Contributing Factors in Pursuit of a Ph.D. in Engineering: The Case of Lebanon*

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Little is known about why students choose to enrol in post-graduate studies. Going through a Ph.D. degree is often seen as a risky decision. This study offers responses' analysis of two groups; the first consists of 274 graduate students enrolled in various engineering programmes in Lebanon and the second consists of 187 working engineers. Both groups of participants completed a survey investigating the factors that may impact on their decision to pursue a Ph.D. Based on the Theory of Reasoned Action, the Likert-scaled items aimed to identify the attitudinal and normative factors leading to the intention of enrolling in Ph.D. An independent t-test revealed no significance between students and engineers' intention. An exploratory factor analysis provided four factors: professional attitude, social attitude, financial attitude and subjective norm. Using multiple regression technique, the professional attitude appeared to be the main contributor to students' and engineers' intention. The findings are discussed and recommendations for future studies are offered.

Keywords: engineering education; Ph.D. enrolment; Theory of Reasoned Action; Middle East

1. Introduction

When surfing the internet, a plethora of publicity materials can be found on university websites encouraging students to enrol in postgraduate studies. Going through a Ph.D. is known as a high risk decision [1–3]. The literature on doctoral students is abundant on issues such as doctoral experience and career paths after the doctorate. As such, Denholm and Evans [4] examined student career paths after the doctoral degree. Other researchers have explored the cause of attrition in doctoral programmes [5] or identified the factors supporting Ph.D. students' persistence through their degrees [6].

However, there is a dearth of research investigating the intention to pursue a Ph.D. Churchill and Sanders [7] identified five motivational categories for enrolling in a Ph.D. programme:

(1) career development,
(2) lack of current job satisfaction,
(3) personal agenda,
(4) research as politics,
(5) drifting in.

Recently, Gill and Hoppe [8] suggested five 'motivational profiles' that can lead business professionals to doctoral studies:

(1) traditional (entry to academia),
(2) advanced entry (professional development),
(3) continuing development (professional advancement),
(4) transition (entry to a new career),
(5) personal fulfilment (self-enhancement).

Gill and Hoppe believe that the first two profiles may occur in early career stages, the second two profiles may occur in mid-to-late career stages, while the personal fulfilment may apply to individuals at any stage of their life.

Carpinelli, et al. [9] conducted a study measuring undergraduate engineering students' attitudes toward postgraduate studies. The results showed that only 28% of students don't have the endurance to attend school for at least five years to complete a Ph.D. programme, 50% agreed that they would like to complete a Masters degree but not a Ph.D. while only 20% consider pursuing a Ph.D. degree in engineering. The same study showed that 70% of students are considering a graduate degree in a field different from the undergraduate major and 50 % agreed that people should work for a couple of years in their field before considering the postgraduate studies.

According to the National Center of Educational Statistics in the US, the number of degrees conferred rose at all levels between 1997–98 and 2007–08. The number of bachelor's degrees was 32% higher, the number of master's degrees was the highest with 45% higher and the number of doctor's degrees was 38% higher [10]. In the Engineering field and during the same period of time, the number of obtained

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doctoral degrees rose 35% from 5996 to 8112 degrees as the third most granted doctoral degree after the Health professions related clinical sciences field and the Education field.

At the same time, the Council of Graduate Schools [11] in the US reported a consecutive four years of growth of international students at US graduate schools. China, one of the first countries to send the most graduate students to the US, increased by 16% and there was 22% growth from the Middle East region.

2. Purpose of the study

A scarcity of research exists in the Middle East region about Education in general and Engineering education in particular. Given the enrolment increase of Middle Eastern students in postgraduate studies, we seek to investigate the predictor factors of engineers and students for enrolling or not enrolling in a Ph.D. programme. Considering Lebanon as a case study, this investigation brings insights into the current situation as well as contributes to the literature by providing a deeper understanding of how and why students develop an interest or a lack of interest in postgraduate studies.

This research attempts to answer the following question: What are the predictor factors for considering enrolment in engineering doctoral programmes?

3. Theoretical framework

Researchers have discussed the factors that investigate the relationship between attitudes and career choice. Several models have been used as a framework such as the social cognitive career theory [12, 13], the theory of reasoned action [14, 15], and the theory of planned behaviour [16, 17].

The Theory of Reasoned Action (TRA) helps characterizing human behaviour as intentional and rational. This model provides a social psychological framework proved to be useful in explaining several types of behaviour [14, 18]. It suggests that someone's Behavioural Intention (BI) depends on Attitude (A) and Subjective Norm (SN) as shown in Fig. 1.
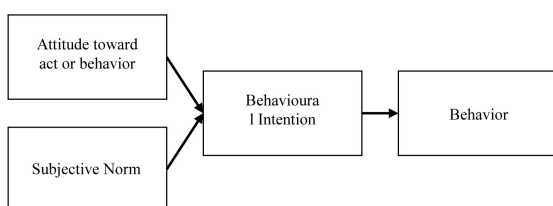
The attitude toward the behaviour is someone's overall evaluation of the behaviour including the beliefs about the consequences of this behaviour and the corresponding positive/negative judgment about each feature of this behaviour. The subjective norm is the individual's own estimate of the social pressure to perform/not perform this behaviour, or in other words the influence of people in one's social environment. This framework will help prediction of the intention for holding a Ph.D. degree in engineering.

Because choosing to become a doctoral student represents a major life decision, the focus of this study is to identify and discuss these factors in terms of attitudes and the subjective norm by using a Likert-scaled survey and to better understand what and how important these factors are to students as well as to engineers as part of their career decision-making process. Therefore, two hypotheses will be tested in this study:

- Hypothesis 1 (H1): There is a positive and direct relationship between Attitude (A) and Behavioural Intention to enrol in a Ph.D. (BI).
- Hypothesis 2 (H2): There is a positive and direct relationship between Subjective Norm (SN) and Behavioural Intention to enrol in a Ph.D. (BI).

The structural model is composed of two independent latent variables and one dependent latent variable (Fig. 2). Constructs of the TRA model have already been measured and validated in several previous studies related to career and major choice. This study uses the TRA model for predicting enrolment in Ph.D. in engineering.

The Behavioural Intention (BI) defines the objective to enroll in a Ph.D. in the future. Attitude (A) refers to the degree of evaluative affect that an individual associates with enrolling in a Ph.D. Subjective norm (SN) is participants' perception that people who are significant for them think that s/he should or should not pursue a Ph.D.

4. Method

For the purpose of this research, Lebanon was considered as a case study. Lebanon has one of the
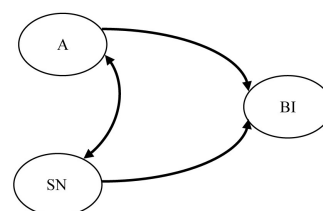

Fig. 1. Theory of Reasoned Action [14].

Fig. 2. Structural model of TRA showing relations between Attitude, Subjective Norm, and Behavioural Intention.

best educational systems in the Middle East where higher education institutions constitute a prosperous source of fresh engineers for the Gulf region. It is regarded as an engineering educational centre in the Middle East [19].

4.1 Participants

In order to obtain a broad understanding of the motives to pursue a Ph.D. in engineering, two populations were targeted: M.S. students and practicing engineers.

The first population includes engineering graduate students who are currently enrolled in various engineering programmes. Three top-ranked universities in Lebanon have been targeted: The American University of Beirut (AUB), The Lebanese University (LU), and Balamand University (BU). The American University of Beirut, established in 1849 by American Protestant missionaries, set up a school of engineering in 1951. The Lebanese university, established in 1951 is the only state operated university; it opened a college of engineering in 1980. The Balamand University, founded by the Greek Orthodox Church in 1988, established a faculty of engineering in 1993 [19]. As of the Spring semester 2009, the number of graduate students enrolled in engineering programmes in the three selected universities was 517. Professors from different disciplines in the targeted universities were contacted and asked to distribute the survey to their students. The survey invites students to voluntarily participate while ensuring them of complete anonymity. The survey was randomly distributed to the targeted population and data collection ended when reaching 274 observations representing over 50% of response rate.

The second population included practicing engineers working in various engineering fields. In order to investigate the motives of the practicing engineers, flyers were posted at engineering syndicates' offices inviting engineers, who had been practicing for no more than five years, to participate in this study. The flyer explained the objective of the research asking engineers who were willing to participate to contact the authors. Within three months, 214 engineers expressed their interest in the study. An anonymous online survey was sent to the 214 engineers using their email addresses and 187 engineers completed the survey.

4.2 Instrumentation

The same instrument was used for both populations. The instrument was based on questionnaires employed in previous studies related to attitudes toward undergraduate and graduate engineering studies [9, 20, 21] and enrolment in doctoral programmes [22]. Questions included general charac-

teristics such as gender and area of specialization. Participants were asked to indicate if any family member holds a Ph.D. degree in any field to explore if any factor had any influence on their intention. Also, participants were asked to rate 18 Likert-scaled items on a scale of 5 (1 = strongly disagree, 5 = strongly agree). The 18 items included:

- six that were designed to reveal the participants' interests in pursuing a Ph.D.;
- three that were used to reflect the subjective norm;
- nine that were used to reflect the participants' attitudes toward enrolling in Ph.D. programmes.

The 18 Likert-scaled items related to the interests, subjective norm and attitudes revealed a reliability of 0.91. Descriptive statistics were calculated to obtain the measures of central tendency as well as the measures of variability of each of the identified items.

5. Statistical analysis and findings

Regarding our first sample of students, participants ($n = 274$) were mostly male (74%) with only (26%) female. The sample was distributed among Civil (25%), Mechanical (29%), Electrical (30%), Computer (5%), Management (7%), and others (4%).

The second sample which includes ($n = 187$) engineers were mostly male (82%) with only (18%) female. The sample was distributed among Civil (31%), Electrical (28%), Mechanical (24%), Management (8%), Computer (7%), and others (2%).

Having a low percentage of women is not surprising since several engineering education studies have discussed the unsatisfactory participation of women in the field [23–25].

5.1 Interest in pursuing a Ph.D.

Using a 5-point scale, participants were asked to reflect on their personal interest in pursuing a Ph.D. degree. Table 1 shows both samples' opinions about enrolling in a doctoral programme.

The first item, that reflects the intention to pursue a Ph.D., indicates that a high percentage of participants—(42% of students and 37% of engineers)—is interested in pursuing a Ph.D. programme.

Looking at the other items, the requirements for a Ph.D. do not represent a barrier for participants. Also, the grades and GRE scores seem not to influence participants' decision with only 15% of students and 8% of engineers believing that their grades may represent a difficulty for the procedure.

Moreover, 69% of participants (same percentage for both students and engineers) strongly favoured the idea of working for a few years in the field before pursuing a Ph.D. Apparently, Ph.D. programmes

Table 1. Interest in pursuing Ph.D.

	MS Engineering Students (n = 274)			Practicing Engineers (n = 187)		
	S. Disagree/ Disagree	Neutral	Agree/ S. agree	S Disagree/ Disagree	Neutral	Agree/ S. agree
I have the intention to pursue a Ph.D.	28%	30%	42%	37%	26%	37%
The research requirements necessary for a Ph.D. are undesirable	38%	35%	27%	35%	44%	21%
My grades and/or GRE scores might be too low	70%	15%	15%	66%	26%	8%
Engineers should work for a couple of years in their field before pursuing a Ph.D.	15%	16%	69%	14%	17%	69%
I would like to complete a MBA degree but not a Ph.D. in my major	33%	21%	46%	13%	25%	62%
I cannot endure 5 years to complete a Ph.D.	29%	18%	53%	29%	27%	44%

emphasize theoretical aspects rather than practical applications and therefore participants may prefer to acquire some experience before getting committed to postgraduate studies.

Interestingly, engineers (62%) find that completing a MBA degree is more beneficial than a doctoral degree. Indeed, these engineers who have been working in the field have had the chance to explore the best for their career prospects. Hence, their preference for a MBA reflects a belief that engineers are in need of some management-related skills.

At the same time, students (53%) and engineers (44%) believe that they cannot endure five years of studies. Such observation is seen as discouraging and may impede the process of enrolling in Ph.D. programmes.

5.2 Attitudes and subjective norm to pursue a Ph.D.

In an attempt to predict the attitudes and subjective norm that may contribute to pursuit of a Ph.D., participants were asked to indicate their opinion regarding twelve items on a scale of 5 (Strongly disagree to Strongly agree). Table2 shows the items along with the frequencies for both groups of students and engineers.

By examining the frequencies, we can notice that both students and engineers almost agree on all the items that may contribute to their decision for enrolling in a Ph.D. and there is a consistency in the responses. The majority of participants converged on four items with 58% of students and 53% of engineers prefer practicing engineering to

Table 2. Subjective norm and attitudes to pursue a Ph.D.

	MS Engineering Students (n = 274)			Practicing Engineers (n = 187)		
	S. Disagree/ Disagree	Neutral	Agree/ S. agree	S Disagree/ Disagree	Neutral	Agree/ S. agree
My professors motivate me to pursue a Ph.D.	24%	46%	28%	31%	38%	31%
My parents motivate me to pursue a Ph.D.	21%	38%	41%	18%	37%	45%
My friends who are seeking a Ph.D. motivate me to pursue a Ph.D.	21%	53%	26%	22%	47%	31%
I prefer practicing engineering to make money instead of pursuing a Ph.D.	23%	19%	**58%**	23%	24%	**53%**
I would like to pursue a Ph.D. because I like teaching in a university	49%	24%	27%	43%	26%	31%
Working as an engineer generates more money than teaching in a university	17%	36%	47%	17%	42%	41%
I would like to pursue a Ph.D. because a professor title is more prestigious	43%	33%	24%	43%	34%	23%
I would like to pursue a Ph.D. to get leadership position in my profession	28%	24%	48%	34%	24%	44%
I would like to pursue a Ph.D. because I like research	34%	28%	38%	27%	27%	46%
I would like to pursue a Ph.D. to learn more about the field	18%	22%	**60%**	16%	27%	**57%**
I would like to pursue a Ph.D. to invent new products	15%	30%	**55%**	15%	33%	**52%**
I would like to pursue a Ph.D. to help others learn	15%	31%	**54%**	15%	34%	**51%**

make money instead of pursuing a Ph.D, 60% of students and 57% of engineers would like to pursue a Ph.D. to learn more about the field, 55% of students and 52% of engineers would like to pursue a Ph.D. to invent new products, and 54% of students and 51% of engineers would like to pursue a Ph.D. to help others learn.

5.3 Do students have different perceptions from engineers?

Before testing the hypotheses that predict the relation between the attitudes, subjective norm, and behavioural intention, the perceptions for both groups (students and engineers) were compared for any difference. An independent Samples t-Test was applied and Table 3 shows no significance between the two groups for all the factors ($p>0.05$).

When conducting the survey, it was expected to find some discrepancies between engineer and student perceptions. The targeted groups have dissimilar characteristics with different status. Engineers have been working for an average of three years and should be comfortably settled and financially secured in their job which is not the case for the students.

Although it is surprising to find strong agreement between both groups regarding Ph.D. enrolment, such a finding reveals that engineers had pre-established their perceptions about postgraduate studies before they started their professional life, and the career doesn't seem to influence their intention. Another possible explanation is that some engineers may not be satisfied with their current job and may find in pursuing a Ph.D. an alternative for better prospects.

5.4 Attitudes and subjective norm factors

Given the non-significant findings between both samples (274 students and 187 engineers), all the available 461 observations were combined in one set of data in order to investigate the predictors of the Behavioural Intention through the attitudes and the subjective norm.

An exploratory Factor Analysis (FA) was applied to the data in order to determine which of the 12 items formed related subsets. FA combines into factors variables that are correlated with one another but largely independent of other subsets of an item [26, 27]. This method was used as an expedient way to identify a smaller number of constructs (subsets) that represent the Likert-type items. As a means to form the potential factors, FA was applied to principal components extracted, eigenvalues greater than 1.00, and absolute value more than 0.40 [28, 29]. Results of Kaiser-Meyer-Olkin (KMO) measure of sampling for students and engineers equal to 0.843, and Bartlett's test (p<0.0001) showed that using FA is appropriate for this study [30].

Table 3. Independent t-test comparing four factors for students and engineers

		n	Mean	SD	Std. Error Mean	Independent Sample Test	
						t	Mean Difference
My professors motivate me to pursue a Ph.D.	Students	274	3.02	0.94	0.057	0.292	0.027
	Engineers	187	2.99	1.02	0.075		
My parents motivate me to pursue a Ph.D.	Students	274	3.30	1.05	0.064	0.382	0.038
	Engineers	187	3.34	1.01	0.074		
My friends who are seeking a Ph.D. motivate me to pursue a Ph.D.	Students	274	3.05	0.86	0.052	0.448	0.038
	Engineers	187	3.09	0.94	0.069		
I prefer practicing engineering to make money instead of pursuing a Ph.D.	Students	274	3.49	1.19	0.072	0.573	0.063
	Engineers	187	3.42	1.10	0.081		
I would like to pursue a Ph.D. because I like teaching in a university	Students	274	2.69	1.30	0.079	0.989	0.121
	Engineers	187	2.81	1.28	0.094		
Working as an engineer generates more money than teaching in a University	Students	274	3.43	1.04	0.063	0.479	0.047
	Engineers	187	3.38	1.04	0.076		
I would like to pursue a Ph.D. because a professor title is more prestigious	Students	274	2.70	1.08	0.066	0.002	0.000
	Engineers	187	2.70	1.09	0.080		
I would like to pursue a Ph.D. to get leadership position in my profession	Students	274	3.33	1.13	0.069	1.445	0.157
	Engineers	187	3.17	1.16	0.085		
I would like to pursue a Ph.D. because I like research	Students	274	3.08	1.20	0.073	1.806	0.201
	Engineers	187	3.28	1.13	0.083		
I would like to pursue a Ph.D. to learn more about the field	Students	274	3.54	1.05	0.064	0.495	0.050
	Engineers	187	3.59	1.06	0.078		
I would like to pursue a Ph.D. to invent new products	Students	274	3.51	1.00	0.061	1.399	0.135
	Engineers	187	3.38	1.03	0.075		
I would like to pursue a Ph.D. to help others learn	Students	274	3.50	1.05	0.064	0.623	0.061
	Engineers	187	3.44	1.01	0.074		

Table 4. Rotated factor matrix with extraction method: principal component. Rotation method: Varimax with Kaiser Normalization

	Component			
Items for Subjective norms and Intentional behaviour	**Professional attitude**	**Subjective norm**	**Social attitude**	**Financial attitude**
I would like to pursue a Ph.D. to invent new products	0.846			
I would like to pursue a Ph.D. to learn more about the field	0.809			
I would like to pursue a Ph.D. because I like research	0.649			
My friends who are seeking a Ph.D. motivate me to pursue a Ph.D.		0.824		
My professors motivate me to pursue a Ph.D.		0.698		
My parents motivate me to pursue a Ph.D.		0.695		
I would like to pursue a Ph.D. because a professor title is more prestigious			0.851	
I would like to pursue a Ph.D. to get leadership position in my profession			0.660	
I would like to pursue a Ph.D. because I like teaching in a university			0.589	
I would like to pursue a Ph.D. to help others learn			0.579	
Working as an engineer generates more money than teaching in a University				0.839
I prefer practicing engineering to make money instead of pursuing a Ph.D.				0.704

The FA of the principal components extracted yielded four factors accounting for 64.03% of the total variance. Table 3 shows the rotated factor loadings, which are the correlations between the variable and the factor. The sizes of the loadings reflect the extent of the relationship between each variable and each factor. The higher the factor loading, the more the particular item contributes to the given factor. For items that were loaded under two factors, only the highest loading was retained. Factor1 reported a variance ($s^2 = 35.09\%$), factor2 ($s^2 = 10.35\%$), factor3 ($s^2 = 9.58\%$), and factor4 ($s^2 = 8.99\%$).

After evaluation of the items loaded under each factor, descriptive names were generated. Factor1 was labelled Professional Attitude (PA), factor 2 was labelled Subjective Norm (SN), factor 3 was labelled Social Attitude (SA), and factor 4 was labelled Financial Attitude (FA).

Four new variables were computed based on the mean of the items falling under each factor. In order to obtain the most important factor, one-way repeated measures ANOVA was applied to the four variables for each sample.

Repeated measures ANOVA indicated significant differences among the four factor scores, ($F(3, 1380) = 25.66$, $p < 0.001$). The Professional attitude was shown as the most important for participants with a mean of ($\mu = 3.39$) followed by the Financial attitude ($\mu = 3.43$), the Subjective norm ($\mu = 3.13$), and the Social attitude ($\mu = 3.04$). The post hoc tests using Bonferroni technique indicated significance ($p<0.0001$) except between the Professional and Financial attitudes and between the Social attitude and the Subjective norm which have close values.

5.5 Behavioural Intention predictors

The Theory of Reasoned Action used for the design of the survey is a combination of attitudes toward pursuing Ph.D. and subjective norm. The relationships between the predictor variables (attitudinal components and subjective component) and criterion variable (behavioural intention to pursue a Ph.D.) are shown in Fig. 3. To test the hypotheses H1 and H2 and to produce the relationships, the following analyses were conducted:

- Pearson correlation (r1, r2, r3) between the attitudinal components (Professional, Social, and Financial attitudes) and the Behavioural Intention
- Pearson correlation (r4) between the Subjective norm and the Behavioural Intention
- Pearson correlation (r5, r6, r7, r8, r9, r10) between all the variables
- Multiple correlation (R) between the attitudinal components, the Subjective norm and the Behavioural Intention.
- Multiple regression between the attitudinal components, the subjective norms and the behavioural intention in order to obtain the regression weights that represents the relative importance of the attitudes and the subjective norm.

The results of Pearson product-moment correlations for each pair ($r1$, $r2$, $r3$, $r4$, r5, r6, r7, r8, r9, and r10) appear in Table 5. Participants' Professional attitude towards pursuing Ph.D. is significantly correlated ($r1 = 0.56$, $p = 0.000$) with the expected Behavioural intention. This correlation was also statistically significant with the other types of attitudes and the subjective norm (r5 = 0.49, r8 = –0.35, r10 = 0.45, $p = 0.000$) confirming that professional expectations figured strongly in participants' decision.

Also, the Social attitude towards pursuing a Ph.D. is shown as significantly correlated ($r2 = 0.46$, $p = 0.000$) with the expected Behavioural intention. This correlation was also statistically
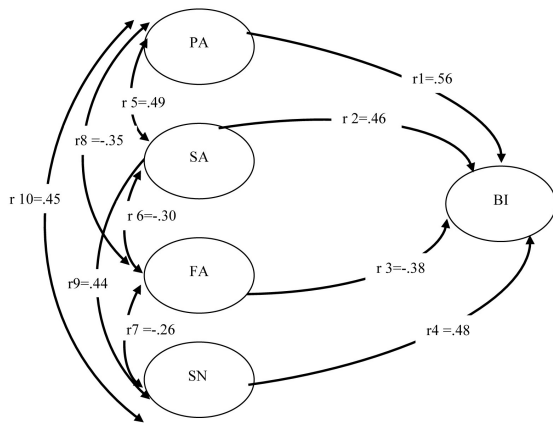
Fig. 3. Relations between participant attitudes (PA, SA and FA), subjective norm (SN), and the intention to pursue a Ph.D. (BI) with the corresponding correlation.

significant with the other types of attitudes and the subjective norm (r5 = 0.49, r6 = –0.30, r9 = 0.44, p = 0.000) revealing that the social factor has an influence on participants' choice.

Participants' Financial attitude is negatively and significantly correlated with the intention to pursue a Ph.D. (r3 = –0.38, p = 0.000). This correlation was also negatively significant with the other types of attitudes and the subjective norm (r6 = –0.30, r7 =

–0.26, r8 = –0.35, p = 0.000) reflecting that the financial factor has a negative association with participants' decision.

The Subjective norm Ph.D. is significantly correlated (r4 = 0.48, p = 0.000) with the expected Behavioural intention. This correlation was also statistically significant with the other types of attitudes (r7 = –0.26, r9 = 0.44, r10 = 0.45, p = 0.000) revealing that the normative component has an impact on participants.

One of the objectives of the Theory of reasoned action is to provide an index of relationship between two variables (r1, . . ., r10) as showed in Fig. 3. Another objective is to find the index that predicts the variable (Behavioural intention) from the other variables (attitudes-toward-the-act and the subjective norm). Such an index is provided by the multiple correlation coefficient, R (see Table 6).

In computing this index, a weight ($w1$, $w2$, $w3$, $w4$) for each of the predictor variables is obtained to measure the independent contribution of that variable in the prediction of intention. Multiple R (0.72) represents the multiple correlation, i.e. the correlation between the dependent variable (intention to pursue a Ph.D.) and the weighted sum of the predictor variables (PA, SA, FA, and SN). R square (0.63) explains the variance of the dependent variable by all of the predictor variables combined. The

Table 5. Pearson product-moment correlations for attitudinal and normative components

	Behavioural intention	Professional attitude	Social attitude	Financial attitude	Subjective norm
Behavioural intention	1	r1 = 0.568(**)	r2 = 0.468(**)	r3 = –0.382(**)	r4 = 0.485(**)
Professional attitude	r1 = 0.568(**)	1	r5 = 0.495(**)	r8 = –0.351(**)	r10 = 0.453(**)
Social attitude	r2 = 0.468(**)	r5 = 0.495(**)	1	r6 = –0.303(**)	r9 = 0.446(**)
Financial attitude	r3 = –0.382(**)	r8 = –0.351(**)	r6 = –0.303(**)	1	r7 = –0.265(**)
Subjective norm	r4 = 0.485(**)	r10 = 0.453(**)	r9 = 0.446(**)	r7 = –0.265(**)	1

** Correlation is significant at the 0.01 level (2-tailed).

Table 6. Multiple regression of criterion variable 'Behavioural intention' with predictor variables 'Professional attitude, Social attitude, Financial attitude and Subjective norm'

Multiple R	0.7264
R square	0.6354
Adjusted R square	0.6273
Analysis of Variance	

	Sum of Squares	df	Mean Square	F	Sig.
Regression	303.618	4	75.904	86.521	0.000
Residual	400.044	456	0.877		
Coefficients					

Variables in equation	B	Std. Error	Beta	t	Sig.
(Constant)	0.485	0.343		1.413	0.158
Professional	0.490	0.064	0.335	7.700	0.000
Social	0.210	0.058	0.154	3.606	0.000
Subjective	0.362	0.067	0.223	5.367	0.000
Financial	–0.220	0.053	–0.159	–4.143	0.000

adjusted R square (0.62), is an estimate of the variance while taking error variance into account.

Both, the R square of 0.63 and the adjusted R square of 0.62, indicate that the combined predictor variables, PA, SA, FA, and SN, have a good contribution in the variance explained in the variable (intention to pursue a Ph.D.). Moreover, the F statistics ($F = 86.52$, $p = 0.000$) is found as highly significant and the Beta weights in Table 6 (PA = 0.33, SA = 0.15, FA = –0.15, SN = 0.22) reveal that the Professional attitude plays the most important role compared with the other variables in determining the intention to pursue a Ph.D. Hence, the statistical analysis shows that participants' intention towards pursuing a Ph.D. is strongly correlated and is mainly determined by the Professional attitude.

5.6 Do parents with Ph.D. affect the decision?

Researchers in sociology have debated the link between parents' education and the educational attainments of their children. Some studies showed strong effect of family background on the decision to attend college or choose a major [31–33]. Others suggested that these effects do not impact on the decision to enrol in graduate studies. As such, Mare [34] showed that parents' education has no impact on children's decisions to attend graduate institutions. Also, Stolzenberg [35] argued that graduation from college marks a break in the link between parental background and the postgraduate educational attainment of their youth.

One question included in the survey asked if parents hold a Ph.D. degree in any field. The objective was to explore the influence of such a factor on the participants' decision. A linear regression was employed to help determine if parental education can be used to predict the intention of their offspring to pursue postgraduate studies. The independent variable produced an adjusted R^2 of 0.002. Therefore, parents with a Ph.D. seem to not have any influence on the interest /lack of interest of participants in pursuing a Ph.D. degree. These findings are consistent with previous research [34–35] showing that parental education has no effect on educational enrolment beyond college.

6. Conclusions

In this study, the behavioural intention of students and engineers to pursue a Ph.D. was investigated. The statistical analysis showed similar driven attitudes for students and engineers regarding Ph.D. Following the Theory of Reasoned Action, analysis of responses to the survey predicted three attitudes and a subjective norm. The Professional attitude appeared to be the most important contributor to enrol in a Ph.D.

Although a good number of participants have a strong intention to pursue postgraduate studies, the implications of these findings necessitate further investigations. This research is a case study that included students from one country in the Middle East region. The scarcity of available information about education in general and engineering education in particular in the Arab world was one of the main limitations of this study. Interviews with some students who are enrolled in engineering Ph.D. programmes would offer more insights and may provide a more complete picture of Ph.D. students' attitudes as well as their lived experience. Interviews may confirm that the Professional attitude is the main predictor for pursuing a Ph.D. while explaining the influence of the other predictors. Also, the negative correlation with the Financial attitude was not anticipated, so interviews would also be useful in gaining a better understanding of this negative association. Moreover, the participants were students and engineers from one country in the Middle East region. Further investigations of other countries in the same region as well as abroad are needed to confirm the findings.

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