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Lebanese secondary physics teachers' attitudes towards the use of ICT

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Abstract

Information and communication technology (ICT) is increasingly widespread, influencing educational systems worldwide. ICT educational tools can be a transformative tool that may facilitate meaningful learning in physics courses if educators are willing to embrace it with a positive attitude. The attitude of physics teachers has a tremendous effect on ICT integration in physics classrooms. This research paper is aimed to examine the attitudes towards the use of ICTs among Lebanese secondary physics teachers. A sample of 141 secondary physics teachers was assessed for their ICTs' attitude using a Likert type questionnaire. The questionnaire focused on the teachers' affect towards ICT, aware of usefulness and their confidence to use ICT. The results of both descriptive and inferential statistics showed a positive attitude towards ICT and no gender, years of experience or age differences among physics teachers' attitudes. Implications for teacher training and suggestions for further research are provided.

Keywords: Information and communication technology (ICT), ICT implementation, ICT attitude, Lebanese secondary physics teachers.

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1. Introduction

Using information and communication technology (ICT) as a teaching tool is widespread in academic areas. ICT educational tools are recognised as efficient and effective in teaching and learning (Salas-Pilco & law, 2018; Tarman & Dev, 2018) and have become an important part in Lebanese society (Yehya, Barbar & Abou-Rjeili, 2018). Educational technology creates a transformative tool that facilitates future lifelong learning by allowing people to learn anytime, anywhere, anyway and with any content they may need (UNESCO, 2015). Integration of this ICT in the classroom helps to create an environment for students' activities that lead to meaningful and sustainable learning experiences (Arias Ortiz & Cristia, 2014). ICT educational technologies have the potential to support physics education across the curriculum, motivate learners, provide visual education to concertise abstract notions, support for effective communications between learners and develop critical thinking skills and other competencies needed to work in an ICT rich environment (Aina, 2013; Hursen & Asiksoy, 2015; Kamei, 2015; Salas-Pilco & law, 2018; Shan-Fu, 2013; Sharma, 2015; Siddiqa, Schererb & Tondeu, 2016). Moreover, ICT supports students in their own constructive thinking and allows them to transcend their cognitive limitations (Angadi, 2014).

The teacher is key to the success of any initiatives to the effective implementation of the ICT educational technology in the educational system. Teacher effectiveness depends mainly on the teachers' attitude (Angadi, 2014). Attitude, in turn, refers to one's positive or negative judgment about a concrete subject (Kumar, Karabenick & Burgoon, 2015). Teachers' attitudes are not skills but they are as important for promoting learning as they are creating a positive learning environment and increasing learning motivation (Eggen and Kauchak, 2011). Attitudes constitute various dimensions related to usefulness, confidence, anxiety and liking (Teo, 2008). The attitudes of teachers and their willingness to embrace the technology are directly related to the success of learning with computer technology in the classroom (Teo, 2008). Thus, the acceptance and the effective usage of ICT in education involve a positive correlation with teachers' knowledge and attitude towards ICT in teaching and learning.

In Lebanon, since 2000, the Lebanese Ministry of Education and Higher Education (MEHE) has been trying to implement ICT in education. MEHE launched many initiatives to implement ICT in Lebanese classes, supported by many US-based companies (Intel, Cisco…) (Burns, 2012) but unfortunately, their potentials were focused on the hardware with less concern on the teachers' skills and beliefs (Alameh, 2013; Yehya et al., 2018). Moreover, there is a lack of the Lebanese studies that examine Lebanese teachers' attitude from their perspective in general and secondary physics teachers' attitude in particular towards technology in spite of the worldwide reasonable research studies that focus on the role of teachers' attitude towards ICT in the success of the implementation process.

Consequently, in response to this lack, this paper is aimed to investigate physics teachers' attitude towards using technology within teaching, learning process in the Lebanese secondary physics classes. In the light of this aim, the study sought to find answers to the questions presented below:

1. What is the overall profile of physics teachers' attitude towards ICT implementation?
2. Do physics teachers' attitudes towards ICT differ by teachers' gender, age and years of experience?

2. Method

2.1. Research design

The real field study adopted the quantitative descriptive method as an appropriate research method to answer the study questions and examine the Lebanese secondary physics teachers'

attitude towards ICT educational technology tools. Structured survey has been prepared and used as a research instrument to obtain data relevant to the study questions. The survey was reviewed and modified many times by other researchers and pretested among a small subset of target respondents to check if it serves to collect appropriate comparable data and to determine its feasibility and usefulness as a research instrument. The measure of central tendency (mean M) and the measure of dispersion [standard deviation (SD)] of the descriptive statistics were used to interpret data to generate descriptive information that leads to important recommendations. Also, the inferential statistical theory was used to examine statistical significant differences between participating groups.

2.2. Population and sample

The population that was considered in this study was all the English, Lebanese secondary schools that form a population of 443 schools (126 public and 317 private) and their physics teachers who teach the scientific sections without gender discrimination. It must be mentioned that the chosen secondary schools in the sampling process are the English section schools because the difference between the languages in determining teachers' attitude, if there is any difference, is beyond the aim of this investigation. Moreover, the concentration on physics teachers for scientific sections is because learners of scientific sections have dedicated more hours per week and that may encourage teachers' initiatives, if any exist, and give better opportunities to use educational technology in physics classes. The selected representative sample designated by the random sampling process was formed of 141 secondary physics teachers of 94 Lebanese secondary officials and private schools (51 private schools and 43 official schools) from different socioeconomic backgrounds and different Lebanese districts from the population of the Lebanese secondary schools in the academic year 2016/2017 without any gender discrimination.

The chosen sample is representative of the considered population. The level of precision in the existing representative sample of the considered population, using the sample size calculator, indicated that the sample size reflects the target population at 95% confidence level and 9% confidence interval. Moreover, the 94 chosen schools represent 22% of the Lebanese secondary schools that instruct physics in English from different socioeconomic backgrounds and geographical locations.

2.3. Data collection tools

A physics teachers' attitude survey developed by the researcher based on the review of literature for previous research studies was used to measure the teachers' attitudes towards ICT educational technology. The survey included sections on physics teachers' demographic background and 9-statements questionnaire that assessed three facets of ICT attitudes (Table 1) such as:

1. Teachers' affect towards ICT composed of three statements that measure feelings (like, anxiety and aversion) towards ICT;
2. Awareness of ICT usefulness composed of four statements that measure the participant's beliefs about the usefulness of ICT in learning/teaching processes;
3. Confidence in using ICT composed of two statements that measure the supposed comfort level or difficulty of using ICT in physics courses;

The validity of the attitude survey statements was checked and reviewed by Ph.D. Educators and physics instructors and modifications were done based on their instructions and feedback. Also, draft copies of this survey were tested by 10 physics teachers, not included in the sample, to check their clearness and the validity of the survey statements. Teachers' comments were taken into consideration. Moreover, the reliability of the ICT attitude statements was measured by Cronbach's alpha. The measure of the internal consistency between the survey's statements is 0.686.

Participated teachers' responses to the attitude survey statements will be assessed using a five-point Likert of strongly agree (SA) = 5, agree (A) = 4, disagree (D) = 2, strongly disagree (SD) = 1). There is no choice (3 = neither agree or disagree) to produce a forced choice measure and collect actionable data where no uncaring option was available. It is important to indicate that the unanswered statements were indicated later in results' analysis with 3 and considered as neither agree or disagree.

Table 1. Statements of ICT attitude distributed in three facets

Facets	Statements	SA	A	DA	SD
Affect	AF 1- Technology has limited capacity to provide benefits in the classroom				
	AF 2- Technology is a distraction in the classroom				
	AF 3- I like the challenge of exploring technology and new software and its possibilities				
Usefulness	U 1- Technology improves teaching and learning				
	U 2- Technology provides students with efficient presentation and communication tools				
	U 3- Technology provides valuable resources and tools to support student learning				
	U 4- Technology is the future and should be where institutions place their main efforts				
Confidence	C 1- Government does not do enough to promote technology				
	C 2- I would like to use more technology, but lack the necessary training to use it to the best advantage				

2.4. Data collection

The 141 physics teachers responded to the designed attitude test survey after the approval of the MEHE at the academic year 2016–2017.

2.5. Data analysis

Collected data were analysed using the Statistic Package of Social Science (SPSS v19) to obtain research statistic. The descriptive statistics were used in collecting the percentages, means and SDs to explain about the respondents' background and attitude towards the use of ICT. Also, the inferential statistical theory was used [Independent *t*-test, analysis of variance (ANOVA)] to examine if there exists any significant difference between mean attitude score for the participated groups.

3. Findings

The following section revealed separately the results in the context of the two questions of this study to come up finally with a discussion that determines the Lebanese secondary physics teachers' attitudes towards the use of ICT.

3.1. Results of the first question

All the participated Lebanese secondary physics teachers (*N* = 141) responded to the attitude survey statements. The results in the context of the research's first question: 'What is the overall profile of physics teachers' attitude towards ICT implementation?' are assessed in terms of teachers' affects, teachers' belief about ICT usefulness and teachers' confidence and components of the attitude survey.

3.1.1. Teachers' affective

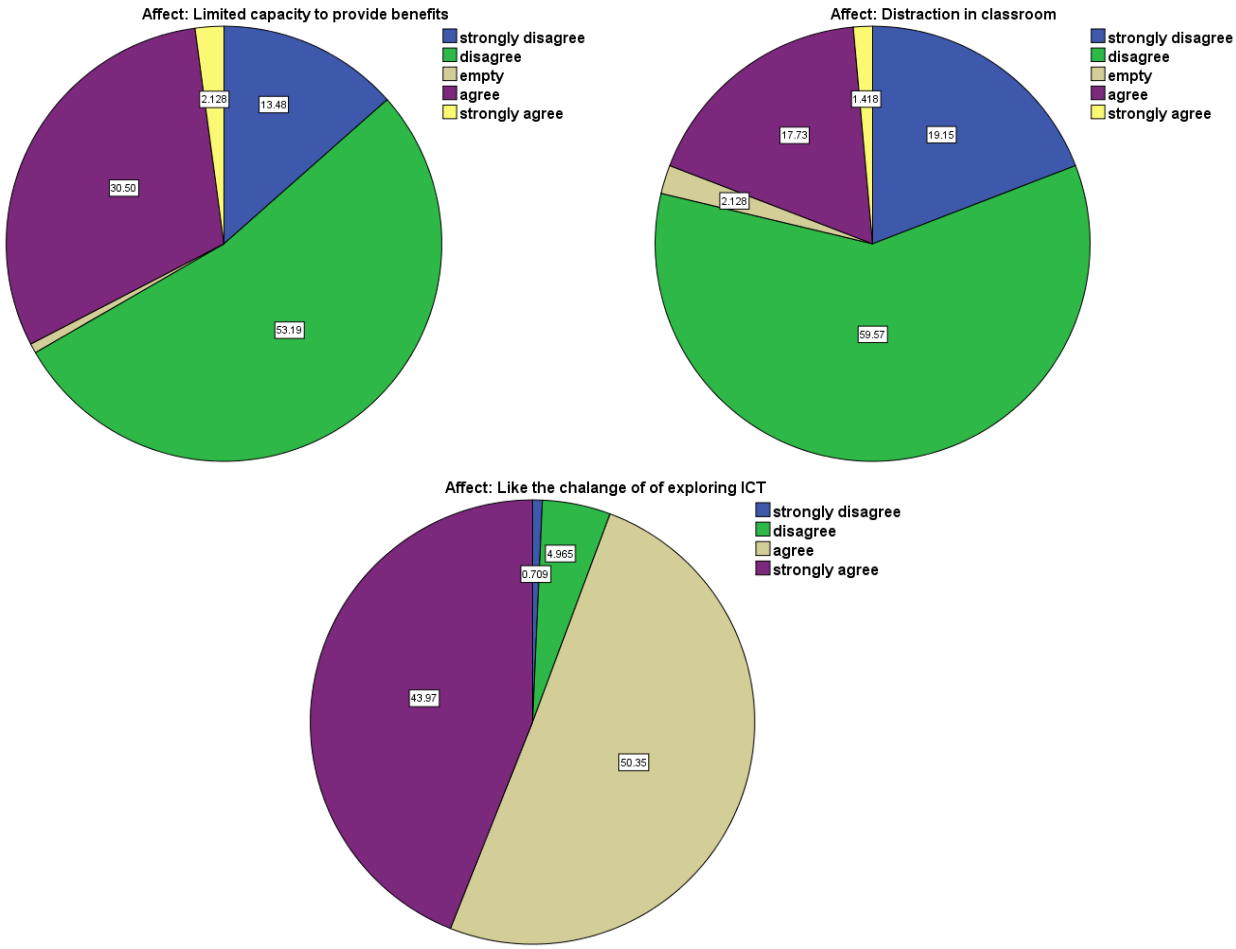

Figure 1. Percentage of physics teachers' affect towards ICT

The pie charts of Figure 1 revealed that 13.4% of the teachers' respondents strongly disagree (SD) and 53.1% of them disagree (D) that technology has limited capacity to provide benefits in the classroom; also, pie charts showed that 17.7% of the participated teachers' SA and 1.41% of them agree that technology is a distraction in the classroom. Furthermore, the results highlighted that 95% of the physics teachers in the sample like the challenge of exploring technology and new

software. Thus, Lebanese secondary physics teachers have a positive affect towards educational ICT.

Also, the participants' mean scores (M) with the SDs of the three statements that measure the participant's affect about the usefulness of ICT in learning/teaching processes are shown below in Table 2.

Table 2. Mean and standard deviation for the affect facet

Report			
	Affect *: Limited capacity to provide benefits (– ive attitude)	**Affect *: Distraction in classroom (– ive attitude)**	**Affect: Like the challenge of exploring ICT (+ ive attitude)**
Mean	2.55	2.23	4.32
Std. Deviation	1.124	1.003	0.778
N	141	141	141

The analyses of the results of the positive statement were based on the following criteria:

1. The statement of mean less than 2 ($M < 2$) is considered as high negative affect (anxiety and aversion) towards ICT in teaching-learning physics.
2. The statement of mean $2 < M < 3$ is considered a negative affect (like) towards ICT in teaching-learning physics.
3. The statement of mean $3 < M < 4$ is considered a positive affect (like) towards ICT in teaching-learning physics.
4. The statement of mean greater than 4 ($M > 4$) is considered as a highly positive affect (like) towards ICT in teaching-learning physics.

In opposition, the analyses of the results of the negative statements (denoted on the table with *) were based on the following criteria:

1. The statement of mean less than 2 ($M < 2$) is considered a high positive affect (like) towards ICT in teaching-learning physics. It is equivalent to a mean $M > 4$ for a positive statement.
2. The statement of mean $2 < M < 3$ is considered a positive affect (like) towards the ICT in teaching-learning physics. It is equivalent to a mean $3 < M < 4$ for positive statement.
3. The statement of mean $3 < M < 4$ is considered a negative affect (anxiety and aversion) towards ICT in teaching-learning physics. It is equivalent to a mean $2 < M < 3$ for positive statement.
4. The statement of mean greater than 4 ($M > 4$) is considered a high negative affect (anxiety and aversion) towards ICT in teaching-learning physics. It is equivalent to a mean $M < 2$ for a positive statement.

The results revealed that the mean of the teachers' respondents for the statement 'I like the challenge of exploring technology and new software and its possibilities' is $M = 4.32$ with SD = 0.77 greater than four ($M > 4$). Results also show that the physics teachers did not agree that technology has limited capacity to provide benefits in the classroom ($M = 2.55$, SD = 1.1) and technology is a distraction in the classroom ($M = 2.23$, SD = 1.0). Thus, Lebanese secondary physics teachers are of positive affect towards ICT in teaching-learning physics.

3.1.2. Teachers' aware of ICT usefulness

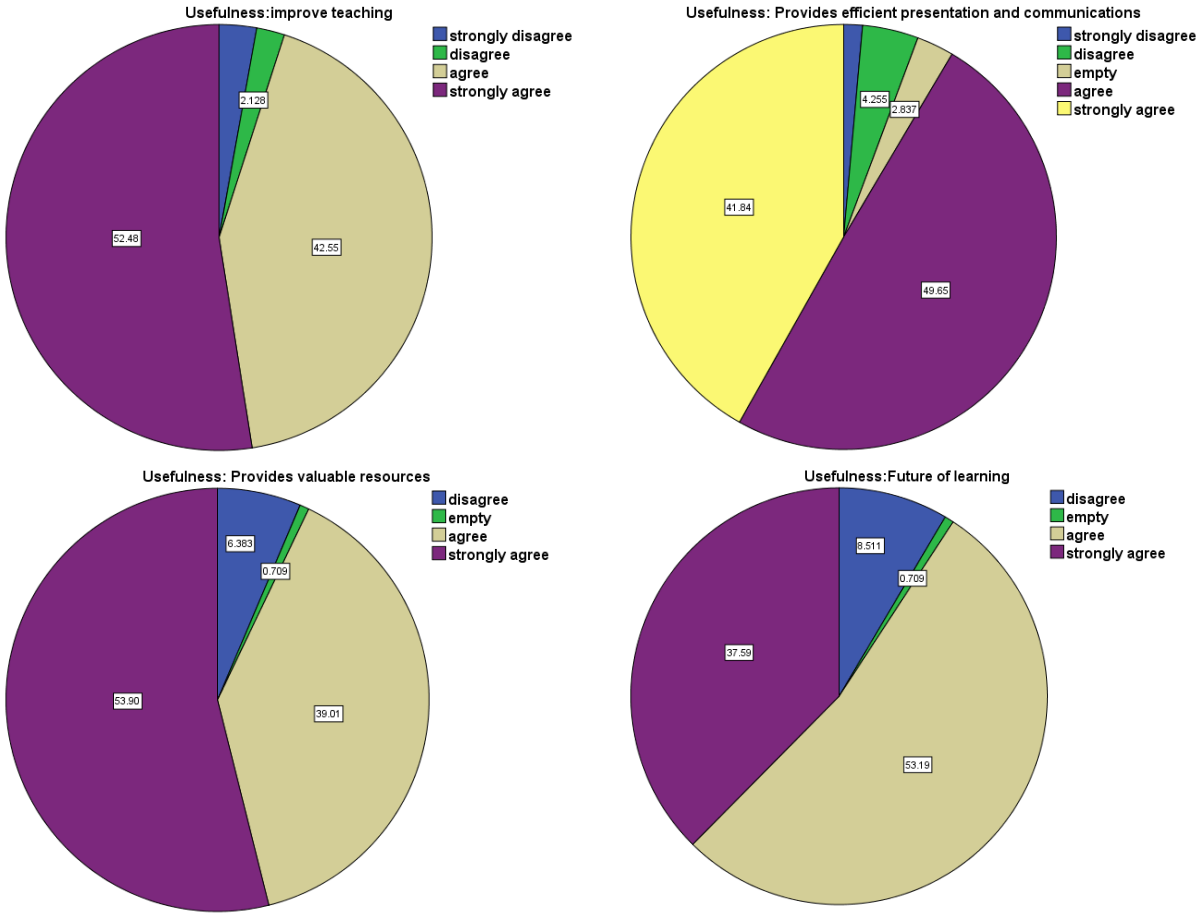

Figure 2. Percentage of physics teachers' aware of ICT usefulness

The pie charts of Figure 2 revealed that 52.4% of the teachers' respondents SA and 42.5% of them agree (A) that technology improves teaching and learning; Also, pie charts showed that more than 90% of the respondents agreed that technology provides students with efficient presentation and communication tools and 41.8% of them strongly agreed with this statement. Moreover, more than 90% of the respondents agree and SA that technology provides valuable resources and tools to support student learning. Furthermore, 37.5% of the teachers' respondents SA and 53.1% of them agree (A) that technology is the future and should be where institutions place their main efforts.

Also, the participants' mean scores (M) with the SDs of the four statements that measure the participant's beliefs about the usefulness of ICT in learning/teaching processes are shown below in Table 3.

Table 3. Mean and SD for the usefulness facet

	Usefulness Facet			
	Improve teaching	**Provides efficient presentation and communications**	**Provides valuable resources**	**Future of learning**
Mean	4.40	4.26	4.40	4.20
SD	0.844	0.825	0.802	0.830
N	141	141	141	141

All the results revealed that the mean of all the teachers' respondents is greater than 4 ($M > 4$). Thus, Lebanese secondary physics teachers are of very high positive awareness towards the usefulness of ICT in teaching and learning physics.

3.1.3. Teachers' confidence

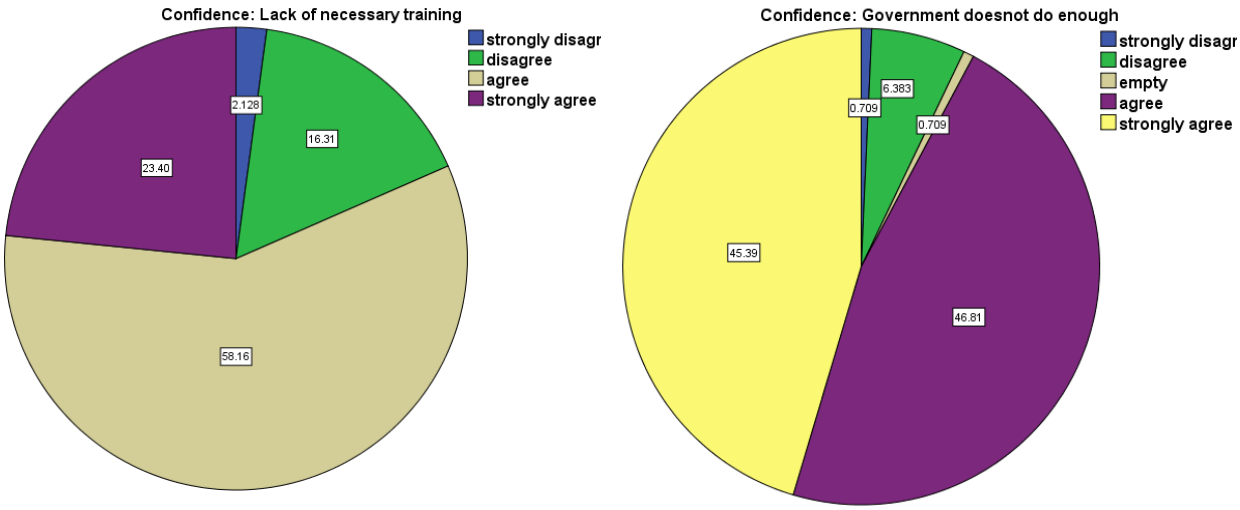

Figure 3. Percentage of physics teachers' confidence to use ICT

Unfortunately, the pie charts of Figure 3 revealed that physics teachers can't implement technology effectively, 81.6% of the teachers agreed with the survey statement that they would like to use more technology, but they lack the necessary training to use it to the best advantage. This lack of effective training reflects some of the lack in teachers' confidence to use technology and the need for skill improvement in spite of their likeness to use technology.

Moreover, 46.8% of the respondents agree and 45.4% of the respondents SA that government does not do enough to promote the technology. Thus, teachers' respondents highlighted the need for the government's potential in promoting technology because governments' dereliction frustrates teachers and reduce confidence in the importance of technology.

Also, the participants' mean scores (M) with the SDs of the statements that measure the participant's confidence in using ICT about the usefulness of ICT in learning/teaching processes are shown below in Table 4.

Table 4. Means and SD for confidence level

	Confidence Facet	
	Government doesn't do enough	**Confidence: Lack of necessary training**
Mean	4.30	3.84
SD	0.834	1.030
N	141	141

The results of the participants' mean scores revealed, using the same criteria used in the previous analysis, that physics teachers despite their enthusiasm to ICT implementation in their courses, they feel less confident with using technology to its best effect. They SA with the need for training to use technology to the best advantage ($M = 3.84$, SD = 1). They need the necessary government's support ($M = 4.3$, SD = 0.8) to promote technology and increase their confidence in using ICT in their classes.

3.1.4. The Overall Profile of Lebanese Secondary Physics Teachers' attitude

To conclude about Lebanese secondary physics teachers' attitude towards ICT educational technology, it is necessary to sum up the participants' attitude mean scores with the SDs of the three attitude facets. It is important to highlight that the mean score of the two negative statements in the affect facet is replaced by their equivalent mean score on the positive scale in order to determine the total mean of the affect facet. Results are shown below (Table 5).

Table 5. Mean and SD for the three attitude facets

Facets	*N*	Mean (M)	SD
Affect	141	3.7	0.79
Usefulness	141	4.31	0.27
Confidence	141	4.07	0.80

The participants scored the lowest on the affect facet (mean = 3.7) followed by the confidence facet (mean = 4.07). The mean scores for the usefulness are the highest (mean = 4.31). The means suggest that participants were more aware of the usefulness of ICT in teaching and learning physics than their affect towards ICT and their confidence to use it appropriately.

At the inclusive level, the overall computer attitude has been high since the attitude mean score in the three facets is greater than 3.5 on a scale of 5 ($M > 3.50$) and this indicated that the Lebanese secondary physics teacher held a positive attitude towards the ICT implementation in their courses.

3.2. Results of the Second question

The second question 'Do physics teachers' attitudes towards ICT differ by age, years of experience and gender of physics teachers?' allowed to find out if there is a difference between male and female teachers' attitude towards ICT and to find out the difference between ages and years of experience on physics teachers' attitude towards ICT.

3.2.1. Attitude difference based on teachers' gender

The mean attitude score M and the SD among the gender of participants for the three attitude facet were presented in the coming section. Additionally, the *t*-independent sample test was conducted to each attitude facet to examine if the differences in mean attitude scores between male and female are significant in validating the research's question.

3.2.1.1. Significance of difference in the mean attitude scores of teachers towards ICT based on teachers' gender at the affect facet level

The mean attitude score M and the SD among the gender of participants for the affect facet were presented in the table below.

Table 6. Mean and SD for the affect for males and females teachers

Statements	Sex	*N*	Mean	Std. Deviation
Affect: Limited capacity to provide benefits	Male	105	2.34	1.082
	Female	36	3.14	1.046
Affect: Distraction in classroom	Male	105	2.23	1.040
	Female	36	2.22	0.898
Affect: Like the challenge of exploring ICT	Male	105	4.37	0.724
	Female	36	4.17	0.910

The *t*-independent samples test was conducted to the affect facet to examine if the differences in mean attitude scores between male and female are significant in validating the research's question.

Table 7. *t*-test to examine the mean difference in mean between males and female in the affect facet

		Independent Samples Test								
		Levene's Test for Equality of Variances		*t*-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Limited capacity to provide benefits	Equal variances assumed	1.710	0.193	−3.842	139	0.000	−0.796	0.207	−10.206	−00.386
	Equal variances not assumed			−3.906	62.526	0.000	−0.796	0.204	−1.203	−0.389
Distraction in classroom	Equal variances assumed	1.164	0.282	0.033	139	0.974	0.006	0.194	−0.378	0.391
	Equal variances not assumed			0.035	69.647	0.972	0.006	0.181	−0.354	0.367
Like the challenge of exploring ICT	Equal variances assumed	0.596	0.441	1.368	139	0.174	0.205	0.150	−0.091	0.501
	Equal variances not assumed			1.224	510.22	0.227	0.205	0.167	−0.131	0.541

Results of Table 6 show that females feel that technology has limited capacity to provide benefits in the classroom (M = 3.14, SD = 1.0), whereas males did not feel (M = 2.3, SD = 1.0) that ICT has limited capacity to provide benefits for the physics classes. The independent t-test (Table 7) showed that there is a significant difference at the 5% level in female attitude towards the capacity of ICT to provide benefits compared to that of the male attitude t (139) = −3.84, $p < 0.05$ in a 95% confidence interval. This difference in feeling towards the capacity of ICT in the classroom may be contributed to teachers' practices with ICT educational technology tool and the quality of training programmes that they attend.

The results of the other two items in the affect facet show that mean attitude score for male and female teachers is the same in feeing technology as distraction tool and in their like for the challenge of exploring ICT. Both male and female did not feel that technology is a distraction in the physics classroom and both like the challenge of exploring technology and software. The independent t-test showed that there is no significant difference between male and female teacher feeling towards ICT as distraction tool t (139) = 0.03, p = 0.06 at 0.05 level of significance, and their like for the challenge of exploring new ICT t (139) = 1.3, p = 0.14 at 0.05 level of significance.

Finally, it is important to mention that in spite of the difference in feeling between male and female in the first item of the affect facet, both male and female have a total mean for this facet greater than 3 (total attitude mean score for males is 3.6 with SD = 0.77 and that for females is 3.17 with SD = 0.85). These results confirm again that both male and female have positive feelings towards ICT in physics classrooms.

3.2.1.2. Significance of difference in the mean attitude scores of teachers towards ICT based on teachers' gender at the usefulness facet level

The mean attitude score M and the SD among the gender of participants for the usefulness facet were presented in the table below.

Table 8. Means and SD for usefulness facet for males and females

	sex	*N*	Mean	SD
Usefulness: improve teaching	Male	105	4.45	0.693
	Female	36	4.25	1.180
Usefulness: provides efficient presentation and communications	Male	105	4.22	0.843
	Female	36	4.39	0.766
Usefulness: provides valuable resources	Male	105	4.40	0.780
	Female	36	4.42	0.874
Usefulness: future of learning	Male	105	4.24	0.779
	Female	36	4.08	0.967

The *t*-independent samples test was conducted to usefulness facet to examine if the differences in mean attitude scores between male and female are significant in validating the research's question

Table 9. *t*-test to examine mean difference in the usefulness facet between males and females teachers

		Independent Samples Test								
		Levene's Test for Equality of Variances		*t*-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
improve teaching	Equal variances assumed	9.749	0.002	1.214	139	0.227	0.198	0.163	−0.124	0.519
	Equal variances not assumed			0.950	43.562	0.347	0.198	0.208	−0.222	0.617
Provides efficient presentation and communications	Equal variances assumed	0.000	0.991	−1.066	139	0.288	−0.170	0.159	−0.485	0.145
	Equal variances not assumed			−1.118	66.252	0.268	−0.170	0.152	−0.473	0.134
Provides valuable resources	Equal variances assumed	0.317	0.574	−0.107	139	0.915	−0.017	0.155	−0.324	0.291
	Equal variances not assumed			−0.101	55.301	0.920	−0.017	0.164	−0.346	0.313
Future of learning	Equal variances assumed	0.555	0.458	0.965	139	0.336	0.155	0.160	−0.162	0.472
	Equal variances not assumed			0.868	51.422	0.389	0.155	0.178	−0.203	0.513

Results of Table 8 show that both females and males physics teachers have the same mean attitude scale that is greater than 4 ($M > 4$). Both males and females believe that ICT provides valuable resources and efficient communication and presentation tools. This highlighted the high awareness of physics teachers towards the role of ICT in improving teaching and learning physics courses. Moreover, the independent *t*-test at 5% significance level showed that there is no significant difference between male and female teacher beliefs about the usefulness of ICT in learning/teaching

processes on a 95% confidence interval (Table 9). Thus, teachers' gender did not affect teachers' awareness towards ICT.

3.2.1.3. Significance of difference in the mean attitude scores of teachers awareness towards ICT based on teachers' gender at the confidence facet level

The mean attitude score M and the SD among the gender of participants for the confidence facet were presented in the table below.

Table 10. Mean and SD for confidence facet between male and female physics teachers

	sex	*N*	Mean	Std. Deviation
Confidence: government doesn't do enough	Male	105	4.33	0.716
	Female	36	4.19	1.117
Confidence: lack of necessary training	Male	105	3.76	1.097
	Female	36	4.08	0.770

The *t*-independent samples test was conducted to usefulness facet to examine if the differences in mean attitude scores between male and female are significant in validating the research's question

Table 11. *t*-test to examine the mean difference in the confidence level between males and females teachers

		Independent Samples Test								
		Levene's Test for Equality of Variances		*t*-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Government doesn't do enough	Equal variances assumed	7.906	0.006	0.861	139	0.391	0.139	0.161	−0.180	0.458
	Equal variances not assumed			0.699	45.264	0.488	0.139	0.199	−0.261	0.539
Lack of necessary training	Equal variances assumed	7.750	0.006	−1.625	139	0.106	−0.321	0.198	−0.713	0.070
	Equal variances not assumed			−1.924	86.519	0.058	−0.321	0.167	−0.654	0.011

Results of Table 10 show that both females' and males' physics teachers have the same mean attitude scale ($M \cong 4.2$) concerning the role of governments and education policymakers to increase the comfort level of using ICT in schools, consequently to increase their confidence in implementing ICT in teaching and learning. Also, results show from teachers' perspective that females' needs for professional development ($M = 4.08$, SD = 1.09) is greater than the males' needs for this development ($M = 3.76$; SD = 0.77). The difference between the mean attitude scale of males and females is 0.32. This result may reflect that physics male teachers are more comfortable to use ICT in physics classrooms than female teachers and this may align with females' affect shown in Section 1 about the limited capacity of ICT to provide benefits in physics classrooms.

Moreover, the independent *t*-test at 5% significance level showed that there is no significant difference between male and female confidence score mean for comfort use of ICT educational tools

without fear and anxiety at 95% confidence interval. Thus, both females' and males' physics teachers have an acceptable level of confidence to use ICT in the classroom in spite of their claim for the training session that develops their skills.

In answering the part of the question that relates gender to teachers' attitude, we can conclude that there is no significant difference between Lebanese secondary male and female teachers' attitudes towards ICT. Thus, the gender of the physics teacher does not affect teachers' attitudes towards ICT educational technology

3.3. Attitude difference based on teachers' years of experience

To examine if the teachers' attitude towards technology varies with the teachers' years of experience, the mean attitude score *M* and the SD based on years of experience were presented in the coming section. Physics teachers are divided into three groups according to their years of experience (less than 10 years; between 10 and 15 years and more than 15 years). Additionally, the one-way ANOVA was conducted to examine the significant variance among the group means in validating the research's question. The results of the attitude mean and ANOVA are presented and analysed in the context of this section.

The mean attitude score M and the SD among the teachers' years of experience were presented in the table below (Table 12).

Table 12. Attitude mean score and standard deviation based on teachers' years of experience

		Report								
		Affect				Usefulness			Confidence:	
Experience		Limited capacity to provide benefits	Distraction in classroom	Like the challenge of exploring ICT	improve teaching	Provides efficient presentation and communications	Provides valuable resources	Future of learning	Government doesn't do enough	Lack of necessary training
less than 10	Mean	3.00	2.19	4.25	4.22	4.42	4.31	3.94	4.17	3.86
	Std. Deviation	1.171	1.091	0.841	1.098	0.649	0.856	0.924	1.108	1.175
	N	36	36	36	36	36	36	36	36	36
between 10 and 15	Mean	2.17	2.15	4.51	4.56	4.32	4.56	4.37	4.44	3.93
	Std. Deviation	0.946	0.963	0.506	0.502	0.567	0.550	0.488	0.743	0.905
	N	41	41	41	41	41	41	41	41	41
more than 15	Mean	2.53	2.30	4.23	4.39	4.14	4.36	4.23	4.28	3.78
	Std. Deviation	1.126	0.987	0.868	0.847	1.021	0.897	0.921	0.701	1.031
	N	64	64	64	64	64	64	64	64	64
Total	Mean	2.55	2.23	4.32	4.40	4.26	4.40	4.20	4.30	3.84
	Std. Deviation	1.124	1.003	0.778	0.844	0.825	0.802	0.830	0.834	1.030
	N	141	141	141	141	141	141	141	141	141

The results of the mean M and the SD for the three attitude facets based on the teachers' years of experience were presented (Table 12).

From one side, results only highlighted that teachers of years' experience less than 10 years feel that ICT have a limited capacity to provide benefits in the classroom. This again may align with a lack of experience and the need for more effective training for effective ICT implementation.

From the second side, results show that the attitude means scores towards ICT of physics teachers despite the years of experience are the same in all the three attitude facets. All physics teachers show an attitude score mean greater than 4 ($M > 4$) for the positive statements of the facet and a score mean less than 2.5 ($M < 2.5$) for the negative statements of the affect facet. In summary, physics teachers of different years of experience have the same positive attitude towards ICT. Thus, the years of experience did not affect their attitude towards ICT in physics courses.

Furthermore, the one-way ANOVA test was conducted to determine whether there are any statistically significant differences between the means of three independent ages' groups on physics teachers' attitude towards ICT.

The output for the SPSS one-way ANOVA test is shown in the table below:

Table 13. ANOVA test among teachers' years of experience

ANOVA						
		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Affect: limited capacity to provide benefits	Between Groups	13.208	2	6.604	5.566	0.005
	Within Groups	163.742	138	1.187		
	Total	176.950	140			
Affect: distraction in classroom	Between Groups	0.617	2	0.309	0.304	0.738
	Within Groups	140.120	138	1.015		
	Total	140.738	140			
Affect: like the challenge of exploring ICT	Between Groups	2.160	2	1.080	1.807	0.168
	Within Groups	82.478	138	0.598		
	Total	84.638	140			
Usefulness: improve teaching	Between Groups	2.205	2	1.102	1.559	0.214
	Within Groups	97.554	138	0.707		
	Total	99.759	140			
Usefulness: provides efficient presentation and communications	Between Groups	1.928	2	0.964	1.425	0.244
	Within Groups	93.362	138	0.677		
	Total	95.291	140			
Usefulness: provides valuable resources	Between Groups	1.487	2	0.743	1.159	0.317
	Within Groups	88.471	138	0.641		
	Total	89.957	140			
Usefulness: future of learning	Between Groups	3.554	2	1.777	2.640	0.075
	Within Groups	92.885	138	0.673		
	Total	96.440	140			
Confidence: government doesn't do enough	Between Groups	1.454	2	0.727	1.045	0.354
	Within Groups	96.035	138	0.696		
	Total	97.489	140			
Confidence: lack of necessary training	Between Groups	0.544	2	0.272	0.254	0.776
	Within Groups	148.024	138	1.073		
	Total	148.567	140			

A one-way between ANOVA test was conducted to compare the effect of teachers' years of experience on ICT teachers' attitude in less than 10 years, between 10 and 15 years and greater than 15 years' conditions.

The results of the first item of the affect facet show that there was a statistically significant difference of teachers' years of experience on teachers' belief about the capacity of ICT in providing benefits in the classroom between the teachers' years of experience groups as determined by one-way ANOVA (F (2,138) = 5.56, p = 0.005). Post hoc comparisons using the Tukey HSD test indicated that the mean score for less than 10 years' experience condition (M = 3.00, SD = 1.17) was significantly different than between 10 and 15 years' experience (M = 2.17, SD = 0.94). However, greater than 15 years' experience condition (M = 2.53, SD = 1.12) did not significantly differ by less than 10 and between 10 and 15 conditions. Taken together, these results suggest that teachers' less experience has an effect on feeling towards the capacity of ICT in the classroom. Specifically, our results suggest that when teachers are of less experience they feel a lack of managing class discipline, subject content and ICT, especially in the absence of professional training as mentioned before. However, it should be noted that teachers' experience of greater than 10 does not appear to significantly affect their feeling towards the capacity of ICT to provide benefits in the classroom.

However, the results of the other remaining items on the attitude test show that there were no statistically significant differences between group means as determined by one-way ANOVA (F (2, 138) is equal to different F ratio with p > 0.05). Thus, there are no significant statistical differences in teachers' years of experience on physics teachers' attitude towards educational technology in physics courses. Thus, in general, physics teachers' attitude doesn't differ according to teachers' years of experience.

Accordingly, to answer the part of the question that relates teachers' years of experience to teachers' attitude towards ICT, we can conclude that the years of experience of the Lebanese secondary physics teacher do not affect teachers' attitudes towards ICT educational technology

3.4. Attitude difference based on teachers' age

To examine if the teachers' attitude towards technology varies with the age, the mean attitude score M and the SD based on physics teachers' ages were presented in the coming section. Physics teachers are divided into three groups according to their ages experience (less than 30 years; between 30 and 40 years and more than 40 years). Additionally, the one-way ANOVA was conducted to examine the significance variance among the group means in validating the research's question. The results of the attitude mean and ANOVA are presented and analysed in the context of this section.

The mean attitude score M and the SD among the teachers' ages were presented in the table below (Table 14)

Table 14. Attitude mean score and SD based on teachers' ages

		Report								
		Affect				Usefulness			Confidence	
Age		Limited capacity to provide benefits	Distraction in classroom	Like the challenge of exploring ICT	improve teaching	Provides efficient presentation and communications	Provides valuable resources	Future of learning	Government doesn't do enough	Lack of necessary training
less than 30	Mean	3.04	2.25	4.21	4.00	4.33	4.17	4.00	4.13	3.96
	N	24	24	24	24	24	24	24	24	24
	SD	1.197	1.113	.977	1.251	0.702	0.963	0.933	1.116	1.233
between 30 and 40	Mean	2.31	2.08	4.41	4.57	4.26	4.59	4.33	4.43	3.87
	N	61	61	61	61	61	61	61	61	61
	SD	1.009	0.936	0.588	0.499	0.772	0.528	0.651	0.805	0.922

more than 40	Mean	2.59	2.38	4.27	4.38	4.23	4.30	4.14	4.23	3.77
	N	56	56	56	56	56	56	56	56	56
	SD	1.156	1.019	0.863	0.885	0.934	0.933	0.943	0.713	1.062
Total	Mean	2.55	2.23	4.32	4.40	4.26	4.40	4.20	4.30	3.84
	N	141	141	141	141	141	141	141	141	141
	SD	1.124	1.003	0.778	0.844	0.825	0.802	0.830	0.834	1.030

The results of the mean M and the SD for the three attitude facets based on the teachers' age were presented (Table 14).

From one side, results again highlighted that teachers of age less than 10 years feel that ICT have a limited capacity to provide benefits in the classroom. This again may align with a lack of experience and the need for more effective training for effective ICT implementation.

From the second side, results show that the attitude means scores towards ICT of physics teachers despite the age are the same in all the three attitude facets. All physics teachers show an attitude score mean greater than 4 ($M > 4$) for the positive statements of the facet and a score mean less than 3 ($M < 3$) for the negative statements of the affect facet. In summary, physics teachers of different ages have the same positive attitude towards ICT. Thus, the teachers' age did not affect their attitude towards ICT in physics courses.

Furthermore, one-way **ANOVA** was conducted (Table 15) to explore whether there are any statistically significant differences between the means of three independent ages' groups on physics teachers' attitude towards ICT.

Table 15. ANOVA test among teachers' ages

		ANOVA				
		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Affect: limited capacity to provide benefits	Between Groups	9.356	2	4.678	3.852	0.024
	Within Groups	167.594	138	1.214		
	Total	176.950	140			
Affect: distraction in classroom	Between Groups	2.522	2	1.261	1.259	0.287
	Within Groups	138.215	138	1.002		
	Total	140.738	140			
Affect: like the challenge of exploring ICT	Between Groups	0.944	2	0.472	0.778	0.461
	Within Groups	83.695	138	0.606		
	Total	84.638	140			
Usefulness :improve teaching	Between Groups	5.716	2	2.858	4.194	0.017
	Within Groups	94.043	138	0.681		
	Total	99.759	140			
Usefulness: provides efficient presentation and communication-s	Between Groups	0.172	2	0.086	0.125	0.883
	Within Groups	95.119	138	0.689		
	Total	95.291	140			
Usefulness: provides valuable resources	Between Groups	4.031	2	2.015	3.237	0.042
	Within Groups	85.927	138	0.623		
	Total	89.957	140			
Usefulness: future of learning	Between Groups	2.140	2	1.070	1.566	0.213
	Within Groups	94.300	138	0.683		
	Total	96.440	140			
Confidence: government doesn't do enough	Between Groups	1.964	2	0.982	1.419	0.246
	Within Groups	95.525	138	0.692		
	Total	97.489	140			
Confidence: lack of	Between Groups	0.676	2	0.338	0.315	0.730

necessary training	Within Groups	147.891	138	1.072
	Total	148.567	140	

A one-way between ANOVA test was conducted to compare the effect of ages on ICT teachers' attitude in less than 30 years, between 30 and 40 and greater than 40 conditions.

The results of the first item of the affect facet show that there was a statistically significant difference of age on teachers' belief about the capacity of ICT in providing benefits in the classroom between age groups as determined by one-way ANOVA (F (2,138) = 3.85, p = 0.024). Post hoc comparisons using the Tukey HSD test indicated that the mean score for less than 30 years' condition (M = 3.04, SD = 1.19) was significantly different than between 30 and 40 (M = 2.31, SD = 1.00). However, greater than 40 condition (M = 2.59, SD = 1.15) did not significantly differ from less than 30 and between 30 and 40 conditions. Taken together, these results suggest that young teachers' age really do have an effect on feeling towards the capacity of ICT in the classroom. Specifically, our results suggest that when teachers are young they feel a lack of managing class discipline, subject content and ICT, especially in the absence of professional training as mentioned before. However, it should be noted that teachers' ages greater than 30 do not appear to significantly affect their feeling towards the capacity of ICT to provide benefits in the classroom.

However, the results of the other remaining items on the attitude test show that there were no statistically significant differences between group means as determined by one-way ANOVA (F (2, 138) is equal to different F ratio with $p > 0.05$). Thus, there are no significant statistical differences of ages on physics teachers' attitude towards educational technology in physics courses. Thus, physics teachers' attitude doesn't differ according to teachers' age.

4. Discussion

Overall, the Lebanese secondary physics teachers showed positive attitudes towards the ICT educational technology as shown by the mean score for each attitude facet being greater than 3.5 (on a five-point scale). This overall positive attitude towards ICT could be attributed to the availability and accessibility to the Internet and computers in the Lebanese society in general and Lebanese secondary physics teachers' community and to physics teachers' intentions to apply ICT in their courses. Unfortunately, results' analyses highlight that despite teachers' enthusiasm to ICT implementation in their courses, more than 80% of physics teachers feel less confident with using technology to its best effect in their physics courses. This is because of the lack of effective training that may increase their confidence for the best use of ICT.

This study found no significant difference in ICT attitudes due to physics teachers' gender. Both male and female secondary physics teachers were of the same positive attitude towards ICT implementation in their courses. This finding, from one side, does not support past research which *suggested significant differences in ICT attitudes by gender (Angadi, 2014; Awofala, Akinoso & Fatade, 2017; Markauskaite, 2006). For example, Awofala et al. (2017) found that there was a significant influence of gender on preservice mathematics teachers' attitudes toward computer and computer anxiety and not on computer self-efficacy and concluded that gender differences in attitudes towards computer and computer anxiety were significant. Another study by Broos (2005) found that males have less computer anxiety than females that leads females to hold more negative attitudes to computers than males.

The findings of this study, from the second side, supports past research that showed no gender differences among teachers' attitudes towards computers and ICT (Teo, Milutinovic & Zhou, 2016). The absence of ICT attitude differences between genders in this study is consistent with research that revealed changing females' attitudes towards ICT to be more comfortable with computers. Females may have been socialised differently in today's computer generation and the use of ICT for teaching and learning in schools was rapidly increased (Teo, 2008).

Moreover, the findings in this study showed, in general, that teachers' attitude towards ICT did not differ due to the teachers' age and teachers' years of experience. Results revealed that older physics teachers are not struggling with ICT educational technology. This finding supports past research that showed no significant relationship for age and ICT attitudes (Teo, 2008) and past research that showed no significant difference between educators' years of experience and attitude towards ICT (Angadi, 2014). However, the results highlighted the differences in the belief towards the benefits of ICT in physics classrooms between young teachers (less than 30 years) and old teachers (> 30 years) from one side and between less experienced teacher (less than 10 years) and more experienced (> 10 years) from the second side. Teachers with low experience believe that technology has a limited capacity to support student learning. This result may have contributed to teachers' experience in the subject itself and their need for professional development to manage the use of ICT in the classroom. According to Kandasamy and Shah (2013), teachers with experience are able to decide when and where to integrate ICT in the teaching and learning process; hence, they have more ICT confidence than those without experience. Developing teachers' experiences with the subject and developing a variety of computer-related skills and techniques increase teacher's knowledge of the computer as a whole and promote a positive feeling towards the potentials of ICT to provide benefits in the classroom. A continued successful period of computer use may serve as a facilitator for further usage of the ICT (Lim & Khine, 2006).

5. Conclusion

Teachers are significant drivers whose roles are crucial in technology integration in the classrooms (Awofala et al., 2017). Thus, it is essential for teachers to possess positive attitudes towards computer since attitude is coupled with usage and intention to use technology in schools (Huang & Liaw, 2005; Kandasamy & Shah, 2013). Attitude towards technology, whether positive and negative, affect how teachers react to technology in instructional settings and a learning environment. This, in turn, influences the way students respond to technology in the classrooms (Teo, 2006) and current and future technology usage (Teo, 2008).

The study approved that Lebanese secondary physics teachers have overall a positive attitude towards ICT implementation in physics courses. This study provides a preview of selected variables that affect the computer attitudes of secondary physics teachers in Lebanese secondary schools. Teachers' gender, age and years of experience have no significant difference in their attitudes towards ICT. The study highlighted the lack of effective training for ICT implementation as an important barrier that affects this positive attitude and makes rise for some fear, anxiety and lack of confidence towards the use of more technology in the classroom, especially with young teachers of minimum experience. The findings of the study have implications for educators and policymakers. This will enable the policymakers to make improvement in the current education system, as well as look into teachers' needs in the information age

Thus, the ministry of educations, policymakers, schools, teachers and community should cooperate, each in his field to provide a conducive and non-threatening environment for teachers to experience success in implementing ICT in education. Policymakers and the ministry of education are responsible for developing ICT infrastructure, ICT resources and train teachers to gain competence and confidence in using ICT for teaching and learning and convert positive perception into practice for positive attitude conservation.

5.1. Limitation of the study

There are several limitations in this study. Firstly, the data collection process was very exhausting and challenging. A delay in answering back the survey questions and sometimes the ignoring for the survey at all were the main constraints of this study. This act, despite it was limited, wasted effort and time and reflected the lack of some teachers' awareness and appreciation for the importance of

research in education. Secondly, this study is limited to the survey; thus, future study done should include interviews or observation to further enhance the findings. Thirdly, the data were collected from a limited sample through self-reports and this may inflate the true associations between variables. Future research may include a comparison of the results of this study against a larger sample using a longitudinal design to examine ICT attitudes over time. Also, future studies should be done in terms of students' perception of teachers towards knowledge, attitude and use of ICT. Fourthly, teachers' attitude in this study was examined based on teachers' affective towards ICT, aware of ICT usefulness and confidence to use ICT. Future research may study teachers' attitude using other tools with other significant variables such as subjective norms, facilitating conditions and technological complexity as suggested by Teo (2008) and merge the results with the results of this paper.

Finally, this study focused on physics teachers' attitude towards ICT and limited with the specific aspect that affects only the attitude of secondary physics teachers. Future studies could include an efficient examination of different aspects and how these aspects can interact to determine teachers' attitudes, acceptance and usage of ICT tools for instructional purposes and professional development at different academic levels and with other subjects as languages, humanities and other sciences.

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