllabuses of the FCE and the TE courses: *"The syllabus needs to be modified." "The syllabus needs to be improved." "The content must be changed." "The syllabus should be more related to our major." "The content does not help us in teaching scientific courses in the foreign language." "We are learning English for general purposes, rather than English for Math and Science." "The content, if relevant however, is more important than the number of courses." "We only benefit from the grammar content."* Although The FCE and the TE courses do not stress listening and speaking, as most of the 1st & 2nd year science and math students stated: *"The courses need to focus more on oral and aural communication." "We need more effective courses that concentrate on oral communication rather than written communication." "There should be a variety of speaking and listening activities." "Provide opportunities for oral communication to enhance our speaking skill." "Focus on oral communication and comprehension." "Oral tests should be administered."*

Beliefs of 3rd Year Science and Math Students about the Efficacy of TE & FCE

To answer this question, a purposeful sample is used. It is formed of science and Mathematics students, enrolled in their 3rd year and who had attended FCE and TE earlier, in years 1 & 2, when they were in the middle of doing their practicum at schools. The purposeful sample is made of 47 students, as follows: Math, English section (12), Science, English section (14), Math, French section (10), Science, French section (11). As the data depicted in Table 8 reveals, only around half of the 3rd year students (56.76%) believe that the language courses are effective and help them develop their foreign language proficiency (item 1), enable them to become fluent in the foreign language (item 2: 54.05%).

Table 8. Evaluation of the Statements about TE and FCE Courses for the Purposeful Sample (N=47)

Items	Mean	SD	Not at all + Very little	Somehow	Much + A lot
1. I believe the course helps improve my foreign language.	3.41	1.21	29.73%	13.51%	56.76%
2. I believe the course enables me to become fluent in the foreign language.	3.43	1.34	27.03%	18.92%	54.05%
3. I believe the course helps increases my vocabulary.	3.16	1.19	32.43%	24.32%	43.24%
4. I believe the content of the course is suitable to my major.	3.00	0.91	24.32%	43.24%	32.43%
5. I believe the course helps improve my skill in writing scientific essays.	3.19	1.05	27.03%	37.84%	35.14%
6. I believe the course helps improve my skill in writing scientific lessons, activities and tests.	3.14	1.07	27.78%	27.78%	44.44%
7. I believe the course enables me to correctly spell scientific words.	3.50	1.06	16.67%	25.00%	58.33%
8. I believe the course enables me to correctly pronounce scientific words.	3.86	0.87	27.78%	50.00%	22.22%
9. I believe the content of the course overlaps with the extensive foreign language course.	3.64	1.27	22.22%	19.44%	58.33%
10. I believe the course enables me to fluently use a foreign language in my future career as a teacher.	3.36	1.17	25.00%	19.44%	55.56%
11. I believe the course does not prepare me to teach science or math in a foreign language.	2.44	1.29	53.13%	18.75%	28.13%
12. I believe the course helps me overcome the problem of translating from Arabic.	3.23	1.03	25.71%	34.29%	40.00%
13. I believe the course helps improve the sentence structure of my foreign language.	3.73	1.07	35.14%	37.84%	27.03%
14. I believe the course enables me to correctly spell words that are not related to my major.	3.57	1.32	16.22%	35.14%	48.65%
15. I believe the course enables me to correctly pronounce words that are not related to my major.	3.46	1.24	21.62%	35.14%	43.24%

However, those percentages drop to less than half for the other items that investigate the efficacy of the language courses. Only 43.24% believe that the language courses help increase their vocabulary (item 3), and 40.00% believe that the courses help them overcome the problem of translating from Arabic (item 12). Very few of the purposeful sample (27.03%) believe that the courses help improve their sentence structures (item 13), enable them to correctly spell and pronounce words that are not related to their majors items (14: 48.65% & 15: 43.24% respectively). Those quantitative results are supported by the qualitative data collected through the open-ended question. The results are summarized in Figure 3.

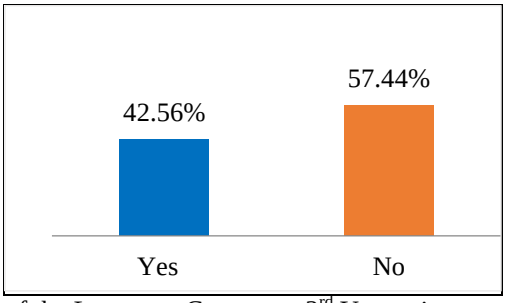

Figure 3. Efficacy of the Language Courses to 3rd Year science and Math Education

Only few students (42.56%) expressed a positive attitude towards the language courses. While more than half of the purposeful sample (57. 44%) believed that the language courses are not effective and sufficient. Students' declarations, displayed in Table 9, support those findings.

Table 9. Statements of the Math & Science 3rd Year Students (N = 47)

	Students' answers	Frequency	Percent
No	1. We need more than one or two courses	6	12.76%
	2. Courses need to concentrate more on oral communication /those courses do not concentrate on oral communication. They only focus on written communication.	5	11.62%
	3. We also need to learn foreign languages during summer/ more courses (more extensive foreign language courses) need to be offered.	4	8.50%
	4. Try to relate them to science	4	8.50%
	5. Not enough	2	4.25%
	6. Method of teaching should be improved.	1	2.12%
	7. We only benefit from the grammar content.	1	2.12%
	8. The content does not help us in teaching scientific courses in the foreign language.	3	6.38%
	9. No answer	1	2.12%
	Total	27	57.44%
Yes	1. We also need to learn foreign languages during summer/ more courses (more extensive foreign language courses) need to be offered.	10	21.27%
	2. Courses need to concentrate more on oral communication /those courses do not concentrate on oral communication. They only focus on written communication.	4	8.50%
	3. They are enough	3	6.38%
	4. Because they are rich in different language activities	2	4.25%
	5. No answer	1	2.12%
	Total	20	42.56%
	Total	47	100

Beliefs of 3rd Year Science and Math Students about the Relevancy of TE & FCE

The data depicted in Table 8 reveals that only around a third of the purposeful sample (32.43%) believe that the course is suitable to their majors (item 4), and helps improve their skill in writing scientific essays (item 5: 35.14%), and writing scientific lessons, activities and tests (item 6: 44.44%). The results also reveal that very few students (22.22%) believe that the language courses help them in correctly pronouncing scientific terms (item 8), however, when it comes to spelling, around half of the students (58. 33%) claim that the language courses help them to correctly spell scientific words (item 7), and 55.56% believe that the courses enable them

to be to fluently use a foreign language in their future careers (item 10), in contrast to 28.13% who believe otherwise (item 11). Yet, a substantial number of those students (58.33%) believe that the content of the courses overlap with that of the extensive course which focuses on language for general purposes (item 9).

A plausible conclusion for those results is that, in general, the foreign language courses are not so much relevant to students' majors. That conclusion is supported by the attestations of the students to the open-ended question on the relevancy of the language courses to their majors. Less than half of the students (44.68%) believe that the courses are relevant, while 55.32% believe that they are not relevant at all. Figure 4 below displays those results which are elaborated on in Table 10.

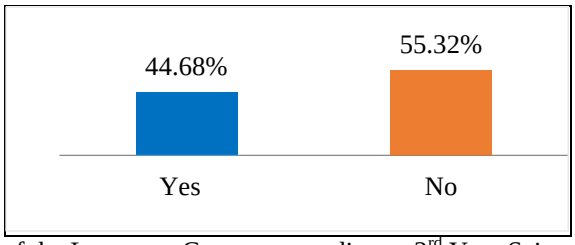

Figure 4. Relevancy of the Language Courses according to 3rd Year Science & Math Education

Table 10. Statements of the Purposeful Sample (N = 47)

	Students' Statements	Frequency	Percent
No	1. We used to summarize different articles with proper guidelines	1	2.12%
	2. We read general articles not related to science and math, but more to EFL and to social problems.	2	4.25%
	3. This was helpful for us.	1	2.12%
	4. Since the course was only helping us to improve in writing and grammar.	3	6.97%
	5. It is not related to our major; it is more literary.	5	11.62%
	6. It is not enough. There should be more oral discussions.	4	8.50%
	7. It was very limited.	3	6.97%
	8. This course includes texts from various domains.	2	4.25%
	9. No answer.	5	11.62%
	Total	26	55.32%
Yes	1. In this course the instructor let us read scientific articles then summarize them.	6	12.8%
	2. It is not enough. There should be more oral discussions.	5	11.62%
	3. Since the course was only helping us to improve in writing and grammar	3	6.97%
	4 In Arabic /in Arabic for literature review.	2	4.25%
	5.we need to read stories in order to sit for the partial exam	2	4.25%
	6. We used to summarize different articles with proper guidelines	1	2.12%
	7. This was helpful for us.	1	2.12%
	8. No answer.	1	2.12%
	Total	21	44.68%
	Total	47	100

Efficacy of the Language Courses according to Major

The results of the purposeful sample were further analyzed to determine whether or not there was any various in results because of students' major. The results, depicted in Figure 5, revealed that math students were more dissatisfied with the language courses (52.20%) than the science students (46.20%). In other words, only 47.80% of the math students believed that the language courses were effective, in contrast to 53.80% of the science students. The calculated P-value is 0.561 > α which indicates that the difference is not significant. Chi-Square test was used since the variables are nominal. The calculated Chi-Square is 0.337.

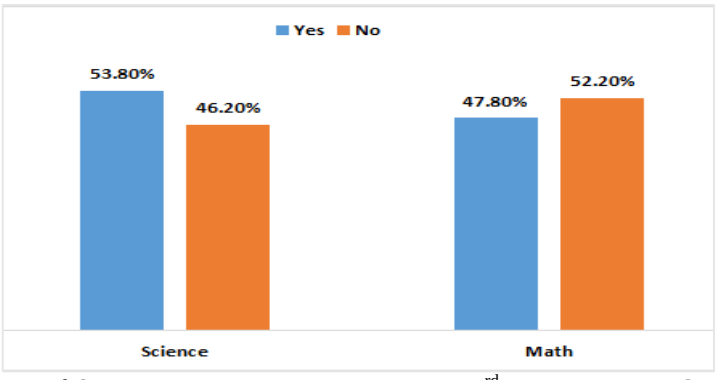

Figure 5. Efficacy of the Language Courses, per Major, to 3rd Year Science and Math Education

Relevancy of the Language Courses according to Major

Regarding the relevancy of the language courses, the results, depicted in Figure 6, revealed that for science students there was no difference in opinion (50.00%) believed the courses to be irrelevant, and 50.00% believed the courses to be relevant. However, the difference in opinion was apparent in mathematics education. About two thirds of the math students (60.90%) believed the language courses to be relevant while only 39.10% believed otherwise.

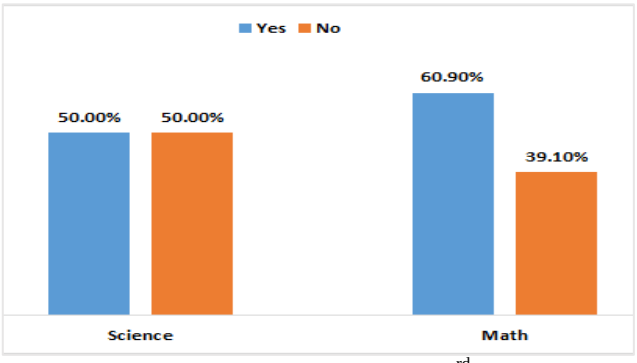

Figure 6. Relevancy of the Language Courses, per Major, to 3rd Year Science and Math Education

Efficacy of TE vs. FCE to Science Students

The results were also analyzed to determine whether or not the course variable made a difference. The results, depicted in Figure 7 reveal that science students were more dissatisfied with the FCE course (75.00%) than the TE course (33.30%). Thus only 25.00% of the purposeful sample for science believed the FCE course to be effective. The calculated P-value is 0.164 > α, indicating that the difference is not significant and the Chi-square is 1.935.

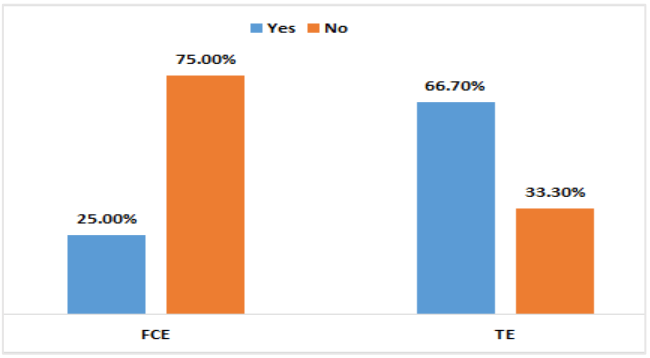

Figure 7. Efficacy of the Language Courses, to 3rd Year Science Education

Relevancy of the FCE and TE to Science Students

The results, depicted in Figure 8 reveal that around two thirds of the science students thought that the FCE course (66.70%) was relevant to their major, whereas 71.40 % believed the TE course to be relevant to their major. It can be concluded that to the science education 3rd year students, TE was more relevant to their major than the FCE course. The calculated P-value is 0.664 > α indicating that the difference is not significant and the computed Chi-square is 0.188.

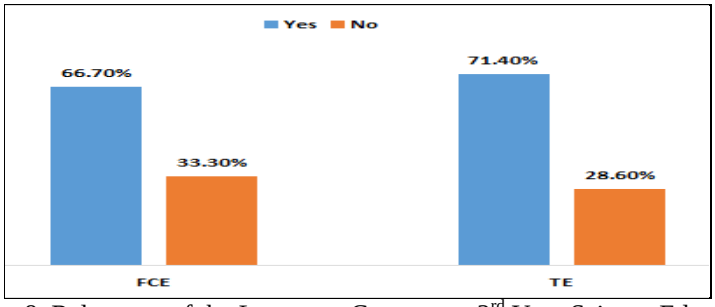

Figure 8. Relevancy of the Language Courses, to 3rd Year Science Education

Efficacy of the FCE and TE to Math Students

The results, depicted in Figure 9 reveal that less than half of the mathematics education students thought that the FCE course (44.40%) was not effective in helping them develop their language proficiency, whereas only 35.70% believed the TE course to be not effective. It can be concluded that to the mathematics education 3rd year students, TE was more effective (64.30%) than the FCE (55.60%) course. The calculated P-value is 0.795 > α indicating that the difference is not significant and the computed Chi-square is 0.068.

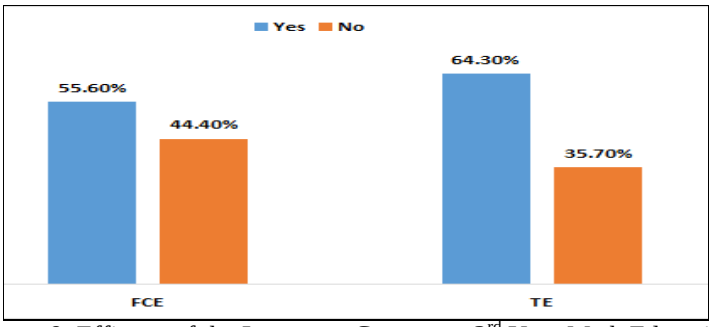

Figure 9. Efficacy of the Language Courses to 3rd Year Math Education

Relevancy of the FCE and TE to Math Students

The results, depicted in Figure 10 reveal around two thirds of the mathematics students (64.30%) thought that the TE course was relevant to their major, whereas only around half of the math students (55.70%) believed the FCE course to be relevant to their major. It can be concluded that to the mathematics education 3rd year students, TE was more relevant to their major than the FCE course. The calculated P-value is 0.675 > α indicating that the difference is not significant and the computed Chi-square is 0.175.

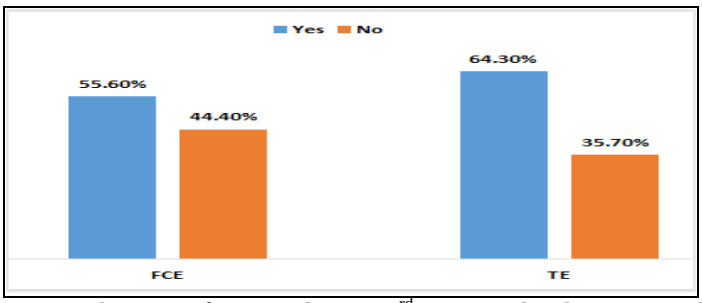

Figure 10. Relevancy of FCE and TE to 3rd Year Math Education Students

A comparison between math and science students' beliefs regarding the relevancy of the two language courses (FCE & TE) indicate that both the science and math students believe the TE to be more relevant to their major than the FCE. Researchers of the current study further asked the students to offer their recommendations for improving the status quo of the language courses that were offered to science and mathematics education students in their 2nd & 3rd year students. Their suggestions are displayed in Table 11 below.

Table 11. Suggestions of the Purposeful Sample to Help Improve the Foreign Language

Students' suggestions	Frequency	Percent
1.Increase the time of the course/increase the number of sessions /increase the number of foreign language courses	22	51.16%
2. Focus on oral communication /on pronunciation and scientific terms rather than grammar.	15	34.88%
3. Write essays about scientific topics	12	27.90%
4.Use new techniques and advanced technology	11	25.58%
5. Coordinate between the language courses and the scientific courses.	10	23.25%
6. The foreign language should be the medium of instruction for all the courses given in Arabic.	9	20.93%
7. Use books/encourage students to read stories/articles	8	18.60%
8. We need ESP rather than EAP courses.	5	11.62%
9. Instructors need to use the foreign language when communicating with students.	4	9.30%
10. Others: the extensive program should be more serious/more effective, we read stories.	4	9.30%
11. Increase the number of language courses related to science (ESP courses).	4	9.30%
12. Extensive program should become part of the BS. syllabus.	3	6.97%
13. Improve the syllabus.	2	4.65%
14. There should be a variety of speaking and listening activities.	2	4.65%
15. Watch movies.	1	2.32%
16. Provide opportunities for discussing scientific topics. Include spelling and pronunciation competitions.	1	2.32%
16. Provide workshops and eliminate the Arabic courses.	1	2.32%
17. No answer/nothing/I don't know.	5	11.62%

Conclusion

Based on the results of this study, the researchers can conclude that the efficacy of the language courses needs to be improved. In their current status, they do not help raise students' foreign language proficiency to an advanced level. A level that is expected of science and mathematics teachers who have to use English or French as the medium of instruction rather than Arabic. This conclusion was confirmed by students who were taking the FCE & TE at the time of the study, as well as by 3rd year students (the purposeful sample), trainers, coordinators and professors/instructors. That conclusion is also in accord with the results of Bateson (1990) and Henry (1997) as cited in Nasiri and Shokrpour (2012), or with Bedard and Thomas (2010) as cited in Mukundan et al. 2012. Analysis of the quantitative and qualitative data enabled the researchers to conclude that the language courses offered at the Faculty of education do not stress vocabulary building. The language courses do not provide the necessary scientific and general terms that would help them overcome the problem of translation. That is why prospective science and math teachers tend to translate from their native language and they tend to rely on Arabic when relaying a message or explaining a lesson.

In addition, the foreign language courses offered at the Faculty of Education, do not stress speaking and listening. Those skills need to be focused upon in the language courses in order to enhance students' oral communication and aural comprehension competencies. In addition, those courses do not highlight pronunciation and spelling which are so much needed and required by the prospective teachers, as they themselves asserted. Those conclusions are congruent with the results of previous research studies Changyu (2009), in his study of second language acquisition and college English teaching asserts that the intensive

second language courses offered at universities need to provide college students with a large amount of understandable language input in order to enable those students to learn a second or a foreign language. ESL learners *have problems with different areas in the use of the language* (Al Othman & Shuqair, 2013). As a result, those learners have to take intensive as well as extensive language courses in order to become proficient in the English language (Al Othman & Shuqair, 2013).

Moreover, the language courses offered at the Faculty of Education are not tailored to students' needs as future teachers of science and mathematics. Thus, the textbooks used, the content, the syllabi and the materials implemented are not relevant to the science and mathematics majors. The content, materials and syllabi of those courses are related to EGP/FGP and EAP/FAP rather than ESP/FSP. They are intended to achieve English proficiency for general communication purposes and academic purposes simultaneously, while ESP/FSP courses are learner-centered and content/context-based specific. ESP/FSP courses aim to meet learners' specific needs in utilizing English in their specific fields such as science and technology. They are used in universities and technical schools to teach students majoring in science, math, and other content area majors (Sulaiman et al., 2018).

Recommendations and Suggestions for Future Research

Based on the conclusions reached in this study, the researchers suggest that for the science and mathematics majors, most of or all of the education courses need to be offered in the foreign language, not Arabic, as is currently the case. Two foreign language courses and a few core courses in the foreign language do not suffice to enable students to develop their linguistic ability to higher proficiency levels. In case, the number of foreign language courses cannot be increased, then the period of the extensive language courses need to be extended over the six semesters, not just be given for a month in their first year of study.

Moreover, the foreign language courses offered to students majoring in science and math education need to target students' oral/aural communication skills, pronunciation, and spelling. More special and technical vocabulary, related to science and mathematics, is needed with more focus on the pronunciation and spelling of those words. The syllabi, the topics and texts need to be in accord with students' majors. Thus, ESP and FSP courses need to be offered to make the language courses compatible with students' science or math major.

Cooperation between language instructors/professors and science and math professors is needed to ensure that language professors/instructors understand the linguistic concepts and terminology and address students' needs. The coordinators of science and math need to play a more vital role by proposing and providing scientific articles to be discussed in the language classroom and scientific essays to be written by students and corrected by both the language and the science/math professors. Placement and diagnostic tests should also be administered to ensure better focal points that would help fill in the gaps in students' linguistic proficiency and thus guarantee better results and better preparation for a career in teaching. The researchers also suggest that future studies be conducted to include graduates of the faculty of education at LU, as well as, third year students who had already taken the language courses in previous years. Other studies could be done on a wider sample that could include students of Mathematics and Science Education at other universities in Lebanon.

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We also feel indebted to our colleagues at the Faculty of Education, namely the English and French language professors and instructors who teach the FCE and the TE courses to students majoring in Science and Mathematics Education. Our sincere gratefulness also goes to the Science and Mathematics coordinators and to the trainers who guided students during the practicum courses on how to put to practice the theories they learnt in the core courses, and who acted as language instructors, as well.

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