

# New Technology Adoption by Business Faculty in Teaching: Analysing Faculty Technology Adoption Patterns

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**To cite this article:**

Sharif Musbah Abu Karsh. New Technology Adoption by Business Faculty in Teaching: Analysing Faculty Technology Adoption Patterns. *Education Journal*. Vol. 7, No. 1, 2018, pp. 5-15. doi: 10.11648/j.edu.20180701.12

**Received:** December 18, 2017; **Accepted:** December 24, 2017; **Published:** January 31, 2018

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**Abstract:** The present investigation surveyed business teachers in traditional university Palestine. Information gathered about technology use patterns, computer experience and use of technology for teaching, perceived computer use self-efficacy, perceived value of IT, perceived incentives, and barriers. This study was designed to establish how instructional technologies were used by business teachers in these universities, and to explore the differences between teachers who have adopted new technology and those reluctant or resistant to IT adoption, and to determine whether business teachers' characteristics contribute to the prediction of teachers' adopter categories.

**Keywords:** Technology Adoption, Diffusion of Innovation, Adopter Categories, Business Teacher's Technology Use

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## 1. Introduction

In the past few years, traditional universities in Palestine have invested heavily in infrastructure to support the diffusion and adoption of technology [Green, 1999; Jacobsen, 2000]. However, despite large investments by traditional universities in Palestine in technology for faculty and student use, instructional technology is not being integrated into instruction in business education institutions [Geoghegan, 1994; Spotts, 1999; Surry, 1997; Albright, 1996; Carlile and Sefton, 1998]. There are many reasons both technical and societal, explaining why innovative technologies have not been widely adopted, however, the major reason for this lack of utilization is that most university-level technology strategies ignore the central role that the faculty plays in the process of change [Surry and Land, 2000].

The Association for Educational Communications and Technology (AECT) has defined instructional technology (IT) as a complex, integrated process involving people, procedures, ideas, devices and organizations, for analyzing problems and devising, implementing, evaluating and managing solutions to those problems involved in all aspects of human learning [Seels and Richey, 1994]. Despite the AECT definition of IT,

in which the emphasis is on IT rather than its' products, many of the debates regarding the use of technology in education continues to focus on products: computers, software, networks and instructional resources [Green, 2000].

Certainly, the use of an adequate technology infrastructure is a prerequisite of IT integration, but the major challenge is to encourage the faculty to adopt these technologies once they are made available. [Geoghegan, 1994] expresses this challenge as follows:

[One of the most basic reasons underlying the limited use of instructional technology is the failure to recognize and deal with the social and psychological dimension of technological innovation and diffusion: the constellation of academic and professional goals, interest, and needs, technology interest, patterns of work, sources of support, social networks, etc., that play a determining role in faculty willingness to adopt and utilize technology in the classroom.]

Adoption of or hesitation to adopt new instructional technologies by the business teachers involves a complex system involving multiple variables. As stated by [Spotts, 1999], "the reality of instructional technology use is in the relationship between the new instructional technologies and the faculty members' individual and organizational context and their personal histories".

## 2. Conceptual Framework

There have been many attempts to understand patterns of adoption in education. The researcher presents one such model in simplified form in order to better understand both traditional and contemporary applications of instructional technology in education. The model, as illustrated in Figure 1, has five phases. The full potential of any educational

technology can only be realized when educators progress through all five phases, otherwise, the technology will likely be misused or discarded [Rieber and Welliver, 1989; Marcinkiewicz, in press, 1991]. The traditional role of technology in education is necessarily limited to the first three phases, whereas contemporary views hold the promise to reach the Evolution phase.

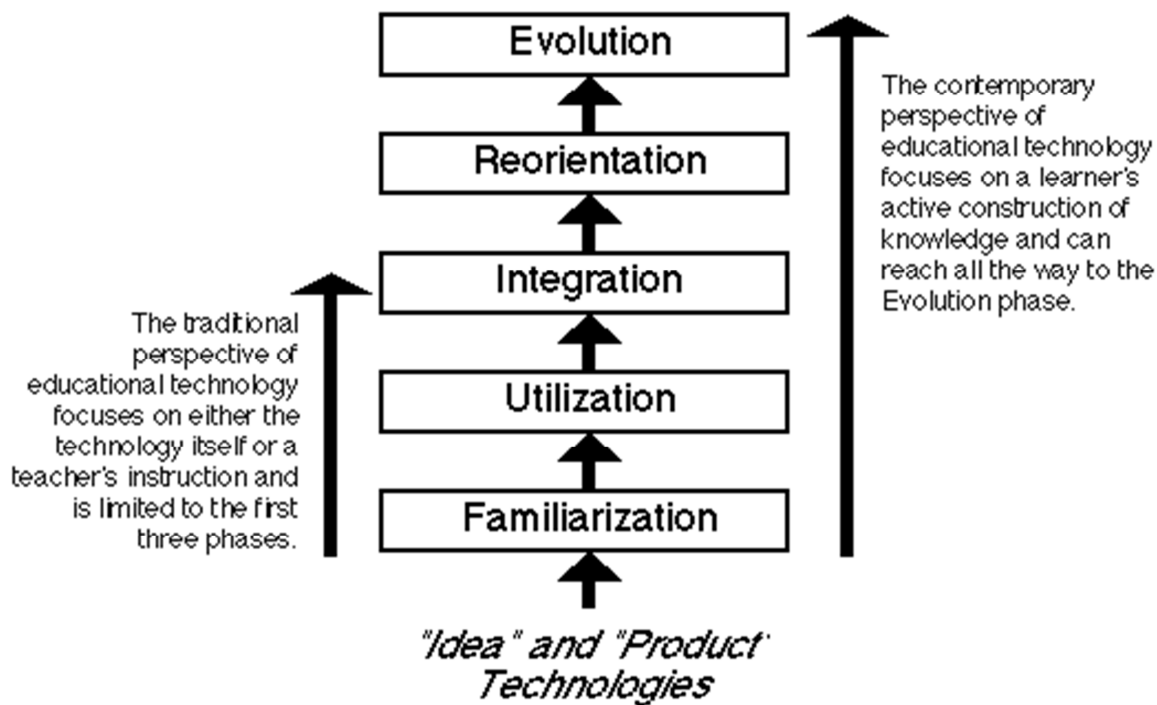


Figure 1. Model of adoption of both Idea and Product instructional technologies in education.

## 3. Study Model

Presented below the Model of study based on previous studies that implemented internationally

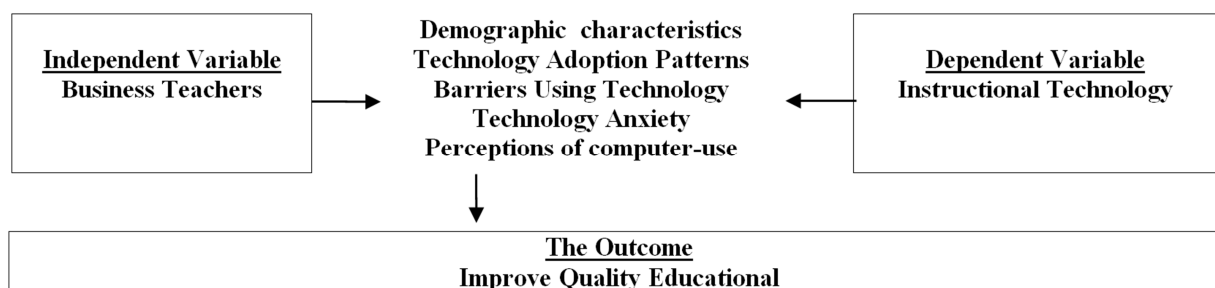


Figure 2. The Model of the Study - Researcher Constructed.

## 4. Study Questions

This study addressed business teachers' use of technology in their instruction, the results should contribute to efforts to enable the instructional use of technology to achieve its maximum possible impact, the research questions were: 1. What are the personal and demographic characteristics of business teachers. 2. To what extent have business teachers adopted technology for use in their instruction 3. What

barriers exist that may prevent business teachers from using technology in their teaching 4. Do business teachers experience technology anxiety when attempting to use technology in instruction 5. Do selected variables explain a significant proportion of the variance in teachers' technology adoption? For the purposes of this study, technology was defined as "high-tech media utilized in instruction such as computers, e-mail, Internet, list-serves, CDROMs, software, laser disc players, interactive CDs, digital cameras, scanners, digital camcorders, etc."

## 5. Study Methodology

### 5.1. Method

The present investigation surveyed business teachers in traditional university Palestine. Information gathered about technology use patterns, computer experience and use of technology for teaching, perceived computer use self-efficacy, perceived value of IT, perceived incentives, and barriers. Survey items were adopted or selected from previous investigations of faculty adoption patterns

[Anderson, Varnhagen, and Campbell, 1999; Jacobsen, 1998] and Microcomputer Utilization in Teaching Self-Efficacy Beliefs Scale [Enochs, Riggs, and Ellis, 1993]. The survey distributed to 105 business teachers and complete data obtained from 105, 100% participants 98% male and 2% female, holding various academic ranks 5% professors, 7% Associate Professors, 35% Assistant Professor and 53% others, having an average of 10 years of teaching experience. While the average age was 41 years, the largest group 55% was in the 31-40 age groups.

*Table 1. Survey participation percentage.*

No.	Traditional Universities	No. of Faculty	No. participated	Participation%
1	Arab American University	33	9	8%
2	Hebron University	11	3	3%
3	Palestine Polytechnic University	23	6	6%
4	An-Najah National University	55	14	13%
5	Palestine Technical University Kadoori	43	12	11%
6	Birzeit University	50	13	12%
7	Bethlehem University	12	3	3%
8	Al-Quds University	24	5	5%
9	Al-Istiqlal University	27	7	6%
10	Al-Azhar University	24	5	5%
11	Islamic University Gaza	64	16	15%
12	Al-Aqsa University	29	6	6%
13	Gaza University	12	3	3%
14	Palestine University	14	3	3%
	Total	421	105	100%

### 5.2. Instrumentation

The instrument contained three scales: technology adoption for use in instruction (15 items), barriers to technology integration in instruction (7 items), and technology anxiety experienced while attempting to use technology in instruction (9 items). All scales and other items used in the instrument developed by the researcher after a review of related research literature. The face and content validity of the instruments evaluated by an expert panel of university teachers, the instruments were pilot tested with

career and technical education teachers. The reliability of the three scales calculated using Cronbach's alpha: technology adoption,  $\alpha = .98$ , barriers,  $\alpha = .84$ , and technology anxiety,  $\alpha = .98$ . All scales possessed exemplary reliability according to the standards for instrument reliability for Cronbach's alpha by [Robinson, Shaver and Wrightsman, [1991]. Table 2 Analysis of Scale Means for Responses Received from business teachers via Mail versus Responses Received via Telephone Follow-up.

*Table 2. Analysis of Scale Means for Responses.*

Scale	Mail Respondents	Telephone Follow-up Respondents	Levene's Test for Equality Variances				
	m (n/sd)	m (n/sd)	F	p	t	df	p
Technology Adoption <sup>a</sup>	3.67 (44/1.13)	3.78 <sup>b</sup> (22/.99)	.95	.33	-.39	47.45	.70
Barriers to Technology Integration	2.03 (42/.67)	2.06 <sup>c</sup> (22/.60)	.65	.42	-.19	62	.85
Technology Anxiety	1.91 (43/1.01)	2.07 <sup>d</sup> (22/.85)	.77	.38	-.64	63	.52

Notes: <sup>a</sup>Equal variances were not assumed for the t-test for technology adoption because the Levene's Test for Equality of Variances resulted in a statistically significant F value.

<sup>b</sup>Technology Adoption Scale: 1 = Not Like Me, 2 = Very Little Like Me, 3 = Some Like Me, 4 = Very Much Like Me, 5 = Just Like Me.

<sup>c</sup>Barriers to Technology Integration Scale: 1 = Not a Barrier, 2 = Minor Barrier, 3 = Moderate Barrier, 4 = Major Barrier.

<sup>d</sup>Technology Anxiety Scale: 1 = No Anxiety, 2 = Some Anxiety, 3 = Moderate Anxiety, 4 = High Anxiety, 5 = Very High Anxiety.

## 6. Variables Related to Technology Adoption

### 6.1. Technology Adoption Barriers

Brinkerhoff (2006) reported that teachers often fail to build on technology's instructional potential due to barriers such as institutional and administrative support, training and experience,

attitudinal or personality factors, and resources. Barriers can be defined as "... any factor that prevents or restricts teachers' use of technology in the classroom" The British Educational Communications and Technology Agency [BECTA, 2003, 1]. Reported that teacher-level barriers included lack of time, lack of necessary knowledge, and lack of self-confidence in using technology. Administrative level barriers included access to equipment, technical support, availability of up to-date software, and institutional support. BECTA, 2003, [Redmann and Kotrlík,

2004, and Mumtaz, 2000] concluded that technology unavailability was an important factor inhibiting the use of technology by teachers. [Park and Ertmer, 2008] expanded on the barriers identified above by stating "... a lack of a clear, shared vision was the primary barrier. Additional barriers included lack of knowledge and skills, unclear expectations, and insufficient feedback".

### 6.2. Technology Anxiety

Technology anxiety has resulted from equipping teachers with technology but failing to provide appropriate teacher training or to consider curricular issues [Budin, 1999]. Technology anxiety has been found to explain variation in technology adoption by career and technical education teachers [Redmann and Kotrlik, 2004] concluded that technology adoption increased as technology anxiety decreased.

### 6.3. Technology Training and Availability

Vannatta and Fordham (2004) found that the amount of technology training was one of the best predictors of technology use. However, it is interesting to note that BECTA (2003) reported that training is focused on teaching basic skills rather than addressing the integration of technology in the classroom. Regarding technology availability, [Mumtaz, 2000 and BECTA, 2003] found that a lack of technology availability was a key factor in preventing teachers from using technology in their instruction.

### 6.4. Gender

Anderson (1996) reported in his analysis of studies of computer anxiety and performance that several studies concluded gender was a significant factor in explaining differences in computer anxiety and attitudes toward computers, while other studies found that no relationships existed. [Kotrlik, Redmann, Harrison, and Handley, 2000] found that gender did not explain any variance in the value placed on information technology by agri-science teachers.

### 6.5. Age and Teaching Experience

Waugh (2004) concluded that technology adoption decreased as age increased. In regard to teaching experience, Mumtaz (2000) reported that a lack of teaching experience with technology was a factor that resulted in teachers avoiding the use of technology and an NCES study (Smerdon et al., 2000) reported that more experienced teachers were less likely to utilize technology than less experienced teachers.

## 7. Background of the Higher Educational Institutions in Palestine

Table 3 summarizes facts of the Palestinian higher education institutions for the academic years (2014/2015 - 2015/2016). These materials facilitated the researcher's conceptualization of the study.

### 7.1. The Statistics for Higher Educational Institutions in Palestine

Table 3. The Higher Educational Institutions.

	Traditional Universities		Open University		University Colleges		Community Colleges		Total	
	14/15	15/16	14/15	15/16	14/15	15/16	14/15	15/16	14/15	15/16
Higher Educational Institutions										
West Bank	9	9	0	0	13	12	11	12	33	33
Gaza Strip	5	5	0	0	6	5	7	6	18	18
Total	14	14	1	1	19	17	18	18	52	51
New Student: 56,969 = Female 33,292 and Male 23,677										
PhD	28	1	0	0	0	0	0	0	28	1
Master	2,776	2,292	0	0	0	0	0	0	2,776	2,292
Higher Diploma	103	79	0	0	0	0	0	0	103	79
Bachelor	31,422	29,819	11,302	9,801	1,870	2,040	0	33	44,594	41,693
Diploma 2 years	1,265	1,373	0	0	4,718	3,577	5,770	4,463	11,753	9,413
Others	621	312	2,495	3,114	84	65	0	0	3,200	3,491
Total	36,215	33,876	13,797	12,915	6,672	5,682	5,770	3,491	62,454	56,969
Enrolled Student: 216,028 = Female 130,843 + Male 85,185										
PhD	40	45	0	0	0	0	0	0	40	45
Master	7,751	6,896	0	0	0	0	0	0	7,751	6,896
Higher Diploma	194	242	0	0	0	0	0	0	194	242
Bachelor	121,008	120,994	57,405	54,316	5,903	6,074	0	175	184,316	181,559
Diploma 2 years	2,624	3,538	0	0	10,431	9,208	12,206	10,379	25,261	23,125
Others	832	633	2,825	3,379	112	140	64	9	3,833	4,161
Total	132,449	132,348	60,230	57,695	16,446	15,442	12,270	10,563	221,395	216,028
Academicians: 7,011										
Prof	215	282	19	19	5	3	2	5	241	309
Associate Prof	367	387	52	58	8	7	0	1	427	453
Assistant Prof	1,416	1,465	327	306	81	89	13	13	1,837	1,873
Lecturer	566	574	80	93	184	353	123	261	953	1,281
Instructor	1,273	1,435	807	961	17	190	279	175	2,376	2,761
Others	0	66	0	19	357	227	30	22	387	334
Total	4,303	4,209	1,431	1,456	949	869	447	477	7,130	7,011

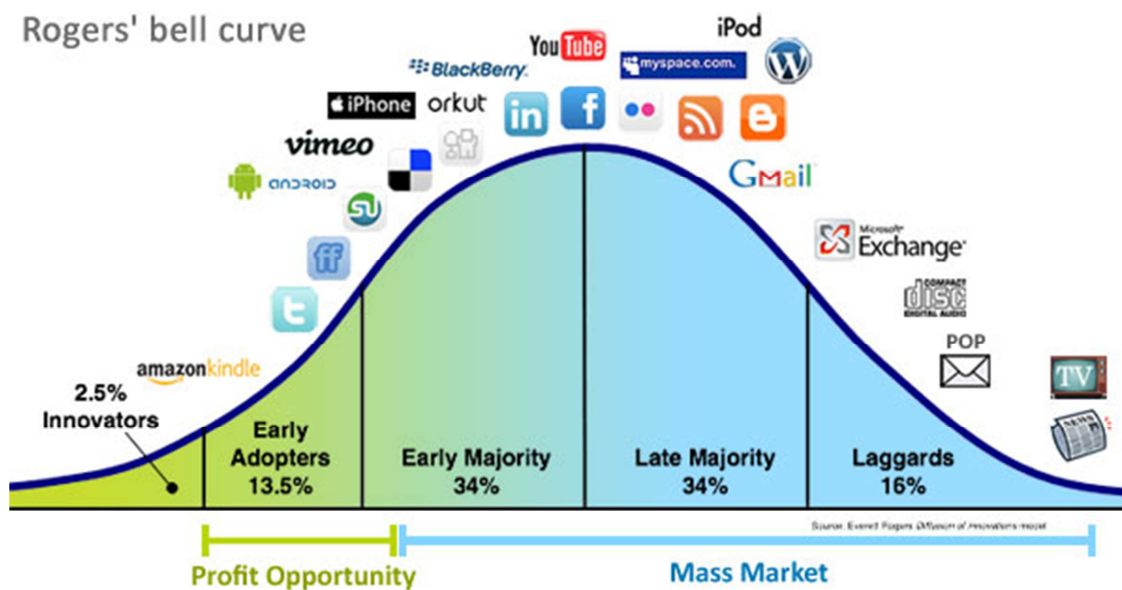
## 7.2. The Statistics for Traditional Universities in Palestine

Educational Institutions; traditional universities for the Academic Year - 2015/2016.

**Table 4.** The Traditional Universities in Palestine.

No.	Traditional Universities	Professor	Asso. Prof	Assi. Prof	Others	Total
1	Arab American University	2	3	12	16	33
2	Hebron University	0	2	01	08	11
3	Palestine Polytechnic University	0	0	11	12	23
4	An-Najah National University	2	2	20	31	55
5	Palestine Technical University Kadoori	0	1	16	26	43
6	Birzeit University	1	2	18	29	50
7	Bethlehem University	0	0	03	09	12
8	Al-Quds University	0	1	08	15	24
9	Al-Istiqlal University	0	0	16	11	27
10	Al-Azhar University	5	7	07	05	24
11	Islamic University Gaza	9	6	16	33	64
12	Al-Aqsa University	0	0	10	19	29
13	Gaza University	0	1	04	07	12
14	Palestine University	1	1	05	07	14
	Total	20	26	147	228	421

## 8. Diffusion of Innovations



**Figure 3.** Adopter Categorization based on Innovativeness [Rogers, 1995].

A conceptual framework for analyzing faculty adoption of technology patterns is provided by Rogers (1995) theory of the diffusion of innovations, which defines diffusion as the process by which an innovation is communicated through certain channels over time among the members of a social system. He defines an innovation as an idea, practice or object that is perceived as new by the individual, and diffusion as the process by which an innovation makes its way through a social system. For research purpose, the innovation is instructional technology for teaching and learning, and diffusion is the extent to which all faculty have adopted this innovation. Because individuals in a social system do not adopt an innovation at the same time,

*innovativeness* is the degree to which an individual is relatively earlier in adopting new ideas than other members of a system. Rogers (1995) describes five adopter categories along the continuum of *innovativeness* which are *ideal types* designed to make comparisons possible based on characteristics of the normal distribution and partitioned by the mean and standard deviation. In this investigation, respondents were assigned to either the earlier adopter (i.e., innovators + early adopters = EA) or mainstream faculty (early + late majority + laggards = MF) subgroups using a scoring procedure developed by Anderson, Varnhagen, and Campbell (1997) in a similar study of faculty adoption patterns. Rogers' bell curve that illustrates Innovator (2.5%),

Early Adopter (13.5%), Early Majority (34%), Late Majority (34%), and Laggards (16%) [Figure3].

The differences between people who fall into Rogers' Early Adopter and Early Majority categories create gaps in motivation, expectations and needs. The literature on individual characteristics of the faculty indicated that early adopters of instructional technology share common characteristics such as higher perceptions of efficacy and expertise [Anderson, Varnhagen and Campell, 1999; Jacobsen, 1998; Lichty, 2000; Oates, 2001], risk taking and experimentation [Oates, 2001], positive attitude toward technology [Spott, 1999] and personal interest in technology [Oates, 2001].

## 9. Study Results Questions

### 9.1. Results Question 1: Personal and Demographic Characteristics

The survey distributed to 105 faculty members and complete data obtained from 105. Most (103 out of 105) of the teachers were male (103 or 98%) while only 2 were female (2%), holding various academic ranks 5% professors, 7% Associate Professors, 35% Assistant Professor and 53% others, The ages of the business teachers ranged from 24 to 70 years and averaged 48years,. The number of years teaching experience ranged from 2 to 35 years with the average teacher having 21 years. (Table 4).

**Table 5.** Summary of Personal and Demographic Characteristics.

Gender	No.	Age	Freq	Academic Rank	Freq	Teaching Experience	Freq
Male	103	24-30	32	Professors	5	5 or less	10
Female	2	31-40	28	Assoc. Professors	10	6-10	30
		41-50	25	Asst. Professor	35	11-15	40
		50 and above	20	others	55	16 and above	25
Total	105		105		105		105

The main source of technology training used by the teachers was 'self - taught' followed by workshops / conferences. (Table 5).

The technology available to teachers presented in Table 6 shows that over two-thirds had a school email account (97.0%), a computer with an Internet connection both at school (94.0%) and at home (82.1%), and a videocassette, CD or DVD recorder (68.7%). Almost one half had a digital video camera (46.3%) while fewer than one-third had students with school email accounts (28.4%), GPS (Global Positioning System) (19.4%), or a PDA (personal digital assistant) (4.5%).

**Table 6.** Sources of Technology Training Used by Technology Education Teachers.

	Source	No.	%
1	Self-taught	100	95.5
2	Workshops/conferences	95	91.0
3	Colleagues	86	82.1
4	College courses	55	52.2

Note: N = 105. The teachers asked to place a check mark (x) beside each type of technology training they had used.

### 9.2. Results Question 2: Technology Adoption / Adopter Groups

The teachers' adoption of technology for use in instruction was measured using the authors' Technology Adoption Scale. The teachers responded to 15 items using an anchored scale: 1 = Not Like Me At All, 2 = Very Little Like Me, 3 = Somewhat Like Me, 4 = Very Much Like Me, and 5 = Just Like Me. The means and standard deviations for the items in the technology adoption scale, along with the interpretation scale, are presented in Table 7.

The highest rated item in this scale was "I have made physical changes to accommodate technology in my classroom or laboratory," which they indicated was "Very Much Like Me" (M = 4.25, SD = .98). The second highest rated item was "I emphasize the use of technology as a learning tool in my classroom or laboratory," which they also indicated was "Very Much Like Me" (M = 4.06, SD = 1.10). The lowest rated item was "I use technology based games or simulations on a regular basis in my classroom or laboratory," which they indicted was "Somewhat Like Me" (M = 2.78, SD = 1.43). The mean for the scale was 3.71 (SD = 1.08), indicating that the teachers perceived the items in the scale overall to be "Very Much Like Me." The scale mean also indicates that technology education teachers had not adopted technology for use in instruction at the highest level, "Just Like Me".

**Table 7.** Types of Technology Available to Technology Teachers for Use in Instruction.

No.	Technology Available for Use in Instruction	No.	%
1	Teacher has school email account	102	97.0
2	Teacher has computer with Internet connection at school <sup>a</sup>	99	94.0
3	Teacher has computer with Internet connection at home <sup>a</sup>	86	82.1
4	Video Cassette, CD, or DVD Recorder <sup>a</sup>	72	68.7
5	Interactive DVDs or CDs <sup>a</sup>	63	59.7
6	Teacher has access to enough computers in a classroom or lab for all students to work by themselves or with one other student	60	56.7
7	Laser disc player or standalone DVD or CD players <sup>a</sup>	55	52.2
8	Digital video camera <sup>a</sup>	49	46.3
9	Students have a school email account	30	28.4

No.	Technology Available for Use in Instruction	No.	%
10	GPS (Global Positioning System) <sup>a</sup>	20	19.4
11	Personal Digital Assistant (e.g., Palm, IPAQ, Blackberry) <sup>a</sup>	5	4.5

Notes:  $N = 105$ . The teachers were asked to place a check mark (×) beside each type of technology that was available for their use in instruction.

<sup>a</sup> The number of technologies available to each teacher ranged from 0 to 9 and was totaled to create an available technology score for use in the regression analysis for research question 5.

### 9.3. Results Question 3: Barriers Using Technologies in Teaching

Participants were asked to indicate which of the 12 instructional technologies they use in the teaching-learning process. Early adopters significantly have used more technologies than Mainstream Faculty group ( $t(151) = 2.841, p < 0.05$  Ms 5.58 vs. 4.38), and it is likely that they have used course web pages (Pearson  $\chi^2(1, 153) = 8.306, p = 0.009$ ), web resources ( $\chi^2(1, 153) = 7.018, p = 0.018$ ) and commercial educational software ( $\chi^2(1, 153) = 22.077, p = 0.000$ ) more than the Mainstream faculty. The proportion of technologies used by the adopter group is presented in Table 1. These findings indicate that relatively new instructional technologies have diffused into the early adopter group more than the mainstream faculty.

The Barriers to Integrating Technology in Instruction Scale was developed by the researchers and used to determine the magnitude of barriers that may prevent technology education

teachers from integrating technology in their instruction. The teachers responded to seven items using the following anchored scale: 1 = Not a Barrier, 2 = Minor Barrier, 3 = Moderate Barrier, and 4 = Major Barrier. The means and standard deviations for the items in the Barriers to Integrating Technology in Instruction Scale, along with the interpretation scale, are presented in Table 5.

Overall, the teachers were experiencing minor barriers as they integrated technology in instruction (Scale  $M = 2.04, SD = .64$ ). They experienced moderate barriers with “Availability of technology for the number of students in my classes” ( $M = 2.64, SD = 1.14$ ), with the “Availability of technical support to effectively use instructional technology in the teaching/learning process” ( $M = 2.59, SD = 1.02$ ), and with having “Enough time to develop lessons that use technology” ( $M = 2.55, SD = 1.13$ ). The statement with the lowest rating was “Administrative support for integration of technology in the teaching/learning process” ( $M = 1.83, SD = 1.01$ ), which indicated they were only experiencing minor barriers.

Table 8. Responses to the Items in the Technology Adoption Scale.

No.	Item	N	M	SD
1	I have made physical changes to accommodate technology in my classroom or laboratory.	105	4.25	0.98
2	I emphasize the use of technology as a learning tool in my classroom or laboratory.	105	4.06	1.10
3	I expect my students to use technology so they can take on new challenges beyond traditional assignments and activities.	105	3.97	1.28
4	I expect my students to fully understand the unique role that technology plays in their education.	105	3.97	1.13
5	I discuss with students how they can use technology as a learning tool.	105	3.88	0.90
6	I expect my students to use technology to enable them to be self-directed learners.	105	3.81	1.22
7	I design learning activities that result in my students being comfortable using technology in their learning.	105	3.81	1.30
8	I expect students to use technology to such an extent that they develop projects that are of a higher quality level than would be possible without them using technology.	105	3.81	1.22
9	I regularly pursue innovative ways to incorporate technology into the learning process for my students.	105	3.70	1.33
10	I incorporate technology in my teaching to such an extent that it has become a standard learning tool for my students.	104	3.68	1.43
11	I am more of a facilitator of learning than the source of all information because my students use technology.	104	3.59	1.36
12	I assign students to use the computer to do content related activities on a regular basis.	105	3.57	1.32
13	I use technology to encourage students to share the responsibility for their own learning.	105	3.43	1.26
14	I incorporate technology in my teaching to such an extent that my students use technology to collaborate with other students in my class during the learning process.	104	3.35	1.43
15	I use technology based games or simulations on a regular basis in my classroom or laboratory.	105	2.78	1.43

Note:  $N = 105$ . Scale interpretation ranges for the scale means: 1 = Not Like Me at All (1.00-1.49), 2 = Very Little Like Me (1.50-2.49), 3 = Somewhat Like Me (2.503.49), 4 = Very Much Like Me (3.50-4.49), and 5 = Just Like Me (4.50-5.00).

Scale  $M = 2.78$  ( $SD = 1.43$ ).

Table 9. Responses to Integrate Technology in Instruction Scale.

No.	Item	N	M	SD
1	Availability of technology for the number of students in my classes.	105	2.64	1.14
2	Availability of technical support to effectively use instructional technology in the teaching/ learning process.	104	2.59	1.02
3	Enough time to develop lessons that use technology.	105	2.55	1.13
4	Scheduling enough time for students to use the Internet, computers, or other technology in the teaching/learning process.	105	2.43	1.05

No.	Item	N	M	SD
5	Availability of effective instructional software for the courses I teach.	105	2.37	0.97
6	My ability to integrate technology in the teaching/learning process.	105	2.09	0.87
7	Administrative support for integration of technology in the teaching/learning process.	103	1.83	1.01

Note:  $N = 105$ . Scale interpretation ranges for the scale means: 1 = Not a Barrier (1.001-1.49), 2 = Minor Barrier (1.50-2.49), 3 = Moderate Barrier (2.50-3.49), 4 = Major Barrier (3.50-4.00). Scale  $M = 2.04$  ( $SD = .64$ ).

#### 9.4. Results Question 4: Teachers Perceived Technology Anxiety

A researcher-developed scale, the Technology Anxiety Scale, was used to determine the anxiety technology teachers feel when they think about using technology in their instruction. The teachers responded to 12 items using the following anchored scale: 1 = No Anxiety, 2 = Some Anxiety, 3 = Moderate Anxiety, and 4 = High Anxiety, and 5 = Very High Anxiety. The means and standard deviations for the items in the Technology Anxiety Scale, along with the interpretation scale, are presented in Table 8.

The technology teachers were experiencing some anxiety as they integrated technology in their instruction. The scale mean (Scale  $M = 1.97$ ,  $SD = .95$ ) and all item means were in the "Some Anxiety" range. They were experiencing their highest anxiety level with the question, "How anxious do you feel when you cannot keep up with important technological advances?" ( $M = 2.15$ ,  $SD = 1.09$ ). They reported their lowest anxiety level when

asked, "How anxious do you feel when you think about using technology in instruction?" ( $M = 1.75$ ,  $SD = 1.06$ ).

#### 9.5. Results Question5: Explanation of Variance in Technology Adoption

Forward multiple regressions were used to determine if selected variables explained a substantial proportion of the variance in the adoption of technology for use in instruction. The Technology Adoption Scale mean was the dependent variable in this analysis. Based on the review of literature, six teacher demographic or personal variables were identified as potential explanatory variables: age, gender, years of teaching experience, perceived barriers to integrating technology in instruction, technology anxiety, training sources used, and technology available for use in instruction. The training sources used by the teachers are presented in Table 5. The training sources score was calculated by assigning one point for each of the four training sources.

Table 10. Technology Education Teachers' Responses to Technology Anxiety Scale.

No.	Item	N	M	SD
1	How anxious do you feel when you cannot keep up with important technological advances?	105	2.15	1.09
2	How anxious do you feel when you are not certain what the options on various technologies will do?	105	2.10	0.99
3	How anxious do you feel when you think about your technology skills compared to the skills of other teachers?	104	2.05	1.27
4	How anxious do you feel when someone uses a technology term that you do not understand?	105	2.04	1.04
5	How anxious do you feel when you hesitate to use technology for fear of making mistakes you cannot correct?	105	2.03	1.06
6	How anxious do you feel when you are faced with using new technology?	104	1.98	1.06
7	How anxious do you feel when you try to understand new technology?	105	1.97	0.98
8	How anxious do you feel when you try to use technology?	105	1.91	1.00
9	How anxious do you feel when you try to learn technology related skills?	105	1.88	0.99
10	How anxious do you feel when you avoid using unfamiliar technology?	105	1.87	0.95
11	How anxious do you feel when you fear you may break or damage the technology you are using?	105	1.76	1.10
12	How anxious do you feel when you think about using technology in instruction?	103	1.75	1.06

Note:  $N = 105$ . Scale interpretation ranges for the scale means: 1 = No Anxiety (1.001-1.49), 2 = Some Anxiety (1.50-2.49), 3 = Moderate Anxiety (2.50-3.49), 4 = High Anxiety (3.50-4.00), 5 = Very High Anxiety (4.50-5.00). Scale  $M = 1.97$  ( $SD = .95$ ).

The technology types included in the technology available for instruction variable are shown in Table 6. The score was computed by assigning one point for each of nine types of technology.

The correlations of the seven demographic and personal variables with the Technology Adoption Scale score are shown in Table 9. Due to the minimum number of observations needed per variable for the regression analysis, it had been determined *a priori* that only those variables that were significantly correlated with the adoption scale score would be utilized in the regression analysis.

The data in Table 9 show that the adoption scale score is moderately correlated with four of the ten variables, namely, barriers to technology integration ( $r = -.32$ ), technology anxiety ( $r = -.42$ ), technology availability ( $r = .43$ ), and the use of colleagues as a training source ( $r = -.31$ ). Therefore, these four variables were utilized in the forward multiple regression analysis. The sample size was adequate for this analysis. According to Hair, Black, Babin, Anderson, and Tatham (2006), a minimum of 5 observations per variable was required, but 15-20 observations for each potential explanatory variable were desirable in a forward regression analysis.

**Table 11.** Correlations of Selected Variables with Teachers' Technology Adoption Scores.

No.				
1	Age	.04 <sup>a</sup>	.793	60
2	Gender	.06 <sup>a</sup>	.619	67
3	Years Teaching Experience	.02 <sup>a</sup>	.859	67
4	Barriers to Technology Integration	-.32 <sup>b</sup>	.011	64
5	Technology Anxiety	-.42 <sup>b</sup>	<.001	65
6	Technology Available	.33 <sup>b</sup>	.006	67
7	Training Sources:			
	Self-taught	-.02 <sup>a</sup>	.853	66
	Workshops/conferences	.19 <sup>a</sup>	.122	66
	College courses	-.04 <sup>a</sup>	.751	66
	Colleagues	-.31 <sup>b</sup>	.012	66

Notes: Variable: *r*, *p*, *N**N* = 105 <sup>a</sup>Negligible association according to Cohen (1988). <sup>b</sup>Moderate association according to Cohen (1988).

Multicollinearity did not exist in the regression analysis (see Table 10). Hair et al. (2006) stated, "The presence of high correlations (generally, .90 and above) is the first indication of substantial collinearity" (p. 227). None of the independent variables had a high correlation with any other independent variable. Hair et al. (2006) also stated, "The two most common measures for assessing both pairwise and multiple variable collinearity are tolerance and its inverse, the variance inflation factor [VIF]. ... Moreover, a multiple correlation of .90 between one independent variable and all others ... would result in a tolerance value of .19. Thus, any variables with tolerance values below .19 (or above a VIF of 5.3) would have a correlation of more than .90" (Hair et al., 2006, pp. 227, 230). None of the tolerance values observed was lower than .19 and none of the VIF values exceeded 5.3. The three variables entered into the forward multiple

regression analysis combined to explain 37% of the variance ( $R^2$ ) in technology adoption in instruction. The variable "technology anxiety" entered the model first and accounted for 17% of the variance, followed by "technology available for instruction" which accounted for an additional 13% of the variance. Colleagues as a training source entered the model last, explaining an additional 7% of the variance. Technology adoption increases as technology available (Standardized  $b = .35$ ) increases, as technology anxiety decreases (Standardized  $b = -.40$ ), and when teachers use colleagues as a training sources (Standardized  $b = -.27$ ). A regression model that explains 37% of the variance represents a large effect size (Cohen, 1988). "Barriers to technology integration" did not explain additional variance in technology adoption. The multiple regression analysis is presented in Table 10.

**Table 12.** Forward Regression Analysis Model Explaining Variance in Technology Adoption in Instruction Scale Mean.

	<i>S</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Regression	27.57	3	9.19	11.43	<.001
Residual	46.66	58	.80		
Total	74.23	61			

Change Statistics								
Explanatory Variables in Model	<i>R</i>	<i>R</i> <sup>2</sup>	Adjusted <i>R</i> <sup>2</sup>	<i>SE</i>	<i>R</i> <sup>2</sup> Change	<i>F</i> Change	<i>P</i> of <i>F</i> Change	
Technology anxiety	.41	.17	.15	1.02	.17	12.01	.001	
Technology anxiety, technology availability	.55	.30	.28	.94	.13	11.13	.001	
Technology anxiety, technology availability, training source: colleagues	.61	.37	.34	.90	.07	6.68	.012	

Excluded variable				
Variable	Beta In	<i>t</i>	<i>p</i>	Partial <i>r</i>
Barriers to technology adoption	.02	.20	.843	.03

Notes: *N* = 105

Dependent variable: technology adoption. Technology Adoption Scale: 1 = Not Like Me at All, 2 = Very Little Like Me, 3 = Somewhat Like Me, 4 = Very Much Like Me, and 5 = Just Like Me.

Technology Anxiety Scale: 1 = No Anxiety, 2 = Some Anxiety, 3 = Moderate Anxiety, 4 = High Anxiety, 5 = Very High Anxiety.

Technology Available variable potentially ranged from 0 to 9 points, but the actual range was 0 to 8 points since none of the respondents had all nine types of technology.

Barriers to Integration Scale: 1 = Not a Barrier, 2 = Minor Barrier, 3 = Moderate Barrier, 4 = Major Barrier.

The combined variables included in the multiple regression model represent a large effect size according to Cohen (1988):  $R^2 > .0196$  - small effect size,  $R^2 > .13$  - moderate effect size, and  $R^2 > .26$  - large effect size.

## 10. Conclusions

Following conclusions may be drawn on the basis of study findings:

1. The survey distributed to 105 faculty members and complete data obtained from 105. Most (103 out of 105) of the teachers were male (103 or 98%) while only 2 were female (2%) holding various academic ranks 5% professors, 7% Associate Professors, 35% Assistant Professor and 53% others, The ages of the business teachers ranged from 24 to 70 years and averaged 48years,. The number of years teaching experience ranged from 2 to 35 years with the average teacher having 21 years.,

2. The highest rated item in this scale was "I have made physical changes to accommodate technology in my classroom or laboratory". The second highest rated item was "I emphasize the use of technology as a learning tool in my classroom or laboratory,". The lowest rated item was "I use technology based games or simulations on a regular basis in my classroom or laboratory."

3. The teachers were experiencing minor barriers as they integrated technology in instruction (Scale  $M = 2.04$ ,  $SD = .64$ ). They experienced moderate barriers with "Availability of technology for the number of students in my classes" ( $M = 2.64$ ,  $SD = 1.14$ ), with the "Availability of technical support to effectively use instructional technology in the teaching/learning process" ( $M = 2.59$ ,  $SD = 1.02$ ), and with having "Enough time to develop lessons that use technology" ( $M = 2.55$ ,  $SD = 1.13$ ). The statement with the lowest rating was "Administrative support for integration of technology in the teaching/learning process" ( $M = 1.83$ ,  $SD = 1.01$ ), which indicated they were only experiencing minor barriers.

4. The technology teachers were experiencing some anxiety as they integrated technology in their instruction. The scale mean (Scale  $M = 1.97$ ,  $SD = .95$ ) and all item means were in the "Some Anxiety" range. They were experiencing their highest anxiety level with the question, "How anxious do you feel when you cannot keep up with important technological advances?" ( $M = 2.15$ ,  $SD = 1.09$ ). They reported their lowest anxiety level when asked, "How anxious do you feel when you think about using technology in instruction?" ( $M = 1.75$ ,  $SD = 1.06$ ).

## Recommendations

The higher education institutions in Palestine today are confronted with instructional technology innovation, which is transforming the way in which teachers and students interact and the roles they take. If the goal of the traditional universities in Palestine is the integration of technology for a transformative change, then rather than the acquisition of technology itself, there must be a clear focus on the teachers who use technology. For large-scale technology integration to occur in teaching, it is essential to understand and address differentiating needs of teachers in faculty development and support systems.

The following suggestions are offered to traditional

universities in Palestine to improve their teachers IT adoption for teaching and diffusion of instructional technology in business education: 1. Develop a long-range technology plan driven by the institutions' overall vision and strategy for its teaching. 2. Establish a promotion system that places a high value on teaching and the use of innovative teaching methods. 3. Design faculty development programs considering the needs of different teachers profiles. 4. Provide training programs not only on the technical aspects of technology, but also about the integration of technology for teaching and learning. 5. Establish an instructional technology center in which teachers can get help from and work together with IT related professionals. 6. Provide systematic technical and professional support.

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