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Do Engineering Students Possess Higher English Self-Efficacy Beliefs than Other Students in Saudi Arabia? A Comparative Study Using ANOVA

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Abstract

Although the concept of Self-efficacy beliefs has been the subject of numerous research in many fields, studies that showed interest in English self-efficacy, especially when English is used as a medium of instruction in higher education in Saudi Arabia, are very limited or non-existent. The present study aimed at assessing the strengths of Engineering, Law, Finance, and other university students' self-efficacy beliefs to complete their higher education in English as a medium of instruction in Saudi Arabia and to compare the different fields of study on the English self-efficacy variable. Descriptive statistics and one-way Analysis of variance were utilized to analyze the data and answer the research questions. Findings showed that participants regardless of their fields of study possess high levels of English self-efficacy beliefs for writing, listening, and speaking. Regarding comparisons, results showed statistically significant mean differences for self-efficacy for speaking. The four Post-Hoc mean comparisons were found to be statistically significant. When compared with Law students, Finance, and others, Engineering students scored significantly higher on the spoken English self-efficacy beliefs subscale. A few limitations were mentioned, and recommendations made for future similar studies.

Keywords: ANOVA, Engineering students, English Self-efficacy beliefs, Saudi Arabia

Introduction

Self-efficacy beliefs are people's convictions that they have the skills necessary to complete a task effectively (Bandura, 1995). During the operational phase, self-efficacy beliefs can be defined as learners' levels of assurance in the planning and execution of their actions to accomplish goals as well as their perceptions of their capacity for adaptation. They are motivated by their confidence in their capacity to learn. According to Snyder and Lopez (2007), self-efficacy is the conviction that one is able to thrive with their skills in a range of settings. It thereby regulates success, perseverance, effort, and aspiration (Schunk & Zimmerman, 2007).

Additionally, during the learning process, interactions between people, their activities, and their environments are facilitated by self-efficacy beliefs. The self-efficacy beliefs variable, according to Bandura (1997), is a multi-dimensional notion based on:1) magnitude, which measures how difficult people believe their given duties are; 2) durability, which denotes people's faith in their capacity to finish all necessary parts of a task effectively; and 3) generality, which measures how well self-efficacy on one task corresponds with self-efficacy in other activities or domains.

Waaktaar and Torgersen (2013) stated that individuals might theoretically boost their self-efficacy beliefs by seeing their successes, receiving compliments and prizes, and becoming proficient in a particular task. In other words, according to Bandura (1977), self-efficacy beliefs are mostly a result of previous experiences. These mastery interactions are especially important for the development of self-efficacy beliefs since those beliefs are strengthened when experiences are perceived positively. On the other hand, it is reduced when events are seen negatively (Bandura, 1997). By observing others perform a task and then determining their own probability of success with that identical task, students can also develop their self-efficacy beliefs. This is what Bandura (1997) refers to as vicarious experiences. It was argued in this context that important people can vocally convince and give feedback on a person's beliefs on self-efficacy (Cassé, Oosterman, & Schuengel, 2015; Gale et al., 2021).

Engineering students' self-efficacy research

Engineering self-efficacy beliefshas been defined as a person's confidence that they can successfully navigate the academic challenges of the engineering curriculum. Four variables were used to determine engineering self-efficacy: self-efficacy 1, self-efficacy 2, expectations for an engineering career, and coping self-efficacy. A repeated analysis of variance among levels of gender, ethnicity, the number of years students had been enrolled in their engineering program, and transfer status was used to investigate the four variables. By gender, ethnicity, and transfer status, no appreciable differences in mean engineering self-efficacy ratings were discovered. Nevertheless, significant associations among gender and the subscales, ethnicity and the subscales, and transfer status and the subscales were found (Concannon, & Barrow, 2009).

More recently,the motivation, self-efficacy, and beliefs of Swedish first-year engineering students regarding the status of their mathematics in relation to their achievements were investigated, as well as how these correlated with their task performance in mathematics. Findings suggested that engineering students who prioritized precise reasoning in their understanding of mathematics outperformed those who prioritized applications of mathematics in a series of

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mathematical problems.The intrinsic and practical value of mathematics, together with improved self-efficacy, are related to better task performance. Regarding their self-efficacy and motivating values, the students' task performance was often rather modest. (Tossavainen, Rensaa, & Johansson, 2021).

Stewart and colleagues (2020) examined how academic feedback affects the development of these distinctions over time and the evolution of students' domain-specific STEM self-efficacy in gateway physics and mathematics courses. This study also examined how gender disparities in self-efficacy beliefs alter in response to academic criticism and if gender differences in self-efficacy are consistent across STEM subjects.With the help of modified subscales from the Motivated Strategies for Learning Questionnaire, self-efficacy beliefs in a variety of academic domains—including the present math/science class, other STEM subjects, and intended profession—was evaluated at various times. To comprehend how changes in self-efficacy beliefs were influenced by the academic feedback supplied by test results, linear mixed effects modeling was performed. Students in all classes indicated varying degrees of self-efficacy beliefs toward various domains, with their current class having the lowest self-efficacy beliefs and their intended vocation having the greatest. Men and women only significantly differed in terms of present math/science class self-efficacy beliefs, with women indicating lower self-efficacy beliefs.

Alves et al. (2016)also explored three factors—self-efficacy beliefs, anxiety toward mathematics, and perceived importance of mathematics—that have been identified in the literature as influencing the learning of mathematical concepts and looked for differences by gender and by type of engineering courses, a factor that hasn't been covered much in the literature but was found to be crucial in the team's earlier research. Results were based solely on differences in the type of course, not gender, and were based on a sample of 140 undergraduate students from the University of Minho's several engineering programs.

Engineering students' English self-efficacy beliefs research

Idrus and Salleh (2017) investigated the self-efficacy of 338 Malaysian ESL students from a private institution in terms of their English-speaking skills. These college students were engineering and technology majors. The perceived self-efficacy beliefs of the students were evaluated using a questionnaire created by Idrus and Sivapalan (2007) and adapted from Bandura (1990) and Mikulecky et al. (1996) on the three dimensions of ability, aspiration, and activity perception.The results showed that students had generally high levels of self-efficacy beliefs in all three aspects of their speaking abilities.Additionally, the study analyzed the students' self-efficacy beliefs scores according to their gender, ethnicity, and academic year.

Another study was conducted to determine whether there were any gender-based disparities in the self-efficacy beliefs in speaking English among 60 technical college ESL students over the course of two distinct semesters. A questionnaire that had been adapted from earlier studies was used for the research. Three categories, including ability, activity perception, and aspiration, were used to gauge the students' perceived self-efficacy beliefs in their speaking abilities. According to the findings, students in Semester 5 and those who were female tended to have higher levels of self-efficacy (Khatib & Maarof, 2015).

In the same vein, Ho (2016) assessedGraduate students in engineering-related fields who speak English as a foreign language (EFL) report writing anxiety and self-efficacy beliefs. Students' perceptions on research writing anxiety were also investigated, as was the relationship between the two writing affective variables.Along with qualitative data gathered from open-ended questions and semi-structured interviews, a total of 218 survey responses from engineering graduate students from Taiwanese universities were analyzed. The findings suggested that, while master's and doctorate students experienced a similar degree of mild writing anxiety, senior doctoral students had higher levels of self-efficacy beliefs than their junior counterparts when it came to writing research papers in English. Overall, students who had greater writing self-efficacy beliefs felt less anxious. Furthermore, among the individual factors, experience in writing for publication was a greater predictor of writing anxiety and self-efficacy beliefs than students' self-reported English ability and the quantity of writing courses taken. The qualitative research revealed a number of causes of writing anxiety at the graduate level, including weak English writing abilities, time restraints, and worry about receiving unfavorable feedback. As a result of the differences in the rhetorical objectives and discourse structures of various sections, writing different parts of a research paper also caused varied amounts of anxiety. The implications for managing research writing anxiety were also highlighted.

Furthermore, Tuncer and Dogan (2016) investigated the connections among Turkish university students learning English's classroom anxiety in a foreign language, academic self-efficacy beliefs, and metacognitive awareness. The sample size included University students who had taken the required English preparatory classes and were already registered to study in several engineering departments. Volunteering student participants were 271. The Academic Self-Efficacy Questionnaire, developed by Owen and Froman (1988) the Foreign Language Classroom Anxiety Questionnaire, and the Metacognitive Awareness Inventory, established by Horwitz et al. in 1986, were utilized for the data collection. To analyze the data, structural equation modeling was used. The results showed that academic self-efficacy beliefs significantly predicted foreign

language classroom anxiety in a positive way; academic self-efficacy beliefs also significantly predicted metacognitive awareness in a negative way; and foreign language classroom anxiety significantly predicted metacognitive awareness in a positive way.

Engineering students' English self-efficacy beliefs research in Saudi Arabia

In Alhamami (2021), a non-native English-speaking nation, Saudi Arabia, was examined in relation to the impact of English as the medium of instruction (EMI) in the engineering college of a public university. The study evaluated the grade point averages (GPA) of alumni and their first-year English proficiency levels as reported on their transcripts. In addition, the study added to the literature by analyzing society attitudes, student attitudes, and student self-efficacy beliefs with regard to their preferred language of instruction. It was argued that most research on EMI policy concentrated on instructional methodologies and interaction styles, in the light of that, the study aimed to fill a gap in the body of knowledge. The study attempted to discover what the effects of the EMI policy were on the performances and attitudes of engineering students.The research utilized three instruments to gather data including records of alumni from engineering colleges; questionnaires for current students; and questionnaires for engineering instructors. The results showed that students' ability to communicate in English significantly correlated with their first-year GPA, thus predicting their overall GPA at the end of their five-year studies. The findings of a survey of current students' opinions coincided with their preferred medium of instruction. The majority of students preferred Arabic, their native language as their primary language of teaching. Most instructors, according to the engineering instructor poll, did not believe that the EMI policy had an impact on students' ability to engage in class activities and exams. Consequently, the opinions of students and teachers conflicted as a result.

The present study

Studies that investigated Engineering students' self-efficacy beliefs to use a non-native language as English for medium of instruction are limited in scope and more so in Saudi Arabia. The present study aimed at measuring the nature of university engineering students' English self-efficacy beliefs in relation with other students. The first objective was to assess levels of self-efficacy beliefs in English as a medium of instruction. The second objective was to compare levels of English self-efficacy beliefs across fields of study. The research questions included the following:

1. For each of the Engineering, Law, Finance, and other students, what are the levels of self-efficacy beliefs to pursue their higher education using the English language in Saudi Arabia?
2. To what extent are Engineering students' levels of self-efficacy beliefs different from Law, Finance, and other students?

Methods

Participants

This survey design study used descriptive and comparative analyses to gauge how confident university students were in their ability to learn using solely English as a second language. The current study included 310 college students whose native language was Arabic who were enrolled in a private institution of higher education in which the only medium of instruction was the English language.The sample size included 221 males (71%) and 86 females (27.7%) of all participants.The mean age was 20.39 (2.23SD), with ages ranging from 18 to 30. Three students did not disclose their genders. Participants were enrolled voluntarily, based on a convenient sampling approach. Both an online survey form and a paper-and-pencil questionnaire were used to collect the data. The investigators initially printed 400 paper surveys, and 245 of those were returned, yielding a response rate of 60% (Fincham, 2008). To include additional participants, they later distributed an online version of the questionnaire. There were 310 students enrolled in total. The final simple size did not include participants whose questionnaires were returned with several missing data.

Procedure

The investigators printed and distributed the consent forms and survey questionnaires to students on campus after explaining the purpose of the study and the voluntary nature of the participation. This was done after the university's Institutional Review Board granted permission for the study and provided an authorization letter. The investigators asked students to rate their own strengths of self-efficacy beliefs for general English, writing, listening, and speaking in English by circling or checking the number that best described those beliefs on a Likert scale that ranged from 1 to 5, with 1 being strongly disagree, 2 disagreeing, 3 undecided, 4 agree, and 5 being strongly agree. Students also provided demographic data on their ages, genders, study fields, and current GPAs before rating their beliefs.

Measures

To gather information about the participants' ages, genders, study areas, and current GPAs, a demographic questionnaire was created by the researchers. Four additional instruments were used to examine various aspects of the English language self-efficacy beliefs. The Questionnaire of the English Self-Efficacy (QESE) was the first instrument and was designed as a measurement of student general self-efficacy beliefs to pursue their academic courses in English. The QESE was developed with 32 items (Wang et al. 2013). Each question encouragedstudents to assess their proficiency in speaking, listening, reading, and writing to carry out particular English-language tasks.

The QESE has undergone adaptation to fit within the cultural contexts of language learning in China,

recent studies on the QESE's psychometric properties (Wang et al. 2014; Wang et al. 2013), the QESE can be utilized as a valid measure in a range of cultural contexts. The instrument has a high level of internal consistency dependability, according to Cronbach's, which is α=97.

The Self-Efficacy for Writing Scale (SEWS) was the second tool. It was added to gauge students' confidence on their ability to write well in English for any subject. The instrument was used as a variable of comparison.The SEWS included 16 elements that represented the three suggested styles of writing: ideation, conventions, and self-regulation (Bruning, Dempsey, Kauffman et al. (2013)). When reliability was calculated, it was discovered that the subscales measuring writing ideation, conventions, and self-regulation self-efficacy had high Alphas of, respectively, 0.923, 0.858, and 0.874.

The third subscale assessed self-efficacy for listening, whereas the fourth assessed self-efficacy for speaking. It was intended to employ both subscales as comparison variables. The two tools were based on Yanar and Bümen's (2012) English self-efficacy measure. The total number of items in the tool is 34, and its reliability estimation is α=.97.

the four subscales using the data from the current study, and alpha was equivalent to α=.98 for general self-efficacy, α=.95 for writing self-efficacy, α=.76 for listening self-efficacy, and α= .88 for speaking self-efficacy. The various reliability estimations were considered sufficient and acceptable to move forward with the study.

Statistical analysis

Using descriptive analysis, the researchers computed the number of participants, gender, average age, and average GPA of participants. See Table 1 for detailed information regarding demographics. Next, for each of the subscales, they calculated total scores to answer the question relative to the strengths or levels of different self-efficacy beliefs.

Finally, a one-way ANOVA was run to determine which major has the highest level of English self-efficacy beliefs. The results were then interpreted after being confirmed against the many assumptions that associate with the test. The ANOVA assumptions were tested prior to running the analyses. The assumption of independence was met as the data was randomly sampled. The assumption of scale of measurement was also met. The dependent variable was on a continuous scale. The third assumption of normality was tested using a histogram. The assumption was met as the

Table1 Participants' demographics

Variables	***N***	***%***
Participants	310	100
Males	221	79.29
Females	86	27.74
Average age	20.40	
Average GPA	2.96	

Table 2 Areas of study

	N	***%***
Engineers	138	44.5
Law	54	17.4
Economics &Finance	58	18.7
Other fields	60	19.4

Table 3. Strengths of Self-efficacy beliefs for speaking by fields

	All fields of study	Engineers	Law	Finance & Economics	Other fields
Low	7	7	7	7	7
High	35	35	35	35	35
Average	27.29	27.75	27.21	25.31	28.21

Table 4 Conventions for the interpretation of the strengths of self-efficacy beliefs

	Strongly (1) disagree	Disagree (2)	Undecided (3)	Agree (4)	Strongly Agree (5)
General S.E	32	64	96	128	160
S.E for writing	16	32	48	64	80
S.E for listening	4	8	12	16	20
S.E for speaking	7	14	21	28	35

curves approximated normal distributions. The last assumption was the one of homogeneity of variance or assumption of equal variance. It was tested using the Levene's test from the SPSS output (IBM SPSS software version 29, IBM Corp (2013)). The Levene's test was not significant, suggesting an equal variance, P= .690 (General English Self-efficacy), P = .475 (Self-efficacy for writing), P = .286 (Self-efficacy for Listening), P = .095 (Self-efficacy for Listening).

Results

Prior to answering question 1, the researchers assessed student participants' demographics. Table 1 provides statistics of participants, genders, age, and GPA. Table 2 provides numbers of participants by areas of study and percentages. The researchersthen computed total, low, high, and average scores for all the variables used in the comparisons. Only the results of the variable *Self-efficacy for speaking* for each of the fields of study have been reported as others were not found to be significantly different. The results are proposed in table 3.

The mean self-efficacy beliefs for all the four subfields together, for engineering students, for Law students, for finance students, and for other fields were respectively 27.29 (SD = 6.14), 27.75(SD = 5.55), 27.21(SD = 6.25), 25.31(SD = 7.43), and 28.21(SD =5.69), suggesting that all clustered around score 28 (agree) and were far away from score 21(undecided), see table 3.

Regarding the question 2 of the research, the one-way ANOVA tests conducted for each of the dependent variables including general English self-efficacy beliefs, self-efficacy beliefs for writing, listening, and speaking, at an alpha level of .05.The results indicated non-significant mean differences across fields of study on general English self-efficacy with F (3, 306) = .567, P = .637; non-significant mean differences across fields of study for self-efficacy for writing with F (3, 306) = .946, P = .420, and non-significant mean differences across fields of studyfor self-efficacy beliefs for listening with F (3, 306) = .777, P = .507.

The results however, showed that the ANOVA was statistically significant with mean differences for self-efficacy for speaking, F (3, 306) = 2.769, P = .042, partial η2 = .026, observed power = .167. Nonetheless, the actual difference in mean scores between groups was deemed small if interpreted based on Cohen's (1988) agreements for the interpretation of effect sizes. The four Post-Hoc mean comparisons were found to be statistically significant. When compared with Law students (M = 27.21; SD = 6.25; CI 95% [25.5, 28.91]), Finance students (M = 25.31; SD = 7.43; CI [23.35, 27.26]), and other students (M = 28.21 ; SD =5.69 ; CI [26.94; 29.68]), Engineering students scored significantly higher (M= 27.75; SD = 5.55; CI [26.82, 28.68]) on the self-efficacy beliefs for speaking subscale. The group *Other fields* were also found to possess statistically higher self-efficacy for speaking than Finance students.The other outcomes showed no statistically significant differences on the other English self-efficacy belief subscales.

Table 5 One-way Anova results

Test of homogeneity of variance			ANOVA				
Variables	M	SD	Levene's statistics	Sig	F	Sig	η2
Engineering	27.75	5.55	2.142	.095	2.769	.042	.026
Law	27.21	6.25					
Finance	25.31	7.43					
Other fields	28.21	5.69					

Discussion

The findings in the present research have been supported by previous studies in the existing literature.Self-efficacy has been demonstrated to be favorably associated to the achievement of undergraduate engineering students. The predictive association between efficacy beliefs and performance should be strengthened by developing self-efficacy measures to evaluate the varied abilities needed by engineers (Mamaril, Usher, Li, Economy, & Kennedy, 2016).

Studies that were however conducted to assess Engineering students' self-efficacy beliefs to pursue their studies in English have been found to be very rare. Most studies showed interest in Self-efficacy as it relates to the field of study, but not in connection with English as a medium of instruction in non-native speakers' countries.

Nevertheless, astudy conducted in Malaysia looked at Malaysian ESL students' (n=338) self-efficacy in their English-speaking skills at a private institution. Student participantswere engineering and technology majors. The results showed that, on average, the students believed highly in their ability to speak on all three dimensions (Idrus, & Salleh, 2017). In a second study conducted in Oman (Ali, 2020), interviews were carried out to find out what engineering students thought about Omani engineering students' difficulties understanding lectures in an English-medium engineering program.The findings showed that students encountered a variety of obstacles and problems. Omani engineering students frequently complained of their inability to comprehend the courses presented in English. This occurred despite the fact that EMI was considered to be a successful method for increasing students' language skills while utilizing English to learn subject matter (Joe & Lee, 2013).

In another study conducted in Indonesia that utilized a qualitative design as well it was argued that students who were majoring in Engineering lack the ability of oral English, thus impeding heir opportunities to secure jobs (Poedjiastutie, & Rifah, 2019). The studies (Ali,2020; Poedjiastutie, & Rifah, 2019)) did not assess Engineering student's Self-efficacy beliefs, yet provided insightful knowledge about the difficulties of using English among non-native speakers.

Furthermore, Liu (2015) found thatfrom high to low, the average values of five independent variables that influence speaking and listening abilities are: social context, English teachers, instructional materials, listening and speaking teaching tools, and curriculum settings. The four subjective elements that affect speaking and listening abilities ranged in average value from high to low: Learning mindsets, motivation for learning, methods and strategies for learning, and autonomous learning environment.

Wang and colleagues (2017) also utilized a structural equation modeling whose results suggested that English self-efficacy incidentally affect international college students' self-efficacy beliefs for higher education by the mediation of students' usage of *English to learn self-efficacy.* Their findings furthermore suggested that utilizing English and utilizing English to study self-efficacy beliefs are two dissimilar variables. These findings called for academic English assistance for international students who are not native English speakers.It was in this light that a review of the literature suggested that value, self-regulation and metacognition, locus of control, intrinsic drive, and the implementation of learned strategies are all associated to self-efficacy beliefs. According to the review, self-efficacy beliefs among university students can be strengthened and is higher in certain circumstances than others. (Bartimote-Aufflick, Bridgeman, et al., 2016).

Yet, most studies on English as a language of instruction concentrate on teaching methods and interaction styles, therefore Alhamami (2021) set out to fill a gap in the literature.In their study, the authors explored the effects of using English as the primary language of instruction in a public institution in Saudi Arabia, a non-native English-speaking nation.The study examined the grade point averages (GPA) of alumni and their first-year English proficiency levels as reported on their transcripts.This study adds to the literature by analyzing society attitudes, current student attitudes, and student self-efficacy regarding their preferred language of teaching.They made an effort to provide answers regarding the effect of the EMI policy on the performances and attitudes of engineering students.The opinions of students were surveyed, and the findings were consistent with their preferred method of instruction. The majority of students preferred their native language, Arabic, as the language of teaching. Mostinstructors, according to the engineering instructor poll, did not believe that the EMI policy has an impact on students' ability to engage in class activities and exams.The opinions of students and teachers conflicted as a result.It was advised that when creating programs, legislators for engineering programs consider the divergent views on EMI held by students and instructors.

Limitations

Regardless, of the statistically significant differences found between Engineering students and others, it is important to note that most groups looked similar.As with any research involving a survey design, researchers must rely on participants' truthful descriptions of their opinions regarding their capacity to complete specific activities; yet, these accounts may be skewed by a number of variables, including the participants' emotions or environments at the time of the data collection. The individuals' academic backgrounds as students may have had an impact on the current findings. Another limitation could be related to the group formations. All engineering students that include Computer sciences, Cyber security, Industrial Engineering, and the like have been put together as group 1 and compared against Finance and Economics students as group 2, and Law students as group 3. Areas of studies that did not fit in the listed majors were assembled and named *other fields of study* and labelled group 4. Additional research is suggested to investigate and compare university students' self-efficacy beliefs strengths when a second language as English is used as the only or primary language of instruction.

Conclusion

The very few studies undertaken in the area of English self-efficacy beliefs among engineering students whose native language is not English have used different objectives, making it difficult to compare and contrast the subsequent findings. Based on the existing literature about the effects of Self-efficacy beliefs and other motivational concepts on engineering students, it is possible to argue that similar personal beliefs and attitude can also direct their achievement in English. Substantial self-efficacy beliefs-based research have suggested that students can transfer their beliefs, motivations, efforts, and the experiences from past successes to other subject areas. In this light, it is believed that the successful efforts and beliefs deployed in Science and Technology courses can also apply to English Learning.

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