

FROM COURSE PROJECT TO ENTREPRENEURSHIP: THE CASE OF ENGINEERING STUDENTS AT PRINCESS SUMAYA UNIVERSITY FOR TECHNOLOGY

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ABSTRACT

This research reviews the situation of entrepreneurship education in Jordan in general and at PSUT in particular focusing on engineering students. It also aims to assess the importance of entrepreneurship for these students, and how they can benefit from it in transforming their course projects into businesses, in addition to giving some recommendations for the university on how it can support entrepreneurship. The value of this paper relies not only on the scarcity of research in Jordan but also on its ability of being applied in other universities and other countries to support entrepreneurship education among engineering students all over the world.

The paper described the situation of PSUT engineering students with regards to the course projects which they make and what actually happens to the resulting products. The research started with attending an exhibition for the engineering students in the embedded systems class where they presented their projects in the presence of some TV channels; the projects included interesting ideas of products which can be actually implemented and sold. A survey was distributed among students to assess their willingness to start their own businesses based on those products and to check their ability to do that, in addition to assessing their awareness of entrepreneurship in general. The survey was distributed during the exhibition under the supervision of the researchers in order to reduce the possibility of misunderstanding the questions. Some recommendations were given to the university based on the data analysis of this survey. Meanwhile, throughout this research interviews were conducted with Jordanian entrepreneurs to investigate the reasons of failure in the Jordanian market.

Four years after applying the above mentioned recommendations another survey was distributed among students of the same major in order to assess the effect of implementing those recommendations.

Keywords: Entrepreneurship, Engineering Students, Entrepreneurship Education, Jordan, Course Projects.

INTRODUCTION

For many years, traditional, lecture-based learning was the most common approach to teaching found in classrooms around the world. This teacher-controlled approach featured the teacher as the holder of all the knowledge who delivered it through comprehensively prepared lessons, the lessons are scripted down to the time allotted for each activity and the possible

answers to questions. This teacher-centred classroom secured the teacher's place as the respected keeper and dispenser of knowledge. This method is also based on an environment of certainty where the students have rules to help them reach the solution which limits the creativity of students (Ardalan, 2008). For these reasons, traditional lecture based learning was adequate for passive students who did not know how to be active participants in classroom dialogues and those who rely on repetition and memorization for learning; Critics also claim that this approach was often used by poor and unqualified lecturers (Major & Palmer, 2001). Furthermore, it has been said that lecturing is not an effective method for advancing problem solving skills as it does not require creativity or critical thinking, lecture-based learning does not prepare students for the real world cases which they will face in the future as professionals (Johnson, 1999).

In response to the above-mentioned reasons, the improvements in educational systems, and the requirements of real life jobs; problem-based learning approach has grown in popularity as a way to address the needs of modern learners. Problem-based learning was defined by Savery (2006) as "*an instructional (and curricular) learner-centred approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem*", Problem-based learning uses real-world case studies, scenarios, and problems in order to teach students to use previous knowledge to solve problems and apply solutions in practical ways.

The application of problem-based learning in groups allows students to share knowledge and add perspectives within their groups and to view the problem from different points adding significant value to the learning process. In addition to the knowledge acquired by students through problem-based learning, the satisfaction and perception of teaching quality gives students who were taught using this method higher grades than of those who were taught through a more traditional approach. Since real-world cases and scenarios place students in challenging situations, they have to think not only about the solution of the problem but also about the process by which the solution would be applied. This leads to better understanding the situation and developing skills which can be used in solving future problems and more complex situations (Downing et. al, 2011). Additionally, the boundaries between teachers and learners are narrowed in the problem-based learning approach allowing closer contact between the teacher and the students and giving the students the opportunity to ask more creative questions and gain knowledge through learning by doing; this puts the teachers in the challenge of gaining more knowledge to be able to overcome the role of the knowledge disseminator due to being a content expert (Yeo, 2005).

Hmelo-Silver (2004) argued that problem-based learning is an effective approach in building flexible knowledge through the integration of knowledge acquired in different domains and use of this knowledge as required and needed by surrounding circumstances across different situations. The effectiveness of this approach does not stop here, as it also helps students in developing their problem solving skills, enhancing collaboration between students through working as part of a team, and activating their internal motivations for learning. The collaboration between students aids in making problems easier for them to be solved as they would consider these problems more difficult when working individually, because they can link their distributed parts of knowledge to create an understanding of the problem under discussion, and through shared reflections on this problem students would develop long lasting life-time skills which can be transferred and used in solving other problems.

One of the challenges facing the problem-based learning is its use in complex multi-variable environments which makes it difficult to assess the usefulness of this method and its real

effect on the development of students' skills (Werth, 2009). Less attention was given to problem-based learning in computer science/IT-related academic programs due to several reasons including the lack of support from faculty, the resistance caused by historical approaches, and lack of motivation to innovate beyond traditional approaches (Hogue & Kapralos, 2011).

The application of problem-based learning can be linked to another very similar method which is the project-based learning to give even stronger results through engaging students in groups so that they can think exponentially to bring up more creative results compared to the results of linear thinking applied by one student; project-based learning is all about raising a question or a problem to solve, organize, and drive activities which culminate a final product that addresses the driving question (Thomas, 2000); one of the essentials of project-based learning is having the students to work in pairs or groups (Vega, 2012).

Engineering education faced many critical challenges which made the adoption of problem-based and project-based approaches as teaching methods a necessity. These issues included the extensive focus of engineering curricula on engineering and technical courses without relating these topics to industrial practice, lack of design experiences provided to students, ignoring the communication and teamwork skills of students which need to be developed, the ignorance of social, environmental, economic and legal issues that are part of the reality of modern engineering practice, lack of practical experience in the existing faculty which prohibits the linkage between theory and practice, teaching strategies in engineering programs were outdated and needed to become more student-centered (Mills & Treagust, 2003); all these issues crystallize the need for adopting new educational approaches in engineering education.

From the practical aspect; the project-based learning approach was applied on a group of first-year students in an introductory electrical engineering course in the University of Hong Kong, the students were required to design a Rube Goldberg machine with electrical sensors and actuators. Students reported that they thought the project was challenging, and helped them develop their technical skills and creativity (Lei et al., 2012). This approach allows students to understand the non-technical aspects of problems, helping them to hurdle sustainability-related problems through the use of interplay, mix and diversity (Lehmann et al., 2008).

Using project-based learning in engineering education provides "*Intellectual Maturity*" through transforming students from dependent learners into independent learners through acquiring knowledge about what they know, in addition to being aware of what they do not know which adds more reality to their expectations (Hasna, 2008). Project-based learning also gives students the ability to "*know how to navigate the world*" which makes them more desirable to employers for these skills than for high grades (Cho & Brown, 2013).

Another application of the project-based learning approach was done in the University of Oviedo (Spain) in the Power Electronics course in an aim to enhance the utilization of the knowledge acquired from traditional theory classes. The application of this approach had a number of objectives such as teaching students the fundamental concepts and ideas of the course, teaching students how to search for information, classify, and analyse them in a manner that suits the topic and through the right sources, providing practical application for theoretical concepts, developing the critical reasoning and thinking skills of students, in addition to enhancing their soft skills. The results showed that student perceived the approach as an effective learning method in terms of skill development, self-management, creating positive collaborative relationships, and the development of high-order knowledge (Lamar et al., 2010).

In another study, Universidad del Valle (Colombia) applied the project-based approach in the control courses (Control I and Control II) of the Electronics Engineering program with the

objective of developing transversal skills such as teamwork, self-learning, communication skills and problem solving, decision making, time and information management, and self-criticism. Students showed positive implications about the development of these skills through the courses (Fernández-Samacá et al., 2013). The application of project-based learning extended to include courses which require students to develop devices that perform specific tasks such as the course of “*A creative introduction to mechanical engineering*” taught at the Faculty of Mechanical Engineering at the Technion (Frank, et. al, 2003).

Project based learning and problem based learning are often used interchangeably since they share several characteristics; both of them engage students in real-world tasks and give them open-ended projects or problems with the freedom of choice for the solution or method they would like to use, on the same hand, both project based and problem based learning are defined as student centred learning due to engaging the student in the learning process while giving the lecturer the role of a facilitator (Donnelly & Fitzmaurice, 2005). Despite the connectivity between these two methods, project based and problem based learning are not synonyms; problem based learning originated in 1960s from medical education and was defined as “*a learning process facilitated by ill-structured problems and problem solving processes*” (Hmelo-Silver, 2004), while project based learning is more associated with engineering and science instruction (Donnelly & Fitzmaurice, 2005) and is less recognised in literature than problem based learning (Tomkinson & Hutt, 2012).

ENTREPRENEURSHIP EDUCATION

Entrepreneurial education has proven its importance over time in the entrepreneurial process as a strong facilitator to success (Arthur et al., 2012). It is also an important factor in addressing the contemporary needs of business which cannot be addressed through the traditional business education (Mitra, 2002). Furthermore, the exposure to entrepreneurship courses increase the intention of university students towards entrepreneurship, compared to the entrepreneurial intention of those who have not taken any courses related to entrepreneurship, this increase in the entrepreneurial intention is caused by the effect of entrepreneurial education in strengthening the internal locus of control and the perceived behavioural control of the students (Gerba, 2012).

It is important to note that entrepreneurial education does not only focus on teaching students how to become managers of firms; it also aims to teach them how to solve problems creatively once they emerge. This learning process is based on experimentation through the use of trial and error, therefore failure becomes an important element in the learning process (Fayolle & Gailly, 2008). The use of the project based learning method develops the critical thinking skills of students therefore it was considered one of the best methods for teaching entrepreneurship (Arasti et al., 2012). Project-based learning can be conducted in either an individual or group basis over a period of time to get a tangible product as a result of the learning process (Helle et al., 2006). Project based learning and problem based learning are often used interchangeably since they share several characteristics; both of them engage students in real-world tasks and give them open-ended projects or problems with the freedom of choice for the solution or method they would like to use, on the same hand, both project based and problem based learning are defined as student centred learning due to engaging the student in the learning process while giving the lecturer the role of a facilitator (Donnelly & Fitzmaurice, 2005). Despite the connectivity between these two methods, project based and problem based learning are not

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Through several comparisons of previous studies Hynes (1996) found out that entrepreneurship can be taught especially with the aim of increasing awareness and providing an understanding of the entrepreneurial process. Entrepreneurship education should focus on both theory and practice hence entrepreneurship theory enables entrepreneurs to know basics about entrepreneurship and business creation and development through analyzing the entrepreneurial activity. Furthermore, entrepreneurship education improves the entrepreneurial skills which aid the business practices. Entrepreneurship education must focus on innovation because entrepreneurship does not exist without creativity and innovation, and this leads to an increased motivation along with a positive attitude towards entrepreneurship from students which is needed by developing countries since investigations have shown that they are more active in early-stage entrepreneurship and have higher entrepreneurial intentions compared to developed countries due to the introduction of new products and services by entrepreneurs through the use of new technology; however students are still passive in the employment process though entrepreneurship education aims to transform them into active employers (Lili, 2011; Nabi & Liñán, 2011). To avoid the mismatch between entrepreneurship education and actual learnt entrepreneurial skills, universities are supposed to provide interactive learning environments in which students can get experience through dealing with business people operating in live projects (Chang & Rieple, 2013), this education is essential for enhancing the entrepreneurial spirit which is vital for the success of entrepreneurs in their businesses (Jones & English, 2004).

Entrepreneurship is vital for economic growth in countries (Chen et al., 2012; Hafer, 2013) and entrepreneurship education can contribute to the development of students (Rae & Woodier-Harris, 2012), therefore, in universities it is the best method for producing better entrepreneurs who can produce innovative products and services and implement innovation to drive economic growth (Anderson, 2011). Engineering students can play a major role in developing new technological firms; however, entrepreneurship courses are not well spread in the engineering schools, the courses should not focus solely on business plan development, but they should also enhance the entrepreneurial attitudes, intentions, and awareness among students (Iacobucci & Micozzi, 2012).

ENTREPRENEURSHIP EDUCATION METHODS

Entrepreneurship education methods are numerous ranging from conventional teaching methods to the interactive and project-based methods. In many cases, practical methods were recommended over the conventional education methods due to providing real-life experience which attracts students into entrepreneurial careers (Fayolle & Gailly, 2008; Heinonen, 2007; Othman et al., 2012). Fayolle & Gailly (2008) have suggested a generic conceptual framework for entrepreneurship education in an attempt to bridging the gap between education sciences and the field of entrepreneurship and stressing the importance of entrepreneurship education; the framework is aimed to help the effective and systematic design, management, and evaluation of both new and existing programs. It is important to note that regardless of the education method

used, the perception of the teacher towards his/her own entrepreneurship education skills is vital to the success of the education process (Ruskovaara & Pihkala, 2013).

Entrepreneurship education has to be integrated with the normal curricular being taught to engineering students in order to support their massive efforts of developing impressive projects for several courses during their studies, however, Ismail & Ahmad (2013) found out that this integration is a tough task which requires careful planning to avoid the discouragement of entrepreneurial initiatives which might be caused by the deficiencies in delivering the programs. To solve this problem they suggested that the content of courses should be flexible, a practical-based approach should replace the examination approach for assessment, instructors should be trained in order to be able to use problem-based approach in teaching and providing a hands-on experience to the students, partnerships with government and local authorities should be conducted to provide the students with real-life experiences, and feedback must be taken from students frequently for development of programs. Along with the problems of program design and assessment methods another problem can be encountered while integrating the entrepreneurship education into non-business curricula which is the crowded study programs of other majors including engineering (Henry & Treanor, 2012). It is recommended for universities to share entrepreneurship education across their school and faculties in order to supply students with transformative experiences (Jones et al., 2012). Universities can also support entrepreneurship education by providing extra-curricular activities such as the participation in entrepreneurial competitions and associations in addition to internships (Lili, 2011).

ENTREPRENEURSHIP AT PSUT

Although entrepreneurial intentions are affected by several psychological, demographic and behavioural factors (Marques et al., 2012); university environment proved to be an essential factor affecting the entrepreneurial intentions of students (Wang & Verzat, 2011), Furthermore, entrepreneurial intentions are affected positively by the creativity level and prior entrepreneurial experience whereas the perception of risk has a negative effect (Hamidi et al., 2008).

PSUT provides many of the above-mentioned methods including partnership with Oasis500 and iPark which are both incubators of entrepreneurial start-ups. In addition to having Queen Rania Centre for Entrepreneurship (QRCE) in campus to provide entrepreneurship training inside the centre and internships in entrepreneurial start-ups outside the centre, Queen Rania National Entrepreneurship Competition focuses on the development of the entrepreneurial spirit among Jordanian university students and local entrepreneurs to support them in transforming their ideas into successful businesses to enhance the economy (Othman, 2014). Additionally, PSUT has spread entrepreneurship education across the university through providing a selective course titled “*Business Entrepreneurship*” for all the students from all the departments at the university.

Engineering and IT departments’ course projects at Princess Sumaya University for Technology (PSUT) usually result in innovative products which can be a good start for new entrepreneurial businesses. The question is: what happens to these projects after passing the course? At the beginning students were showing great interest in their projects, however, they did not know how to take their projects to the next level. At PSUT, engineering and IT disciplines focus solely on the technical aspect of learning, i.e. how to create, but there is little interest in the business aspect of the new product development process. Students care about creating new innovative products without matching these products to real market needs, or even

without thinking if there is a need for these products in the market. This research reviews the situation of entrepreneurship education in Jordan in general and at PSUT in particular focusing on engineering students. It also aims to assess the importance of entrepreneurship for these students, and how they can benefit from it in transforming their course projects into businesses, in addition to giving some recommendations for the university on how it can support entrepreneurship. The value of this paper relies not only on the scarcity of research in Jordan but also on the ability to be applied in other universities and other countries to support entrepreneurship education among engineering students all over the world.

In this research we are trying to assess the importance of entrepreneurship for engineering students at PSUT, and how they can benefit from it in transforming their course projects into businesses. This study can be applied on other universities in the future to expand the sample both inside and outside Jordan. This paper establishes a guide for Jordanian universities to follow when thinking about including entrepreneurship education in their curricula.

METHODOLOGY

According to the Global Entrepreneurship Monitor (GEM) data of 2016, entrepreneurial education at both school and post school stages in Jordan and the region is insufficient, which means efforts must be exploited in this area. The value of this paper generates from this point as the methodology of this paper can be applied on other countries of the region. This paper aimed to describe the entrepreneurial education methods available at PSUT in particular and the Jordanian universities in general, along with suggestion of linking the project-based learning method with entrepreneurship education as a way for linking the students lacking the business background with the market through their course projects.

Interviews were conducted with Jordanian entrepreneurs to investigate the reasons of failure in the Jordanian market; the results could be grouped in three general categories as follows:

1. The weak linkage between the entrepreneurs and the market in the early stage of the business.
2. Insufficient entrepreneurial characteristics.
3. Insufficient motivators.

The results of the interviews mentioned above support the background upon which this paper was developed; the weak linkage between the entrepreneurs and the market in the early stage of the business can overcome if sufficient entrepreneurial education was provided to university students especially if they have courses where they should develop products to the real market, here the importance of entrepreneurship education crystalizes. Additionally, if the student understood the value of his product and believed in its merits he would be highly motivated to enter the market away from the insufficient motivators such as solely gaining money or just being his own boss as these motivators' effect fades away quickly leaving the entrepreneur with a weak entrepreneurial spirit. On the same hand, if the students could understand the characteristics of an entrepreneur then they can work on their selves to develop these characteristics.

The paper described the situation of PSUT engineering students with regards to the course projects which they make and what actually happens to the resulting products. The research started with attending an exhibition for the engineering students in the embedded

systems class where they presented their projects in the presence of some TV channels; the projects included interesting ideas of products which can be actually implemented and sold. A survey was distributed among students to assess their willingness to start their own businesses based on those products and to check their ability to do that, in addition to assessing their awareness of entrepreneurship in general. The survey was distributed during the exhibition under the supervision of the researchers in order to reduce the possibility of misunderstanding the questions. The survey focused mainly on measuring the relationship between students' entrepreneurial abilities and awareness, measuring their acceptance to the idea of getting a partner with a business background, in addition to measuring their willingness to start their own businesses based on the products they have already developed throughout the course. A descriptive analysis was conducted on those results and the preliminary results suggested some recommendations for the university to follow in order to increase the entrepreneurial spirit among the students along with increasing the students' awareness of entrepreneurship at PSUT. The question which remained in the mind was although we have some PSUT students who actually started their own businesses after graduation but the number of them should be higher since they have the willingness to do that; so we suggested that students do not get the required support for starting their businesses as engineering students do not have the business and management background so they need someone to guide them through the process. As mentioned before, at PSUT we have connections with Oasis500, iPark, and QRCE, so in an initiative to activate their role and connect them with our students we held an "*Entrepreneurship Day*" in the Business Department of King Talal Faculty in Business and Technology. We asked some of the engineering students to present their projects in a form of a business idea to experts from the industry representing the above-mentioned companies. The experts gave valuable advices for the students about the prototype development based on the market requirements and customer needs. The effect of this initiative was great, and the students worked on their projects and created prototypes which were applied for both functional and market testing. Furthermore, other students were motivated to present their ideas in later events and showed a great interest in doing that. This initiative supported our suggestion that our students do not lack the willingness to start their businesses but they lack the guidance and support through the vague phases of the entrepreneurial process due to the weak business background which was caused by the focus on technical aspects of engineering without giving any attention to business education in general and entrepreneurship education in particular.

The recommendations were also a reflection of the literature for increasing the awareness of entrepreneurship and fostering students' motivation towards business and entrepreneurship. The most important recommendations were first; making the "*Introduction to Entrepreneurship*" course-which was an elective course for Accounting students-an elective course for all the majors inside PSUT including the Engineering and IT students. And the second recommendation was applying the Entrepreneurship Day event as an annual event at PSUT to insure having extra-curricular activities related to entrepreneurship. The university was also advised to mix students from different departments and colleges by opening the entrepreneurship course for all the majors so that students can make friends from different fields easily, this would enhance the discussions between students and broaden their horizons by communicating frequently with students from other disciplines. For facilitating the relationship between engineering and entrepreneurship at PSUT, QRCE proposed an initiative that aimed to link both graduation and course projects with entrepreneurship through providing support for students in terms of training, mentoring, and incubation in partnership with iPark. This initiative fostered the cooperation

between PSUT faculties and QRCE and linked engineering projects with entrepreneurship; furthermore, this initiative included business and IT students to give the opportunity for all PSUT students to become entrepreneurs. The recommendations also included requiring the attendance of a training with QRCE for engineering students as a condition for their graduation. Four years after applying the above mentioned recommendations another survey was distributed among students of the same major in order to assess the effect of implementing those recommendations.

DISCUSSION AND FINDINGS

We distributed 58 surveys to the Electronic Engineering students of the “*Embedded Systems*” class in order to assess several entrepreneurial aspects among them. Through this survey our aim was to assess the students’ awareness towards entrepreneurship, their willingness to start their own businesses, and their ability to start a business. We focused on engineering students after attending an exhibition of their projects which was held in the 30th of January, 2014 at PSUT and was covered by the press. As in every year, some of the projects seemed very promising business wise, but unfortunately, most of them get directly forgotten and ignored after the completion of the course.

For assessing the students’ awareness towards entrepreneurship we asked them a direct question (Do you know what entrepreneurship is?); in the first survey, 81% of the students said they do not know what entrepreneurship is; while in the second survey only 47% of the students said they did not know what entrepreneurship was. This great difference in the students’ awareness towards entrepreneurship is a result of applying the recommendations of the first survey.

To follow up, we asked the 19% who said they know what entrepreneurship is to describe it with one sentence; only 7 out of the 58 students could provide an answer (12%), which means that their awareness of entrepreneurship is too low. On the other hand; we asked the 31 students (53%) in the second survey to describe entrepreneurship with one sentence and we got 25 correct answers. This is another evidence that the students’ awareness towards entrepreneurship was increased throughout the four years.

We asked the students about their aim from doing the project; 26% of them said their aim was to pass the course, 19% said they want to start a business based on this project, and 55% said they wanted to both pass the course and start a business; the results of the second survey were (45%, 0.05%, and 50%) correspondingly. For insuring the willingness factor we asked them if they are willing to do more developments on their projects, and we got a 90% of them willing to develop their products in the first survey, and 84% in the second survey. However, when we asked them if they prefer starting a business or working in a well-known company 55% of the students willing to start a business in the first survey and 53% in the second survey. In total the students’ willingness to start a new business is high, and the difference in the results of the two surveys could be due to the increased awareness of entrepreneurship as the students started recognizing the difficulties that could face an entrepreneur through the entrepreneurial process.

The students’ ability to start a business was measured through asking them if they would prefer to manage their future business by themselves or to have a partner with a business background; 81% of the students said they prefer to have a partner with a business background in the first survey and 74% in the second survey, this result indicates that the students know they do not have adequate abilities to manage a business due to the lack of knowledge in that field,

furthermore, this indicates that engineering students have a high team spirit due to their willingness to work with others which is a vital entrepreneurial skill (Barringer & Ireland, 2012). The students showed a good interest in the target market for which they are providing their projects as in the first survey 98% of them said they thought about the usability of their products in addition to who will use their product, how and why the product will be used; the result was so close in the second survey as it was 97%. This result indicates that the students have the ability to market their products, but they under-estimate their abilities since they said they need a partner with business background; however this is very logical because they do not recognise the knowledge they have as a valuable asset, however, recognizing this knowledge can increase their control over situations and environments (Evans & Kersh, 2004).

The researchers found out that there is a positive relationship between students' low level of awareness towards entrepreneurship and accepting the idea of getting a partner with business background, the analysis of questions 4 and 7 in Table 1 shows that in the first survey 69% of the students said they do not know what entrepreneurship is and are willing to hire someone with business background to help them manage their future companies, while only 12% of the students said that they do not know what entrepreneurship is and are willing to manage their future companies by themselves. The second survey shows that the percentage of students who know what entrepreneurship is and are willing to run their companies by themselves was increased from 0.07% to 19% which indicates that the students' awareness of entrepreneurship was increased along with their belief in their business and entrepreneurial skills. On the same hand, the results show that the percentage of students who knew what entrepreneurship is was increased from 19% in the first survey to 53% in the second survey.

Survey 1					Survey 2				
		VAR00007		Total			VAR00007		Total
		1	2				1	2	
VAR00004	1	4	7	11	VAR00004	1	11	4	15
	2	7	40	47		2	20	23	43
Total		11	47	58	Total		31	27	58

As shown in Table 2 the research results suggest that there is a positive relationship between students' willingness to develop their products and their willingness to start a business; this resulted through analysing the relationship between questions 3 and 5; 69% of the students said that they are willing to develop their products and start their own businesses based on these products while only 9% said they will not develop their products nor start their businesses. The results of the second survey were close as 57% of the students said they are willing to develop their products and start a business while only 12% said they will not develop their products nor start a business.

Survey 1					Survey 2				
		VAR00005		Total			VAR00005		Total
		1	2				1	2	
VAR00003	1	40	1	41	VAR00003	1	33	16	49
	2	12	5	17		2	2	7	9
Total		11	47	58	Total		35	23	58

The relationship between students' entrepreneurial abilities and accepting the idea of getting a partner with business background proved to be positive after the analysis of questions 2 and 4 which is shown in Table 3; this can refer to the awareness of the entrepreneurial challenges; in the first survey 81% of the students had some entrepreneurial abilities and were willing to hire someone with business background to help them manage their businesses, while only 17% had entrepreneurial abilities and were willing to manage their future businesses by themselves. In the second survey 71% of the students had some entrepreneurial abilities and were willing to hire someone with business background to help them manage their businesses, while only 26% had entrepreneurial abilities and were willing to manage their future businesses by themselves. The slight difference between the two surveys might be a result of the increased motivation of the students towards entrepreneurship.

Survey 1										Survey 2				
		VAR00004		Total			VAR00004		Total					
		1	2				1	2						
VAR00002	1	10	47	57	VAR00002	1	15	41	56					
	2	1	0	1		2	0	2	2					
Total		11	47	58	Total		15	43	58					

The results indicated that engineering students at PSUT are a good target for entrepreneurship courses and initiatives and this is supposed to be utilized by the university to create an entrepreneurial environment in the campus.

CONCLUSIONS AND RECOMMENDATIONS

Based on this analysis we can say that there is no relationship between students' awareness of entrepreneurship or their ability to start a business and their willingness to start a business; which means students' willingness of starting a business should not be affected directly by their awareness of entrepreneurship and their ability to start a business, however willingness alone is not enough, and engineering students still do not start their businesses!

The analysis showed that first; there is a positive relationship between students' low level of awareness towards entrepreneurship and accepting the idea of getting a partner with business background. Second; there is a positive relationship between students' willingness to develop

their products and their willingness to start a business. Third; there is no relationship between students' entrepreneurial abilities and accepting the idea of getting a partner with business background.

The question which remains in the mind is although we have some PSUT students who actually started their own businesses after graduation but the number of them should be higher since they have the willingness to do that; so we suggested that students do not get the required support for starting their businesses as engineering students do not have the business and management background so they need someone to guide them through the process. As mentioned before, at PSUT we have connections with Oasis500, iPark, and QRCE, so in an initiative to activate their role and connect them with our students we held an "Entrepreneurship Day" in the Business Department of King Talal Faculty in Business and Technology. We asked some of the engineering students to present their projects in a form of a business idea to experts from the industry representing the above-mentioned companies. The experts gave valuable advices for the students about the prototype development based on the market requirements and customer needs. The effect of this initiative was great, and the students worked on their projects and created prototypes which were applied for both functional and market testing. Furthermore, other students were motivated to present their ideas in later events and showed a great interest in doing that. This initiative supported our suggestion that our students do not lack the willingness to start their businesses but they lack the guidance and support through the vague phases of the entrepreneurial process due to the weak business background which was caused by the focus on technical aspects of engineering without giving any attention to business education in general and entrepreneurship education in particular, these students were then given an intensive course about entrepreneurship to fill this gap.

For increasing the awareness of entrepreneurship and fostering students' motivation towards it we recommend making the Entrepreneurship Day event an annual event at PSUT, we also recommend conducting sessions on a monthly basis to allow students to present and develop their business ideas. Furthermore, we advise the university to hold several sessions about entrepreneurship topics during each semester.

The university is also advised to mix students from different departments and colleges by making the buildings of its colleges closer so that students can make friends from different fields easily, this will enhance the discussions between students and broaden their horizons by communicating frequently with new people from new disciplines.

For facilitating the relationship between engineering and entrepreneurship at PSUT, QRCE is proposing an initiative that aims to link both graduation and course projects with entrepreneurship through providing support for students in terms of training, mentoring, and incubation in partnership with iPark. This initiative will foster the cooperation between faculties and QRCE and will link engineering projects with entrepreneurship; furthermore, this initiative will include business and IT students to give the opportunity for all PSUT students to become entrepreneurs.

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