Received: 01.06.2019
Received in revised form: 20.03.2020
Accepted: 28.03.2020

Mavi, D. (2020). Analysis of the attitudes and the readiness of maker teachers towards e-learning, with use of several variables. *International Online Journal of Education and Teaching (IOJET)*, 7(2), 684-710

ANALYSIS OF THE ATTITUDES AND THE READINESS OF MAKER TEACHERS TOWARDS E-LEARNING, WITH USE OF SEVERAL VARIABLES

Research Article

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Abstract

The purpose of this study is to determine maker teachers' attitudes towards e-learning, as well as their levels of readiness to implement it. Their attitudes and level of readiness will be evaluated by the use of several demographic variables. 104 maker teachers of different ages, who had different professional experiences; has participated in the study. "*The Personal Information Form*" made up of 11 questions; a 5 point likert scale survey made up of 20 questions titled "*Scale Survey about General Attitudes Towards E-Learning*"; and a 7 point likert scale survey made up of 33 questions, titled "*Scale Survey about Level of Readiness for E-Learning*"; were used as data gathering instruments. Descriptive (*f*, %, M) and procedural analyses (t-test, ANOVA) were made, with the help of the SSPS program. The results of these analyses demonstrate that in general, maker teachers have a positive attitude towards e-learning, and that they have a high level of readiness for e-learning.

Keywords: Maker teacher, e-learning, attitude, readiness

1. Introduction

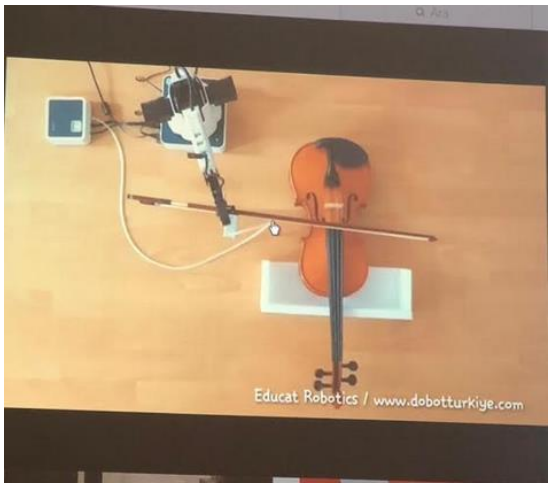
The constant development of science and technology, which become more and more integrated with our everyday lives, causes a rise in the need to train qualified individuals, who are able to benefit from these developments efficiently. Wagner (2017) argues that current and future generations need to have skills and abilities such as critical thinking, problem solving, entrepreneurship, taking initiative, utilizing verbal-written communication skills efficiently, information analysis and evaluation, curiosity, imagination; and many more, to be able to track scientific and technologic developments, and use them to their advantage. These skills can only develop through the use of efficient education procedures, and content. Scientists, educators, program developers, and many others who work on these procedures; highlight the importance of science, technology, mathematics, and engineering; and emphasize the current and future need for a teaching procedure integrating these concepts with one another. In this context, the aim to implement the aforementioned basic skills in future generations, once again revealed the importance of education reforms. The Science, technology, engineering, and mathematics (FeTeMM for short in Turkish, STEM in English) approach, has been suggested to be a core development in pioneering education reform movements (Aytekin, 2018).

One of these education reform movements is the maker movement, which emerged as a result of the integration of the do-it-yourself approach, with technology (Akıncı ve Tüzün, 2016). Making robots, designing objects and constructing them, making 3-D designs, making products

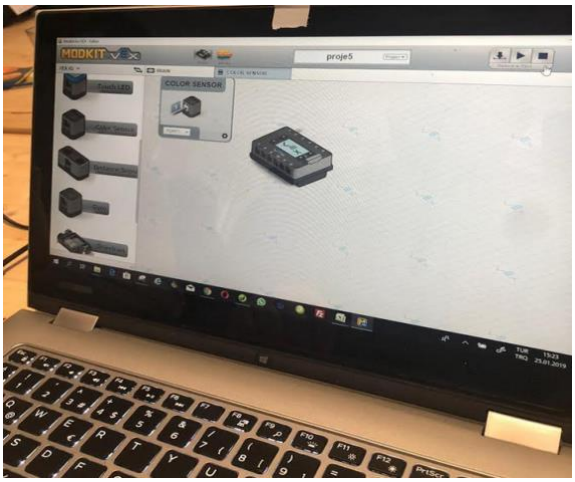
with the use of 3-D printers, making tools with electric circuits, and modeling airplanes; reflect the spirit of maker education, which is based on production. The maker spirit involves

- Sharing over competition
- Ability over money and
- Experience over intense memorization (Makers Türkiye, 2015).

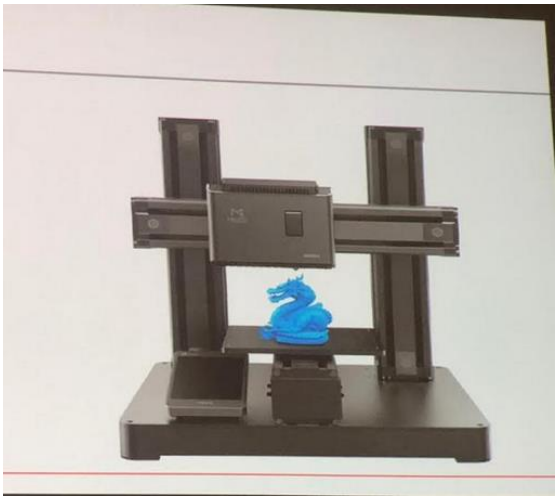
The maker movement is made up of curious people (e.g. repairmen, engineers, teachers, artists, etc.) interested in making creative designs, and producing helpful products while also having fun. The maker movement concerns getting the youth interested in fields such as science, technology, mathematics, engineering and art; while also developing their creativity, through the do-it-yourself approach (Davee, Regalla ve Chang, 2015). The maker movement is concerned with many different actions; such as learning, designing, supporting, participating, playing, using tools, doing, giving, sharing; and many more (Hatch, 2013).



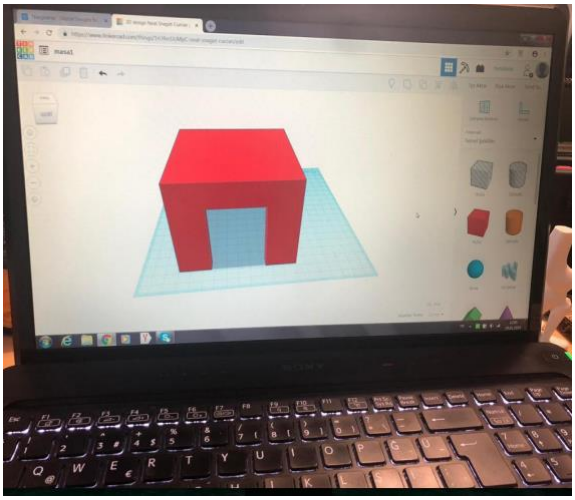
Teaching robot



Designing with a program (Modkit)



3-D printer



3-D object design

As this movement is concerned with production more than consumption; it encompasses nearly every aspect of production (robotics, woodwork, mechanical operations, textile - design,

cooking etc.), it will be one of the in-demand professions of the future. Above are some examples which could be done through the do-it-yourself method.

This movement causes individuals to ask questions such as "how was this made", "how is this used" "in which new ways can it be used", and "how can it be repaired"; and thus results in the improvement of their curiosity, and their knowledge about technology. Individuals who have the maker spirit have many skills and abilities such as problem solving, critical thinking, questioning, noticing, sharing, and collaborating (Dixon ve Martin, 2014; Kalil, 2013). Teachers play a vital role in the education of students who will make their own designs, and who will possess the skills listed above. Teachers will implement the maker programs designed for children, and therefore they should be the first ones to be trained as makers, and who should be given the maker spirit. When designing with the maker spirit, teachers can design products of a great variety, and they can use e-learning environments while doing so.

E-learning, which is a segment of distance-learning; is a method through which people receive (or upload) the designated content online, electronically, regardless of time and place, through the use of the internet (Zhang ve Nunamaker, 2003). E-learning is the computer network technology used to provide learners with educational experiential information, with the purpose of teaching (Welsh, Wanberg, Brown and Simmering, 2003); and in this way, it constitutes a learning environment where instant delivery and correction is possible (Sanderson, 2002) through the use of the internet and other digital technologies (Hortor, 2001). E-learning provides interactive and rich learning environments where teaching strategies, methods, and techniques are used, in integration with technology, in a way that is appropriate to the subject matter, generally with the use of the internet and computers. E-learning encompasses many computer-based and web-based learning applications, and can be both synchronous, and asynchronous (Gülbahar, 2002).

Even though e-learning has certain disadvantages such as removing the physical interactions between students and between teachers and students, and the fact that content creation and updating is a costly and time-consuming process (Aytaç, 2003); it has many advantages regarding the learning environment, for both learners and education planners. E-learning provides the opportunity to learn everywhere, without any limitation to location (Aytaç, 2003); the speed, the place and the time of education is designated by the learners (Yücel, 2006); the content is available for multiple use of the learners; the use of things such as discussion groups and e-mail/chat segments ensures a multi-faceted way of communication and access (Dikbaş, 2006). Therefore, students in e-learning processes, are able to acquire many different skills in this rich learning environment, with the technologic devices, applications, methods, and techniques that are available to them (Khan, 2001). The learners need to have access to e-learning environments and their facilities so that they can benefit from them in the best way, and the effective use of teachers who utilize these environments in their education and training processes. The readiness of teachers in using these environments, and their general attitudes towards the concept; are thought to be deciding factors in whether the teachers utilize these environments, or avoid doing so.

When we look at the literature in the field, we see that studies, conducted mostly with students, are numerous and varied. In their study which they conducted with information communication experts and educators, Bhuasiri and friends (*Bhuasiri ve arkadaşları*) (2012) discovered that learner characteristics along with the quality of the groundwork and the system; are the most important factors in defining the success of an e-learning system. Many others have conducted relevant research; Şentürk (2016) on the attitudes of teachers towards e-learning; Sun, Tsai, Finger, Chen and Yeh (2008) on student evaluations and their defining factors; Mahdizadeh,

Biemans and Mulder on the reasons as to why educators use e-learning; Yoo, Han and Huang (2012), on the effect that internal and external motivators have on e-learning; Çobanoğlu, Ateş, İliç and Yılmaz (2009) on BÖTE preservice teachers' opinions about e-learning; Haznedar (2012) on the attitudes of college students towards e-learning; and Çetin (2018) on the attitudes of high school students towards e-learning.

As is evident from the studies reported here; there have been a very limited number of studies conducted with teachers. Teachers tasked with certain duties need to receive maker education to improve. It has been observed that teachers who do not receive this education, have trouble adjusting to changes and innovations that cross their path, in their career. This study has been conducted to determine the level of readiness of the teachers who receive this education, to implement the maker approach; as well as their general attitudes about it. No other study chronicling the readiness of maker teachers to implement the maker approach, and their attitudes about maker education; has been found. Therefore, this study, demonstrating the readiness of maker teachers, who possess the do-it-yourself spirit, to implement the maker approach, and their attitudes about maker education in general; will be a roof for future studies which scientists will conduct in this important field of our time, and will create a perspective emphasizing the importance of teachers in e-learning applications, as well as the maker movement.

1.2. Purpose of study

The purpose of this study is to demonstrate the general attitudes of maker teachers towards e-learning, their level of readiness to implement it, and the factors which have an effect on this level. To that affect, the questions below have been researched.

1. What are the general attitudes of maker teachers towards e-learning?
2. At what level is maker teachers' readiness to implement e-learning?
3. How do the general attitudes and readiness of maker teachers towards distance learning change according to certain demographic variables (sex, age, professional experience etc.)?

2. Method

This study, chronicling the general attitudes of maker teachers towards e-learning, and their readiness to implement it; has been done in the descriptive survey model, which is a form of quantitative research. The descriptive survey model is helpful in collecting data from a large number of subjects, fast. This research model, seeking to describe certain qualities and conditions of groups and individuals (Kaptan, 1998) helps to present a past or current condition, as it is (Karasar, 2005).

2.1. Sampling

A total of 104 maker teachers has participated in the study. Demographic information regarding these teachers has been given in Table 1.

Table 1. Demographic characteristics of the participants (n=104)

Characteristic	*f*	%
Sex		
Male	52	50
Female	52	50
Age		
20 – 25	10	9.6
26 – 30	55	52.9
31 – 35	16	15.4
36 and older	23	22.1
Professional experience		
0 – 5 years	60	57.7
6 – 10 years	25	24
11 and more	19	18.3

52 male, and 52 female maker teachers participated in the study. In terms of age; we can see that 10 teachers were between the ages of 20-25, that 55 teachers were between the ages of 26-30, 16 teachers were between the ages of 31-35, and that 23 teachers were 36 years old, or older. In terms of professional experience, we can see that 60 teachers had 0-5 years of experience, that 25 had 6-10 years of experience, and that 9 had professional experience amounting to, or more than 11 years.

2.2. Data Collection Tools

3 data collection tools have been used in the study. These tools were; the personal information form, The Scale Survey about General Attitudes Towards E-Learning, and The Scale Survey about Level of Readiness for E-Learning

2.2.1. Personal Information Form

The personal information form has been put together by the researcher, and is made up of a total of 11 questions, which seek to reveal personal information of the participants, as well as their experiences with the maker movement.

2.2.2. Scale Survey about General Attitudes Towards E-Learning

The Scale Survey about General Attitudes Towards E-Learning, which has been created by Haznedar and Baran (2012), is made up of a total of 20 points in the 5-point Likert scale (1-Completely agree, 5 - Completely disagree). This scale survey has been implemented to reveal the general attitudes of participants towards e-learning. It has two sub-dimensions; prone to e-learning (10 points) and avoiding e-learning (10 points). The first sub-dimension has a Cronbach's alpha reliability coefficient of .93, while the second has a reliability coefficient of .84 Points in the sub-dimensions are demonstrated in Table 1.

Table 2. General attitudes about e-learning scale survey sub-dimensions and their points

Sub-Dimension	Number of Points	Points (point number)
Prone to e-learning	10	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Avoiding e-learning	10	11, 12, 13, 14, 15, 16, 17, 18, 19, 20

2.2.3. Scale Survey about Level of Readiness for E-Learning

The Scale Survey about Level of Readiness for E-Learning, developed by Demir (2015), is made up of a total of 33 points in the 7-point Likert Scale (1 - Doesn't suit me at all, 7 - Completely suits me). This survey has been put together to reveal the participants' readiness for e-learning; and is made up of a total of 6 sub-dimensions; namely, computer self-efficacy (5 points), internet self-efficacy (4 points), online communication self-efficacy (5 points), self-confidence (8 points), learner control (4 points) motivation for e-learning (6 points) The Cronbach's alpha reliability coefficients of these sub-dimensions vary between .84 and .95. Table 2 demonstrates the points in each sub-scale.

Table 3. Sub-dimensions of the scale survey about level of readiness for e-learning, and the points they contain

Sub-Dimensions	Number of Points	Points (point number)
Computer self-efficacy	5	1, 2, 3, 4, 5
Internet self-efficacy	4	6, 7, 8, 9
Online communication self-efficacy	5	10, 11, 12, 13, 14
Self confidence	8	15, 16, 17, 18, 19, 20, 21, 22
Learner control	4	23, 24, 25, 26
Motivation for e-learning	7	27, 28, 29, 30, 31, 32, 33

2.3. Data Collection Process

The data was collected in the spring term of the 2018-2019 academic year. Maker teachers were contacted through the internet and the data about the teachers was collected through the use of an internet survey.

2.4. Data Analysis

The data collected through the internet, was transferred into the SPSS data set. Afterwards, data cleaning took place, and analyses were done regarding the extreme points, and missing data. Later, coefficients of kurtosis and skewness were calculated to see if the variables passed the normality hypothesis test. There are not any extreme points in the set of data, and the kurtosis and skewness coefficients vary between [-2, +2]. Descriptive statistics (*f*, %, M) and procedural statistics (t-test, ANOVA) techniques were used in the analysis of the data.

3. Findings

The findings of the study have been evaluated under three headings.

3.1. The experiences of maker teachers, about the maker movement

When we look at the daily time maker teachers spend on the computer; we see that 7 teachers spend less than 30 minutes, that 17 teachers spend 30 minutes - 1 hour, that 26 teachers spend 1-2 hours, that 34 teachers spend 2-4 hours and that 20 teachers spend more than 4 hours. 86 teachers out of all the participants (%82.7) think that e-learning is beneficial 17 (%16.3) of them think that it is partially adequate, and 1 of them thinks that e-learning is inadequate. When we asked the teachers how many programming languages they were familiar with; 13 (%12.5) said that they did not know any, 9 (%8.7) said that they only knew one, 13 (%12.5) said that they knew two, 15 (%14.4) said that they knew three, 13 (%12.5) said that they knew four, 6 (%5.8) said that they knew five, 2 said they knew 6, and 1 said that they knew 7. 32 teachers did not give any answers indicating whether or not they knew programming languages. When we look at how long the teachers have spent involved in the maker movement we see; that 48 (%47.1) of them only recently joined this education movement, and have been involved for less than a year, that 22 (%21.2) of them have been involved for 1-2 years, that 23 (%22.1) of them have been involved for 2-4 years, and that 10 (%9.6) of them have been in this movement for over 4 years. 69 (%66.3) teachers received maker education, while 34 (%32.7) did not. 1 has not indicated whether or not they have received maker education.

3.2. Attitudes of maker teachers towards e-learning

When we evaluate the answers that the maker teachers have given regarding points about their attitudes towards e-learning, we can see that the attitudes vary between $\bar{X}$ = 4.55 and $\bar{X}$ = 1.64. The answers given by the teachers to the points about attitude, and their averages, have been given in Table 3. The point in which the teachers gave answers with the highest average in general, was "*E-learning makes learning easier"* while the one with the lowest average was *"I feel as though I will have more problems when I take classes by e-learning"*. The 10 points in the first dimension are positive, while the 10 points in the second dimension are negative. When we look at the frequency distribution of the answers given to each point; we can see that most teachers answered, “completely agree", and "agree" for the first 10 points, while most of them answered "disagree" and "completely disagree for the last 10 points. When we consider the fact that the last 10 points are negative, the participants' negative answers to these points indicate

that they have a positive outlook. Therefore, it can be said that the teachers have a generally positive attitude towards e-learning.

Table 4. Attitudes of maker teachers towards e-learning

Points		1		2		3		4		5	
	$\bar{X}$	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
Dimension I – Proneness to e-learning											
E-learning makes learning easier.	4,55	-	-	-	-	5	4.8	37	35.6	62	59.6
I am interested in e-learning.	4,28	-	-	-	-	10	9.6	55	52.9	39	37.5
I would like to learn something in an e*learning environment.	4,42	-	-	3	2.9	8	7.7	35	33.7	58	55.8
E-learning increases productivity in learning.	4,38	1	1	1	1	13	12.5	32	30.8	57	54.8
E-learning increases motivation.	4,42	-	-	1	1	11	10.6	35	33.7	57	54.8
E-learning is fun.	4,21	1	1	2	1.9	16	15.4	40	38.5	45	43.3
E-learning increases success.	4,25	-	-	1	1	10	9.6	55	52.9	38	36.5
E-learning should be more common.	4,50	-	-	1	1	8	7.7	33	31.7	62	59.6
I like working at my own pace through e-learning.	4,24	-	-	1	1	9	8.7	58	55.8	36	34.6
I track the developments in the field of e-learning.	4,05	-	-	1	1	18	17.3	60	57.7	25	24
Dimension II – Avoiding e-learning											
I feel as though I will have more problems when I take classes by e-learning.	3,21	9	8.7	25	24	15	14.4	45	43.3	10	9.6
E-learning doesn't fit into the way I study.	1,95	50	48.1	30	28.8	9	8.7	9	8.7	9	8.7
I do not think I will receive adequate support from teachers in e-learning.	2,54	15	14.4	43	41.3	26	25	15	14.4	5	4.8
The thought of learning via e-learning makes me feel bad.	1,80	55	52.9	27	26	12	11.5	8	7.7	2	1.9
Healthy and fair evaluations are not possible with e-learning.	1,98	51	49	24	23.1	13	12.5	12	11.5	4	38
The lack of face-to-face interaction in e-learning bothers me.	2,70	14	13.5	29	27.8	40	38.5	16	15.4	5	4.8
I do not like to learn in an e-learning environment.	2,35	30	28.8	40	38.5	12	11.5	12	11.5	10	9.6
I do not think e-learning will be beneficial.	2,06	52	50	21	20.2	11	10.6	13	12.5	7	6.7
E-learning is unnecessary.	1,64	65	62.5	23	22.1	6	5.8	8	7.7	2	1.9
E-learning hinders socialization.	2,13	47	45.2	21	20.2	16	15.4	15	14.4	5	4.8

There are two sub-dimensions of the scale which measures teachers' attitudes towards e-learning. The averages of the attitude points, the standard deviations and min-max points of these sub-dimensions; and of the scale survey as a whole, have been given in Table 4. The general attitudes towards e-learning, and the total e-learning about the sub-dimensions, have been given in Figure 1, while averages have been given in Figure 2.

Table 5. *Descriptive findings about the scale survey in general, as well as its sub-dimensions*

Dimensions	Max - Min	$\bar{X}$	Ss
I. Proneness to e-learning	25 – 50	43.29	4.85
II. Avoiding e-learning	10 – 50	37.63	8.58
General attitudes about e-learning	44 - 100	80.93	11.50

The total of the points regarding the maker teachers' general attitudes towards e-learning is $\bar{X}$ = 80.93 and the average of these points is $\bar{X}$ = 4.04. This average demonstrates that teachers generally hold e-learning in high regard. When the points for the attitudes to sub-dimensions to e-learning were calculated; it was seen that the total of the points regarding proneness to e-learning was $\bar{X}$ = 43.28, and the average of these points were $\bar{X}$ = 4.33; whereas the total of the points regarding avoiding e-learning was $\bar{X}$ = 37.63, and the average of these points were $\bar{X}$ = 3.76.

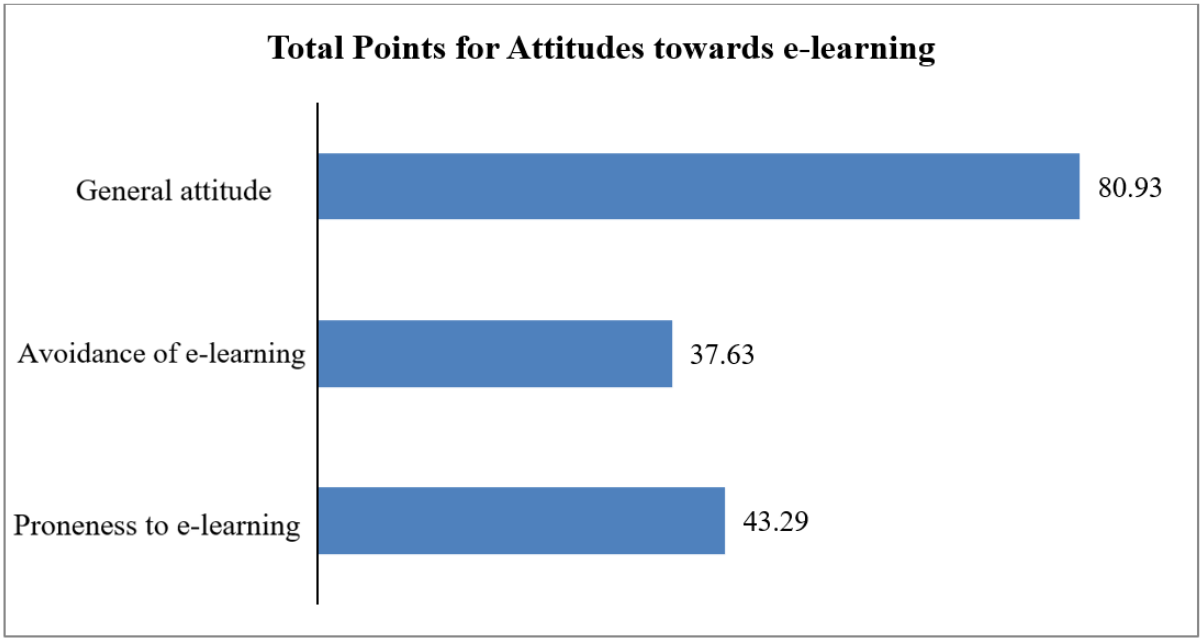


Figure 1. Total points regarding the general attitude scale survey and its sub-dimensions

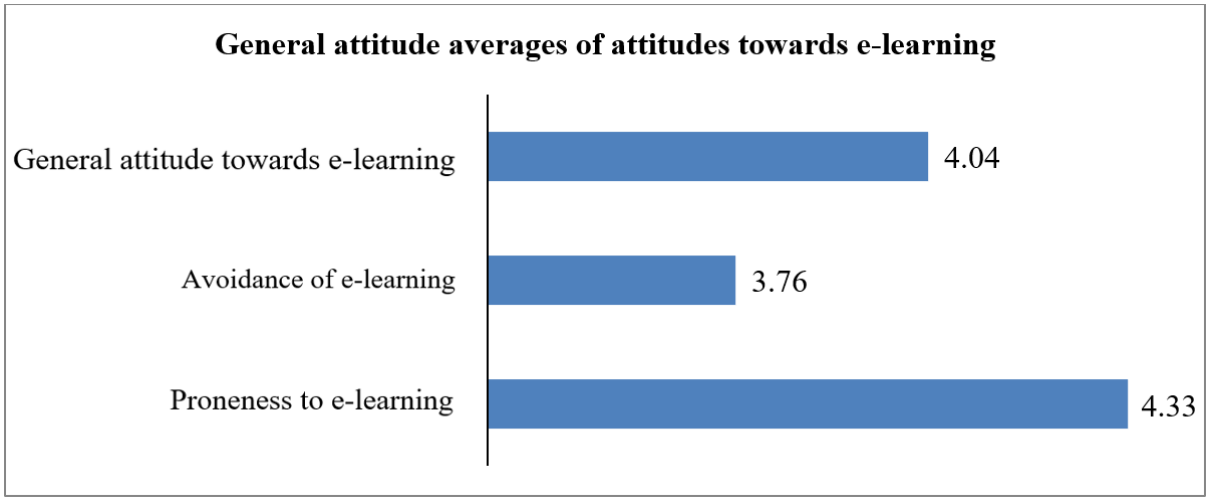


Figure 2. Average points regarding the general attitude scale survey and its sub-dimensions

There are 10 points in total, under proneness to e-learning, which is the first sub-dimension of the scale survey for general attitudes towards e-learning. When we look at the average of the points falling under this sub-dimension, we see that it is between $\bar{X}$ = 4.55 and $\bar{X}$ = 4.05 The point in which the teachers gave answers with the highest average , was "*E-learning makes learning easier"* while the one with the lowest average was *"I track the developments in the field of e-learning"*. The point averages under this sub-dimension, have been given in Figure 3.

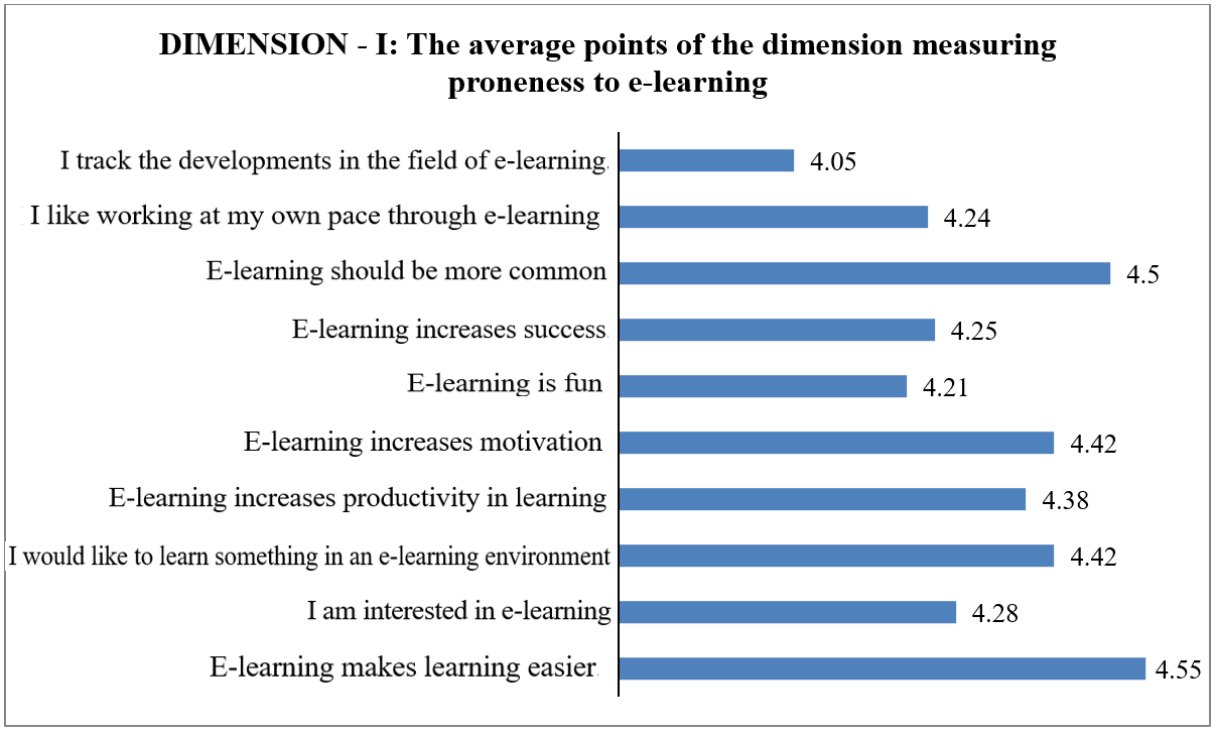


Figure 3. Point averages under the sub-dimension measuring proneness to e-learning

There are 10 points in total, under avoiding e-learning, which is the second sub-dimension of the scale survey for general attitudes towards e-learning. When we look at the average of the points falling under this sub-dimension, we see that it is between $\bar{X}$ = 3.21 and $\bar{X}$ = 1.64. The

point in which the teachers gave answers with the highest average, was "*I feel as though I will have more problems when I take classes by e-learning."* while the one with the lowest average was *"E-learning is unnecessary"*. The point averages of the points under this sub-dimension, have been given in Figure 4.

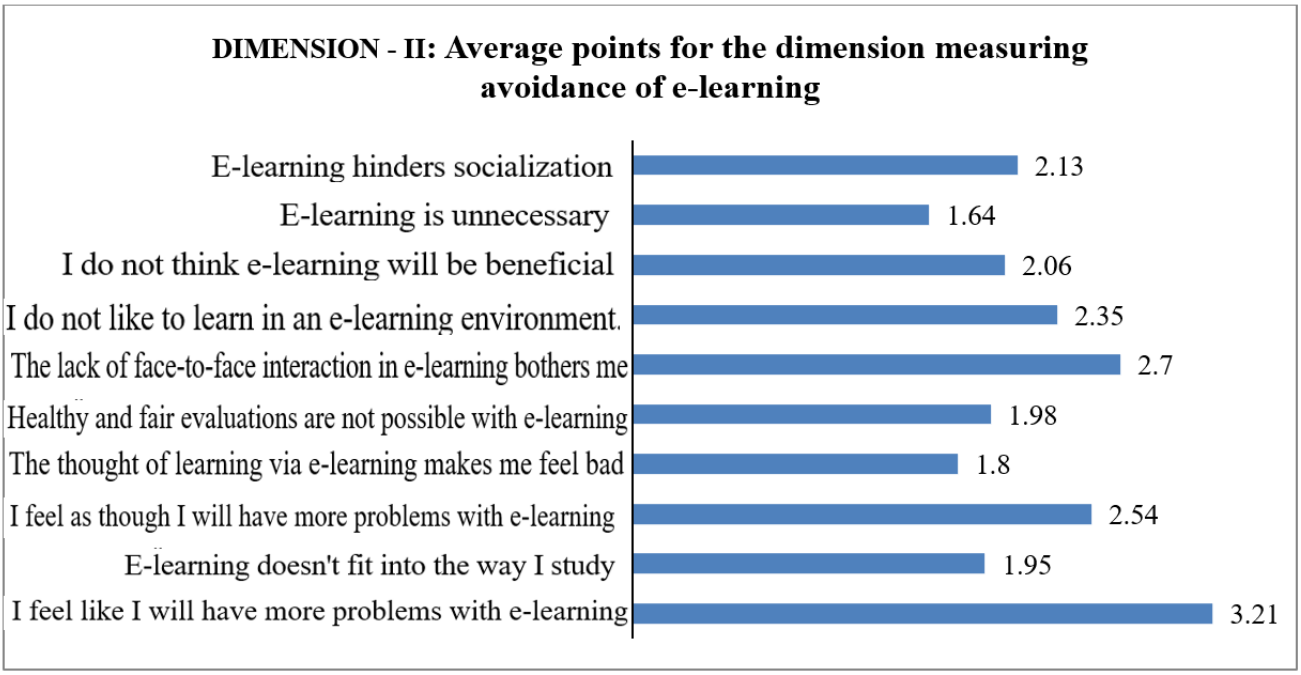


Figure 4. Point averages under the sub-dimension measuring the avoidance of e-learning

A t-test analysis was made, to determine if the attitudes of maker teachers towards e-learning differentiated according to gender. There is no statistical difference between male and female teachers for both of the sub-dimensions [*proneness to e-learning*, t (102) = 0.624, p = 0.534; *avoiding e-learning*, t (102) = -1.587, p = 0.116].

A one-way analysis of variance (ANOVA) was made, to determine if the attitudes of maker teachers towards e-learning differentiated according to age. There is a significant statistical difference in the attitudes of teachers under the sub-dimension measuring their proneness to e-learning, [F (3, 100) = 3.280, $p < 0.05$]. The Post-Hoc analysis, made to reveal the source of the difference, demonstrates that the teachers belonging to the 20-15 age group have the highest proneness level to e-learning, while the teachers belonging to the 31-35 age group have the lowest proneness, and the lowest contribution points. The difference between these two groups is especially significant. That being said, there is no significant difference to the average points regarding the sub-dimension of avoidance to e-learning [F (3, 100) = 2.184, p = 0.095], according to age.

A one-way analysis of variance (ANOVA) was made to determine whether or not the attitudes of maker teachers towards e-learning differed according to levels of professional seniority (experience). There is no statistical difference between male and female teachers for neither of the sub-dimensions [*proneness to e-learning*, t (101) = 0.418, p = 0.660; *avoiding e-learning*, t (101) = 1.786, p = 0.173].

3.3. Maker Teachers' Readiness for E-learning

When we evaluate the answers that the maker teachers have given regarding points about their readiness for e-learning, we can see that the attitudes vary between $\bar{X}$ = 5.97 and $\bar{X}$ = 5.63. The answers given by the teachers to the points about their readiness, and their averages, have been given in Table 5. The point in which the teachers gave answers with the highest average in general, was "*I believe I am responsible for what I learn"* while the one with the lowest average was *"I can handle problems that come up while using the computer".* There is a total of 33 points in the scale survey, and all of them are written in positive sentences. When we look at the frequency distribution of the answers given by the teachers in the survey, we can see that the answers have piled around "completely suits me" and "suits me". Generally speaking, we can say that teachers have an approximately high level of readiness to e-learning. There are six sub-dimensions of the scale survey about readiness for e-learning. The averages of the readiness points, the standard deviations and min-max points of these sub-dimensions; and of the scale survey as a whole, have been given in Table 6. Additionally, the total of the points of the sub-dimensions of this survey, as well as the survey in general, have been given in Figure 5, while their averages have been given in Figure 6.

Table 6. Descriptive findings regarding the scale survey measuring the levels of readiness for e-learning.

Dimensions	Max - Min	$\bar{X}$	Ss
I. Computer self-efficacy (competence)	10 – 35	28.80	4.23
II. Internet self-efficacy (competence)	10 – 28	23.50	3.59
III. Online communication self-efficacy (competence)	13 – 35	29.01	4.37
IV. Self confidence	32 – 56	46.53	5.74
V. Learner control	12 – 28	23.33	3.26
VI. Motivation for e-learning	15 – 49	40.36	5.23
General readiness for e-learning	109 - 231	191.56	23.03

The average of the points regarding maker teachers' levels of general readiness is $\bar{X}$ = 191.56, Ss = 23.03; which shows that the teachers' answers were generally focused around "suits me". These findings suggest that the general level of readiness of maker teachers for e-learning is approximately high.

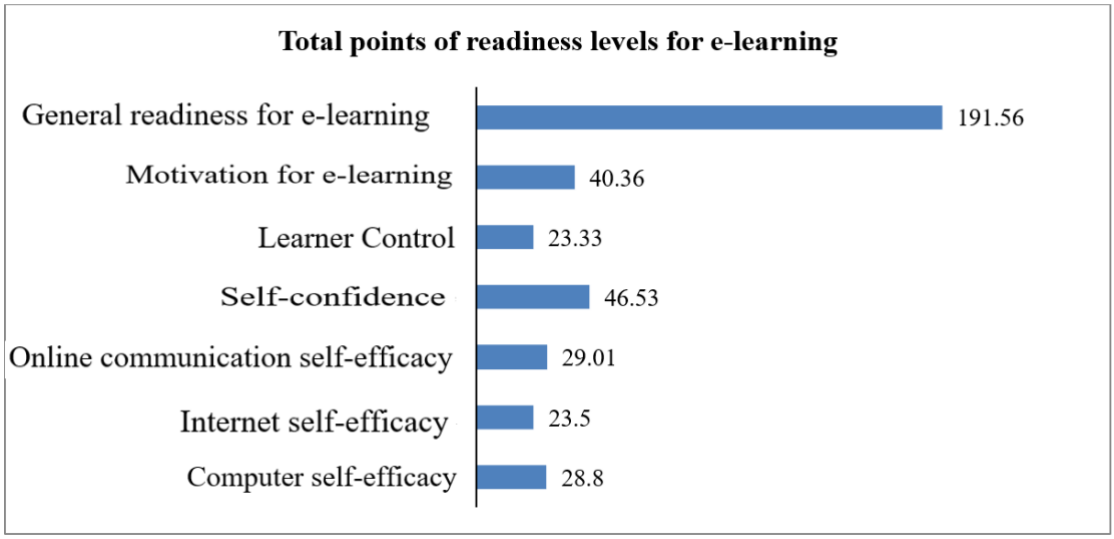


Figure 5. Total points of the scale survey measuring maker teachers' general readiness levels; and its sub-dimensions

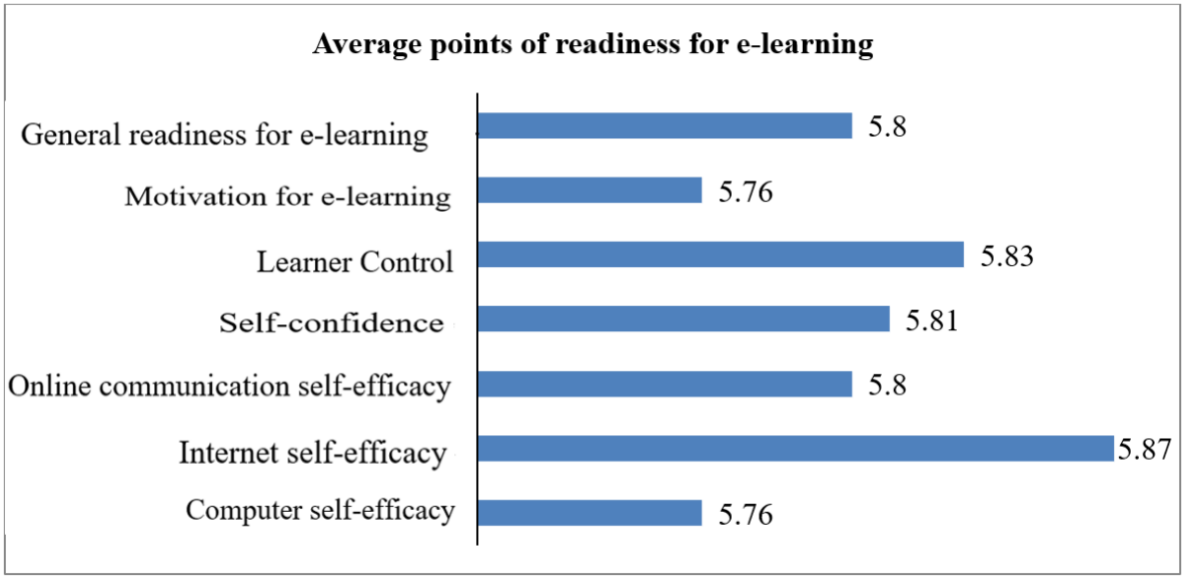


Figure 6. Average points of the scale survey measuring maker teachers' general readiness levels; and its sub-dimensions

When the total points and average points for the sub-dimensions of their readiness for e-learning were calculated; it was seen that the total points related to the computer self-efficacy sub-dimension is $\bar{X}$ = 28.80, and that the average is$\bar{X}$ = 5.76; the total points related to the internet self-efficacy sub-dimension is $\bar{X}$ = 23.50 and the average is $\bar{X}$ = 5.87; the total points related to the online communication self-efficacy sub-dimension is $\bar{X}$ = 29.01, and the average is $\bar{X}$ = 5.8; the total points related to the self-confidence sub-dimension is $\bar{X}$ = 46.53, and the average is $\bar{X}$ = 5.81; the total points related to the learner control sub-dimension is $\bar{X}$ = 23.33, and the average is $\bar{X}$ = 5.83; and the total points related to the motivation towards e-learning is $\bar{X}$ = 40.36, and the averge is $\bar{X}$ = 5.76.

Table 7. *Readiness of maker teachers for e-learning*

Points	$\bar{X}$	1		2		3		4		5		6		7	
		f	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
Dimension I – Computer self-efficacy (competence)															
1. I am comfortable with the use of Windows operating systems.	5,82	-	-	1	1	-	-	4	3.8	33	31.7	40	38.5	26	25
2. I can view the contents of an electronic document (audio, music, text etc.)	5,87	-	-	1	1	-	-	8	7.7	27	26	35	33.7	33	31.7
3. I can handle problems that come up while using the computer	5,63	-	-	1	1	1	1	11	10.6	35	33.7	30	28.8	26	25
4. I am comfortable in the use of Office programs (word, excel, power point, outlook etc.)	5,82	-	-	1	1	1	1	6	5.8	32	30.8	32	30.8	32	30.8
5. I can use application software (editing, design etc.) comfortably if I am in a need to do so.	5,67	-	-	2	1.9	3	2.9	6	5.8	31	29.8	36	34.6	26	25
Dimension II – Internet self-efficacy (competence															
6. I am comfortable in the use of Web browsers (Internet Explorer, Google Chrome etc.)	5,82	-	-	2	1.9	-	-	4	3.8	33	31.7	35	33.7	30	28.8
7. I am comfortable in the use of search engines (Google, Yandex etc.)	5,91	-	-	-	-	2	1.9	5	4.8	33	31.7	24	23.1	40	38.5
8. I can download a file from the internet to my computer.	5,87	1	1	-	-	1	1	10	9.6	21	20.2	36	346	35	33.7
9. I can easily find information I look for online.	5,90	-	-	-	-	-	-	7	6.7	29	27.9	35	33.7	33	31.7
Dimension III –Online communication self-efficacy (competence)															
10. I am comfortable with the use of internet tools (e-mail, forums, skype etc.) to communicate with people more effectively.	5,92	-	-	2	1.9	-	-	3	2.9	29	27.9	35	33.7	35	33.7
11. I can easily ask questions on an online forum.	5,86	1	1	1	1	-	-	8	7.7	27	26	30	28.8	37	35.6
12. I am comfortable in expressing myself in writing (conveying emotions, humor, etc.)	5,80	-	-	-	-	-	-	8	7.7	33	31.7	35	33.7	28	26.9
13. I can ask for help via internet tools (forums, social networks, e-mail etc.), and find answers I need.	5,71	1	1	-	-	1	1	9	8.7	32	30.8	33	31.7	28	26.9
14. I am comfortable with auditory or visual communication through the internet (Skype, Google Hangout, Google Talk etc.)	5,73	-	-	2	1.9	1	1	8	7.7	30	28.8	34	32.7	29	27.9

Table 8. *Readiness of maker teachers for e-learning (Continued)*

Points	$\bar{X}$	1		2		3		4		5		6		7	
		f	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
Dimension IV –Self confidence															
15) I determine my learning-related shortcomings.	5,91	-	-	-	-	2	1.9	5	4.8	24	23.1	42	40.4	31	29.8
16) I determine my own learning objectives.	5,84	-	-	1	1	-	-	8	7.7	26	25	40	38.5	29	27.9
17) I construct a study plan for myself when I am learning something.	5,77	-	-	-	-	-	-	8	7.7	32	30.8	40	38.5	24	23.1
18) I stick to my study plan completely when I am learning something.	5,66	-	-	1	1	1	1	8	7.7	33	31.7	40	38.5	21	20.2
19) I re-arrange my study plan when circumstances change.	5,70	-	-	-	-	1	1	12	11.5	30	28.8	35	33.7	26	25
20) I determine the appropriate resources and tools for my learning process.	5,77	-	-	-	-	1	1	6	5.8	30	28.8	46	44.2	21	20.2
21) I believe I am responsible for what I learn.	5,97	-	-	-	-	-	-	7	6.7	24	23.1	38	36.5	35	33.7
22) I keep my motivation (to learn) high, until I have reached my goal.	5,91	-	-	-	-	2	1.9	5	4.8	25	24	40	38.5	32	30.8
Dimension V –Learner Control															
23) I am in charge of the learning process when I learn about a subject on the internet.	5,82	-	-	1	1	1	1	5	4.8	30	28.8	39	37.5	28	26.9
24) I decide how much I am going to focus on the learning materials on the internet.	5,82	-	-	1	1	-	-	7	6.7	27	26	43	41.3	26	25
25) I decide when I will study the material on the internet.	5,78	-	-	-	-	2	1.9	8	7.7	28	26.9	39	37.5	27	26
26) I decide in which order I will study the material on the internet.	5,92	-	-	-	-	1	1	7	6.7	25	24	37	35.6	34	32.7

Table 9. *Readiness of maker teachers for e-learning (Continued)*

Points	$\bar{X}$	1		2		3		4		5		6		7	
		f	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
Dimension VI – Motivation towards e-learning															
27) I am highly willing to take classes on the internet.	5,71	-	-	1	1	1	1	5	4.8	35	33.7	40	38.5	22	21.2
28) I am interested in taking classes on the internet.	5,72	-	-	1	1	-	-	4	3.8	37	35.6	42	40.4	20	19.2
29) Taking classes on the internet is an effective method to learn.	5,80	-	-	1	1	-	-	7	6.7	31	29.8	37	35.6	28	26.9
30) I think it will be fun to take classes on the internet.	5,80	-	-	1	1	-	-	5	4.8	33	31.7	39	37.5	26	25
31) I am confident that I would be able to learn on the internet.	5,77	-	-	-	-	2	1.9	8	7.7	25	24	46	44.2	23	22.1
32) I would like to share my thoughts and opinions with other people when I take classes on the internet.	5,79	1	1	-	-	-	-	6	5.8	31	29.8	40	38.5	26	25
33) I learn from my mistakes when I take classes on the internet.	5,78	-	-	1	1	1	1	5	4.8	29	27.9	45	43.3	23	22.1

There is a total of four points in the first sub-dimension of 'readiness for e-learning", which is computer self-efficacy. When we look at the average of the points falling under this sub-dimension, we see that it is between $\bar{X}$ = 5.87 and$\bar{X}$ = 5.67 The point in which the teachers gave answers with the highest average , was "*I am comfortable with the use of Windows operating systems."* while the one with the lowest average was *"I can use application software (editing, design etc.) comfortably if I am in a need to do so."* The point averages of the points under this sub-dimension, have been given in Figure 7.

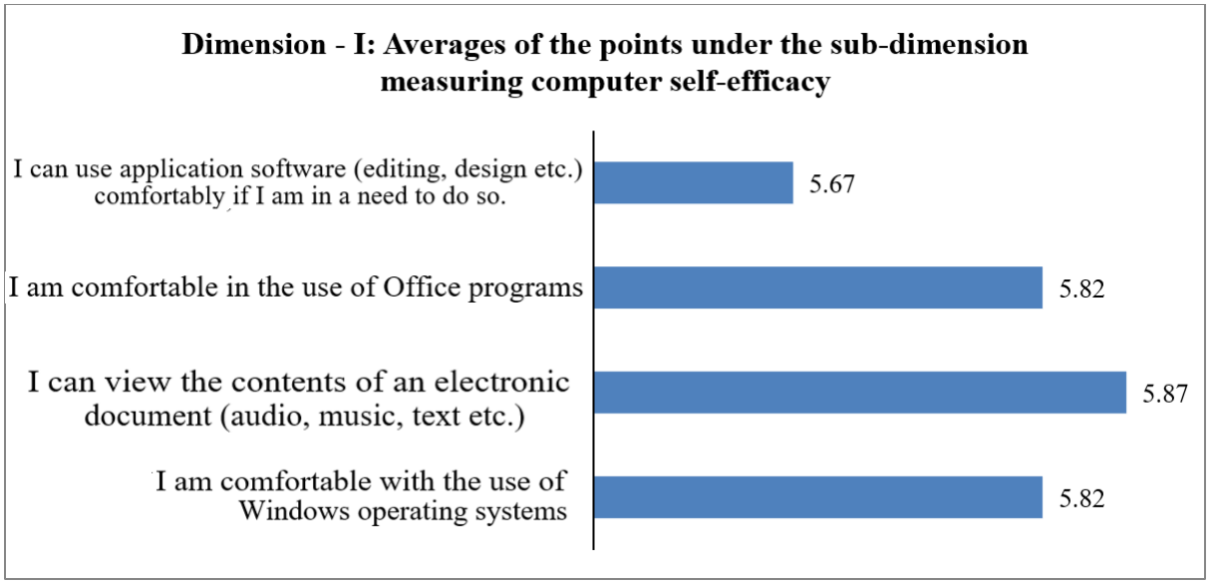


Figure 7. Averages of the points under the sub-dimension measuring computer self-efficacy

There is a total of ten points in the second sub-dimension measuring readiness for e-learning, which is internet self-efficacy. When we look at the averages of the points falling under this sub-dimension, we see that they are between $\bar{X}$ = 5.91 and $\bar{X}$ = 5.82. The point in which the teachers gave answers with the highest average , was "*I am comfortable in the use of search engines (Google, Yandex etc.) "* while the one with the lowest average was *"I am comfortable in the use of Web browsers (Internet Explorer, Google Chrome etc.)".* The point averages of the points under this sub-dimension, have been given in Figure 8.

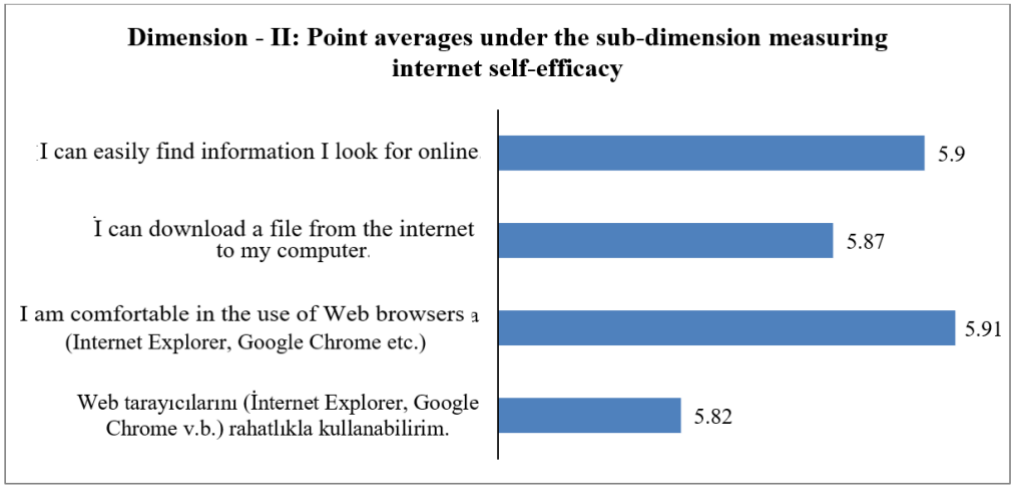


Figure 8. Point averages under the sub-dimension measuring internet self-efficacy

There is a total of ten points in the third sub-dimension measuring readiness for e-learning, which is online communication self-efficacy. When we look at the average of the points falling under this sub-dimension, we see that it is between $\bar{X}$ = 5.92 and $\bar{X}$ = 5.71. The point in which the teachers gave answers with the highest average, was "*I am comfortable with the use of internet tools (e-mail, forums, skype etc.) to communicate with people more effectively. "* while the one with the lowest average was *"I can ask for help via internet tools (forums, social networks, e-mail etc.), and find answers I need."* The point averages of the points under this sub-dimension, have been given in Figure 9.

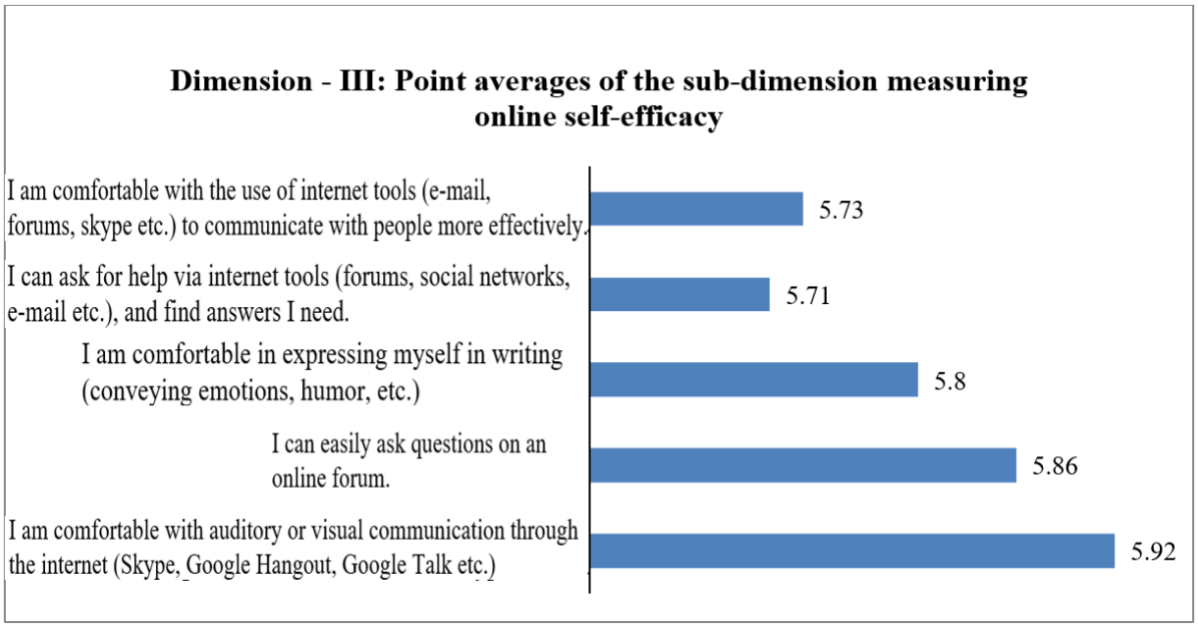


Figure 9. Point averages under the sub-dimension measuring online communication self-efficacy

There is a total of ten points in the fourth sub-dimension measuring readiness for e-learning, which is self-confidence. When we look at the averages of the points falling under this sub-dimension, we see that they are between $\bar{X}$ = 5.97 and $\bar{X}$ = 5.66. The point in which the teachers gave answers with the highest average, was "*I believe I am responsible for what I learn."* while the one with the lowest average was *"I stick to my study plan completely when I am learning something."*. The point averages of the points under this sub-dimension, have been given in Figure 10.

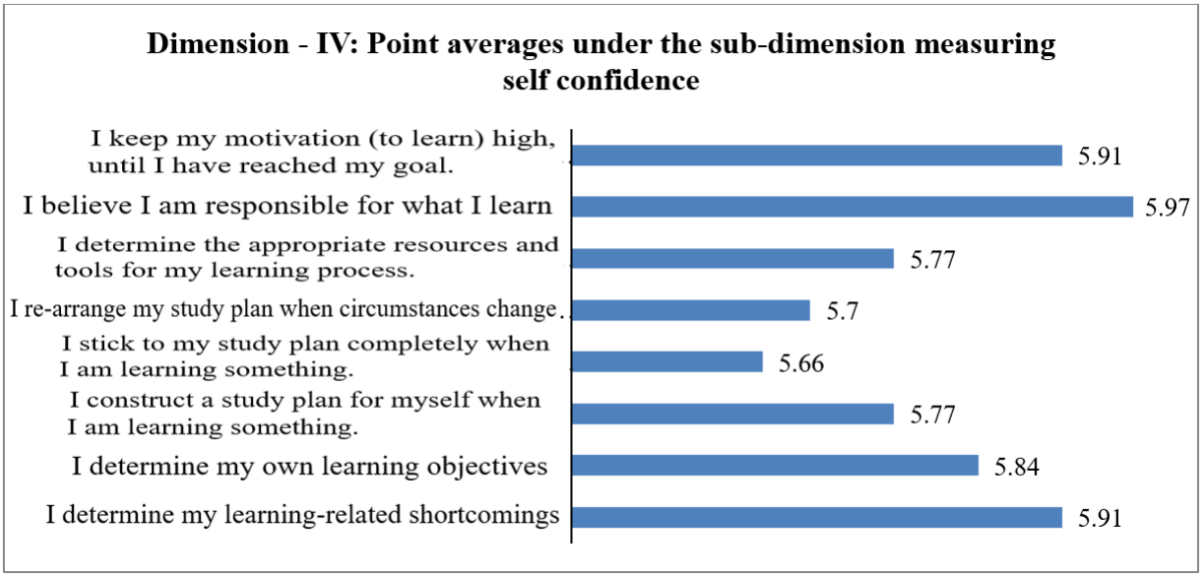


Figure 10. Point averages under the sub-dimension measuring self confidence

There is a total of four points in the fifth sub-dimension measuring readiness for e-learning, which is learner control. When we look at the averages of the points falling under this sub-dimension, we see that they are between $\bar{X}$ = 5.92 and $\bar{X}$ = 5.78. The point in which the teachers gave answers with the highest average , was "*I decide in which order I will study the material on the internet"* while the one with the lowest average was *"I decide how much I am going to focus on the learning materials on the internet."* The point averages of the points under this sub-dimension, have been given in Figure 11.

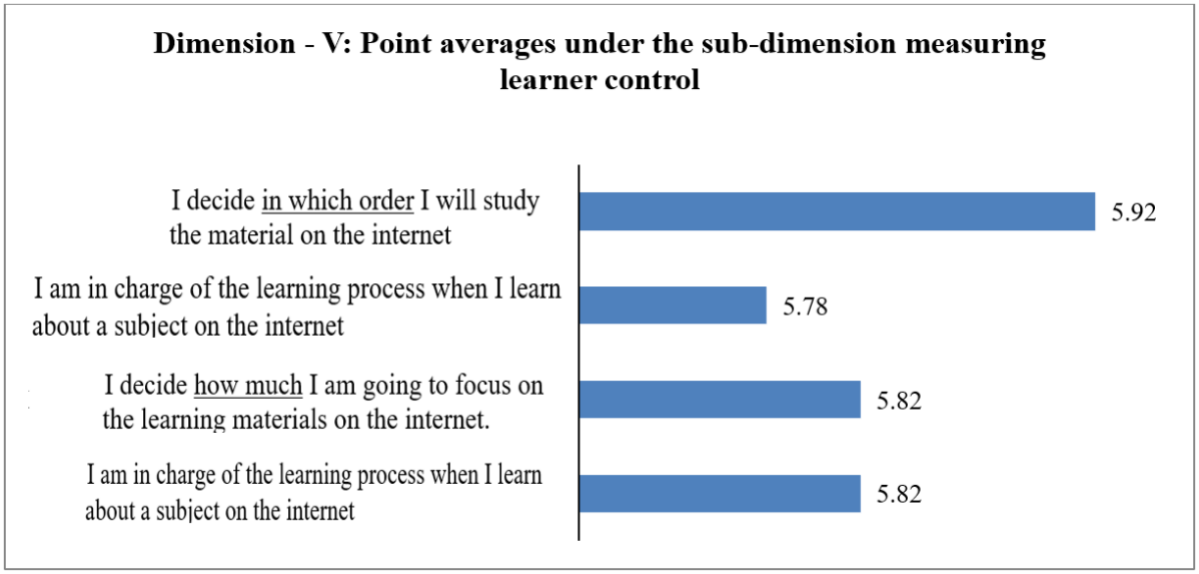


Figure 11. Point averages under the sub-dimension measuring learner control

There is a total of seven points in the sixth sub-dimension measuring readiness for e-learning, which is motivation towards e-learning. When we look at the averages of the points falling under this sub-dimension, we see that they are between $\bar{X}$ = 5.8 and $\bar{X}$ = 5.71. The point in which the teachers gave answers with the highest average, was "*I think it will be fun to take classes on the internet."* while the one with the lowest average was *"I am highly willing to take*

classes on the internet.". The point averages of the points under this sub-dimension, have been given in Figure 12.

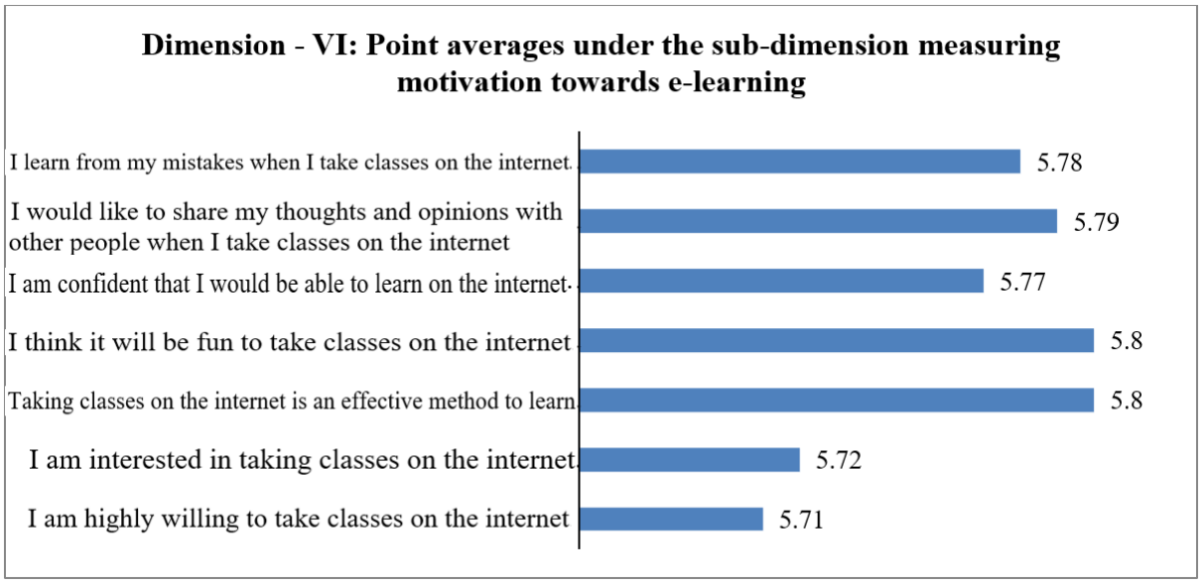


Figure 12. Point averages under the sub-dimension measuring motivation towards e-learning

A t-test analysis was made, to determine if the readiness of maker teachers for e-learning differentiated according to gender. There is a statistical difference between male and female teachers for the sub-dimensions; *self-confidence* [t (102) = -2.011, p = 0.047], and *learner control* [t (102) = -2.044, p = 0.044], favoring the females. No other gender-related statistical difference was observed [*computer self-efficacy*, t (102) = 0.786, p = 0.433; *internet self-efficacy*, t (102) = -1.650, p = 0.102; *online communication self-efficacy*, t (102) = -1.349, p = 0.180; *motivation towards e-learning*, t (102) = -0.112, p = 0.911].

A one-way analysis of variance (ANOVA) was made, to determine if the readiness of maker teachers for e-learning differentiated according to age. It was determined that age has no effect on readiness in any sub-dimensions [*computer self-efficacy*, F (3, 100) = 1.965, p = 0.124; *internet self-efficacy*, F (3, 100) = 0.742, p = 0.529; *online communication self-efficacy*, F (3, 100) = 0.293, p = 0.830; *self-confidence*, F (3, 100) = 2.081, p = 0.107; *learner control*, F (3, 100) = 1.849, p = 0.143; *motivation towards e-learning*, F (3, 100) = 1.879, p = 0.138].

A one-way analysis of variance (ANOVA) was made to determine whether or not the readiness of maker teachers for e-learning differed according to levels of professional seniority (experience). It was determined that professional seniority has no effect on readiness, on any of its sub-dimensions [computer self-efficacy, F (2, 101) = 0.004, p = 0.997; internet self-efficacy, F (2, 101) = 0.196, p = 0.822; online communication self-efficacy, F (2, 101) = 0.424, p = 0.655; self-confidence, F (2, 101) = 1.491, p = 0.230; learner control, F (2, 101) = 1.914, p = 0.153; motivation towards e-learning, F (2, 101) = 0.560, p = 0.573].

4. Conclusion and Discussion

This study aims to exert the attitudes of 104 maker teachers; from all different ages, who work in different regions of Turkey, and who have different levels of professional seniority; towards e-learning, as well as their levels of readiness for it. The study also seeks to point out any effects that gender, age, and professional seniority may have on these attitudes, and levels of readiness. It has been concluded that most of maker teachers spend more than 2 hours-per-day on the computer, that they find e-learning to be useful, and that they are familiar with two or more programming languages. Furthermore, almost half of the maker teachers have expressed that they have only recently joined the maker movement.

It can be said that maker teachers, and teachers in general, have a positive outlook on e-learning. There are two sub-dimensions of the scale which measures teachers' attitudes towards e-learning. The total of points for proneness to e-learning ($\bar{X}$ = 43.29), is higher than the total of points for the avoidance of e-learning ($\bar{X}$ = 37.63). This is because the points in this scale are reversed, and that teachers' answers to the points in this sub-dimension leaned towards "I do not agree". The total being low in this dimension, indicates that teachers do not have a tendency to avoid e-learning (as the points are reversed). Therefore, it can be said that maker teachers have a positive attitude towards e-learning, that they feel close to it, and that they do not have a tendency to avoid it. When we look through the points in the attitude scale, one by one, we see that the point stating that e-learning makes learning easier has the highest average ($\bar{X}$ = 4.55), while the one stating that e-learning is unnecessary has the lowest average ($\bar{X}$ = 1.64). Most of the teachers have answered that they "completely disagree" or "disagree", to the statement proclaiming e-learning to be unnecessary. This finding suggests that teachers mostly think that e-learning is necessary.

The literature in the field contains findings that both coincide with the findings of this study, and contradict with it. In the study evaluating the attitudes of branch teachers towards e-learning, Şentürk (2016), states that the points measuring the proneness of the teachers towards e-learning ($\bar{X}$ = 3.69) was lower than the points for the teachers' avoidance of e-learning ($\bar{X}$ = 3.76); and that most teachers answered close to "indecisive" to points under the sub-dimension measuring proneness , while they answered "I agree" to points under the sub-dimension measuring avoidance. Mohammadi, Hosseini and Fami (2011), have reported that instructors have a positive attitude towards e-learning. Behera (2012) has reported that university professors have a neutral attitude towards e-learning; saying they were indecisive in leaning either way.

When we look at the total points measuring readiness towards e-learning, we see that generally, the points measuring the readiness for e-learning is $\bar{X}$ = 191.56. The scale survey measuring readiness for e-learning has sub-dimensions. When we look at the averages of these points under these sub-dimensions, we see that they are between $\bar{X}$ = 46.53 ile $\bar{X}$ = 23.33, and that the general readiness average is $\bar{X}$ = 191.56. Furthermore, when we look at the averages of the points falling under this readiness scale-survey, we see that they are between $\bar{X}$ = 5.97 and $\bar{X}$ = 5.63. Generally speaking, we can say that teachers have an approximately high level of readiness to e-learning, and therefore that maker teachers are generally ready for e-learning. The main reasons why maker teachers are ready for e-learning could be due to the fact; that they are involved in the maker movement, and therefore use the internet and open access sources more regularly; that they spend time on the internet; and that they have a need to access information for their own designs within the maker movement, not relying on a certain time or place.

In the study, the sub-dimensions with the highest readiness point average is internet self-efficacy ($\bar{X}$ = 5.87) while the lowest is the sub-dimension measuring motivation for e-learning. The findings which were established through different kinds of sampling, in the literature in this area, have both similarities and differences with our own study. One of the studies, of which the findings suggest a similarity with this one, was done by Demir (2015). Demir (2015), found that teacher candidates had the highest readiness level in terms of internet self-efficacy ($\bar{X}$ = 6.31), whereas they had the lowest readiness level in terms of motivation for e-learning ($\bar{X}$ = 4.53); in the study conducted with teacher candidates belonging to different fields. Furthermore, in a study of which the findings were partially similar to our own; Hung and ark.

(2010) reported that the sub-dimension with the highest participant average was internet self-efficacy ($\bar{X}$ = 4.37), whereas the one with the lowest participant average was readiness for e-learning ($\bar{X}$ = 3.60). In another study, Çiğdem and Yıldırım (2014) have expressed that the sub-dimension with the highest average was motivation for e-learning ($\bar{X}$ =4.46), whereas the one with the lowest was computer self-efficacy ($\bar{X}$ = 3.56).

Procedural statistics techniques were used (t-test and ANOVA) in order to determine how the readiness of teachers for e-learning was affected by demographic variables; gender, age, and professional seniority. The t-test analysis results of unrelated groups where male and female teachers were compared, suggest that gender does not have a significant effect on teachers' attitudes towards e-learning. These results indicate that male and female teachers have a similar attitude towards e-learning. Likewise, Behera (2012) has stated that gender does not have an effect on attitudes towards e-learning. In another study conducted with teachers, Şentürk (2016) observed that there is a significant difference between the attitudes of male and female teachers towards e-learning, and that this difference was in favor of male teachers.

On the other hand, gender does cause a significant statistical difference in the sub-dimensions measuring readiness for e-learning, this time in favor of female teachers. That being said, no other difference due to gender is observed in the rest of the sub-dimensions. These findings which show that female teachers have higher points in the sub-dimensions of self-confidence and learner control, suggest that they are more confident about e-learning as opposed to male teachers, and that they feel more ready about controlling learners. The male and female teachers indicate similar levels of readiness in the other sub-dimensions measuring readiness. Sakal (2017), after a study conducted with university students, has stated that gender only had a significant effect in the online communication self-efficacy sub-dimension; and that the male students had much higher points measuring readiness, than female students.

When we look at the effect age has on attitudes towards e-learning, we see that it is significant in the sub-dimension measuring proneness to e-learning. However, we also see that age has no effect in the sub-dimension measuring avoidance of e-learning. There is a significant statistical difference in the attitudes of teachers belonging to the 20 - 21 age group, and the ones belonging to the 31 - 35 age group. These findings suggest that young teachers are more prone to e-learning; but that there is no difference between younger and older teachers in regard to their avoidance of e-learning. Age has no effect on the levels of readiness of teachers towards e-learning, either. The younger and older teachers have close levels of readiness for e-learning, meaning that young-age or old-age does not affect their readiness.

When we look at how professional seniority affects maker teachers' attitudes towards e-learning, we see that it has no significant affect. There is no significant difference between the attitudes towards e-learning, in teachers who have just started their careers, or in teachers who have more experience in the field. Similarly, professional seniority has no significant effect on the readiness of maker teachers, either. There is no significant difference between the readiness for e-learning, in teachers who have just started their careers, or in teachers who have more experience in the field.

5. Suggestions

The suggestions below have been made in light of the findings of this study:

1. This study was conducted with a previously determined number of maker teachers, and it constitutes a basis for future studies. A similar study with a wider sampling should be

conducted, and a general understanding about maker teachers' attitudes towards e-learning, and their readiness for it, should be put forth.

2. This is a quantitative study outlining the general attitudes of teachers. Teachers' understanding, comprehension, application, attitude and practice of the subject should be put forward with qualitative studies which should be conducted with smaller groups; and which involve observations and re-enactments of sample situations with maker teachers who use e-learning platforms.

3. This study has looked into the effects of the variable factors; gender, age, and professional seniority. In later studies, researchers can evaluate the effects of different and more diverse variables (e.g. how much time they have been using e-learning, how much time they have been involved in the maker movement etc.)

4. It has been observed that younger teachers' attitudes towards e-learning is more positive than older teachers The reasons for his phenomenon should be outlined with future, qualitative studies; and older teachers should be assisted with in-house training about e-learning, if necessary.

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