Socio-Demographic Related Difference in Digital Literacy among Undergraduate Students of State universities in Iran

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Abstract

The concept of literacy has undergone a conceptual leap due to the constant growth of technology and the introduction of digital tools. Often-cited as an important component of modern literacy, digital literacy has received significant attention. Since the role of socio-demographic characteristics like gender, place of residence, access to digital tools, fields of study, level of university and previous experience with these tools is very decisive in digital literacy. The current study aimed at filling the gap that exists in the literature in this regard by examining the existence of any relationship between digital literacy level and the mentioned variables in the context of Iran. The study utilized quota sampling to select the respondents. The sample consisted of the undergraduate students of level 1 to level 4 universities. Two public universities from each level 1 to 4 and 8 in total contributed to the sample. The results indicated that all of the selected socio-demographic variables were significantly effective in digital literacy of students. The findings of this study, it is hoped, to provide insights to the education system of our country to recognize the areas of problem and introduce necessary programs in our education system either curricular or extracurricular to meet the required standards.

Keywords: Digital literacy, Quota sampling, Socio-demographic characteristics, Undergraduate Students

1. Introduction

Changes in technological, social and economic aspects of society entail a series of competences that need to be reflected in education system, According to European Commission (2006), the competencies identified are as follows: 'Communication in the mother tongue,' 'Communication in foreign languages,' 'Mathematical competence and basic competences in science and technology,' 'Digital competence,' 'Learning to learn,' 'Social and civic competences,' 'Sense of initiative and entrepreneurship,' and 'Cultural awareness and expression'. In the list of the mentioned competencies, the role of digital competency is more prominent. An increase in technology-mediated educational setting has transformed students' idea into believing that their academic needs should be addressed in quite different ways. In other words, for the new generation, literacy has found a new concept (Cope & Kalantzis, 2000). Accordingly, it is stated that teachers need to collect sufficient information about the context in which they will integrate technology into pedagogical practice (Graham et al., 2009).

As an Iranian and within the country, there is no doubt that technology-oriented education has not yet been achieved, and if it happens in the future, its full implementation will take time. Meanwhile, digital tools are dominant in every aspect of Iranian life, especially university students, but they are not limited to education. The question that needs to be addressed is how digitally

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literate our students are? Answering this question is of utmost importance because poor digital literacy will lower the chances of being employed and will have a harmful effect on academic achievement. Most of the studies which have focused on pedagogical application of technologies have expressed their concerns of the low level of this kind of literacy in society among academics and students without few reference (if any) to how they have conceptualized digital literacy and upon which statistics, their decision have been made (Madadi, Ghomi, & Kiakalayeh, 2015). The current study aims at answering this question by collecting statistics on the digital literacy of students at a scale that has not been attempted at any study prior to the current one in Iran and furthermore delving into the role that socio-demographic characteristics plays in digital literacy.

2. Literature Review

2.1. Definition of Digital Literacy and Theoretical Background

It is better to differentiate between digital literacy and various terms in the literature with the suffix of literacy like computer literacy, e-literacy, information literacy, media literacy, network literacy, ICT literacy and the terms without this suffix like informacy and information fluency. Computer literacy (IT literacy) and Information literacy encompass sets of skills and abilities that are used in obtaining and processing of information on the net. The first concept is still referred to as computer-related skills, but the second one has gained the status of a multi-faceted concept. The term "information literacy" has been profusely used in the literature related to the academic library community and it entails the computerized information as well as finding and evaluating information. In 1989, a six-stage model for information literacy was promoted by American Library Association which required skills for a) acknowledging the importance of information, b) identification of necessary information, c) locating the information, d) assessing the information, e) organizing the information, f) utilizing the information. The terms "network literacy" (McClure, 1994) is related to the information in networks. "Informacy" (Neelameghan, 1995) is about the combination of traditional and information literacy and "mediacy" (Inoue, Naito, & Koshizuka, 1997) is how individuals face digital information in different forms of media. All these three concepts refer to the necessity of having general knowledge and attitudes as well as specific skills in dealing with new literacy.

It was Gilster (1997) who initially introduced the concept of "digital literacy" and defined it as the ability to make sense and utilize information from a variety of sources in the digital era. The proposed definition was general without any reference to specific skills, competencies, or attitudes that are the characteristics of a literate person. Lanham (1995) argued that a new form of literacy is required to take account of diverse forms of information that a digital source delivers such as texts, images, sounds and so on. His argument of a solid definition may sound fascinating at first glance but it may restrict the definition to one era considering the ever-changing nature of digital tools. Eshet (2002) concludes that digital literacy is a special kind of mindset or thinking and it is not equated with the effective use of digital tools. Glister (1997) supports the same idea and names the core competencies as follows: "internet searching," "knowledge assembly," "hypertext navigation," "content evaluation." According to Martin and Madigan (2006), digital literacy concept is valuable in that it extends beyond computer skills, information literacy, ICT literacy, and so on. It is a quality and life circumstances of each individual will have a determining role. It is dynamic and includes both attitudinal and technological aspects. According to Eshet-Alkalai (2004), digital literacy includes five literacies of "photo-visual (ability to understand visual information)," "reproduction (reusing material in creative ways)," "information (information evaluation)," "branching (ability to deal with hypermedia)," and "socio-emotional literacy (appropriate behavior in cyberspace)". According to Martin (2006), it is not reasonable to try to reduce the definition to a specific number of linear steps. It is also not reasonable to suggest that a digital literacy model be suitable for all people, or indeed for one person throughout their entire lives. Finally, considering all the above-mentioned caveats, Bawden (2008) neatly summarizes four generally accepted components of digital literacy which are 1. Underpinnings (literacy in general sense and computer/ ICT literacy) 2. Background knowledge (the world and nature of information resources) 3. Central competencies (understanding material in digital and no-digital formats, generating digital information and its

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communication, evaluating of information, storing information, information literacy, and media literacy), and 4. Perspectives and attitudes (learning independently and moral/ social literacy).

2.2. Review of the Related Literature

Many studies have examined the digital literacy as it relates to different aspects of education (e.g., Greene, Seung, & Copeland, 2014; Janssen et al., 2013; Julien & Barker, 2009; Ng, 2012). For example, Ng (2012) examined the relationship between digital nativity of students and their educational utilization of technology after their attendance in a course on digital literacy. According to their findings, teachers can use some strategies to routinize the use of technology among students such as assigning students some tasks that require the use of technology, encouraging students to follow missed lectures through podcasts, or modeling the use of these tools by teachers. If plans are not introduced or the current ones are not fully implemented, students or 'digital natives' (Prensky, 2001) will still use technology for entertainment and social activities. A number of studies have also emphasized the role of digital literacy in education (e.g., Aziz, 2010; Greene et al., 2014; Khalkhali, Moradi, & Amuei, 2008; Mahboudi, Farrokhi, & Ansarin, 2017). According to Aziz (2010), exposing students to educational technology in a context where teaching and learning is practiced through technology will help students to consciously consider educational use of technology. The literature is also replete with studies which have conceptualized digital literacy (e.g., European Commission, 2006; Ng, 2012; Ojedokun, 2007; Svensson & Baelo, 2015).

Ng (2012) defined digital literacy as including three intersecting dimensions of technical, cognitive, and socio-emotional. The technical dimension is related to technical and operational skills that students need to possess in order to use technology for education. The cognitive dimension is the part of digital literacy that addresses students' ability in the process of searching, evaluating, and creating digital information. It includes knowledge of and ability in procedures that contribute to retrieval, evaluation, interpretation and production of information. The socio-emotional dimension of digital literacy is associated with responsible use of technology for communication, socializing and learning. It discusses concepts like netiquette, internet safety and privacy, and managing threats.

Some of studies also indicate that socio-demographic characteristics are related to digital literacy especially gender differences in using computer and technology (e.g., Bunz, Curry, & Voon, 2007; Hargittai & Hinnant, 2008; Jones, Ramanau, Cross, & Healing, 2010; Li & Kirkup, 2007; Shashaani & Khalili, 2001). However, there is still a lack of conclusive evidence considering the relationship between ICT competencies and gender as the findings of the studies indicate either a lack of or a weak relationship between socio- economic factors and the development of ICT competencies (e,g.,Tondeur, Sinnaeve, Van Houtte, & van Braak, 2011). Gender inequality still exists in using technology. The causes of this difference are the subject of the dispute, however, it is unanimously agreed that there is a need for further research on the different aspects of this issue. Shashaani and Khalili (2001) focused on stereotypical views about computer users and evaluated whether or not males and females have the same amount of competency in computer use. According to their findings, males believed computer use is more of a manly field. Unlike their belief in equality in competence, in response to the statements related to their personal ability and competence to work with computer, females felt helpless around the computers and regarded computers as making them nervous and uncomfortable. Accordingly, in Li and Kirkup (2007), the males portrayed a picture of themselves as the skilled operators of search engines in locating digital information. Overall, these studies show that while female students favour gender equality among computer users, they have less confidence in their own ability with computers. The studies that differentiate males and females across different aspects of ICT competencies provide a clear picture of the situation. For example, in Hargittai and Hinnant (2008), the females stated that they had difficulty in understanding Internet-related terms. However, they significantly perform better in other aspects of ICT competencies like communication (Bunz et al., 2007). Jones et al. (2010) have reported similar results. According to Tsai and Tsai (2003), the tendency of girls to excel in communication activities and the awareness of this fact increases their self-efficacy in online communication. In accordance with social cognitive theory (Bandura, 1986; Pajares, 1997), the

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practice of social online activities gradually enhances the female students' self-efficacy with regard to online communication only if the result of these activities is interpreted as successful. Consequently, as the result of increased self-efficacy, girls are more inclined toward not only these activities but also more demanding ones since they feel confident that they can finish the task successfully. Every successful experience they accumulate will increase their self-efficacy and the process continues.

Similar to gender, socio- economic factors have been the subject of many studies. Claro et al. (2012) found a relationship between students' socio-economic level and their ability in accessing digital information and processing them, effective communication, and interactive presence in virtual environments. Arsenijević and Andevski (2016) examined the effects of socio-demographic variables like place of residence on media literacy of students and found that there was not a difference in media literacy between students in rural areas and towns. They explained the results by indicating that the users have an equal opportunity to access the same content regardless of their geographical location. In addition, access to high-speed internet which is the characteristic of large cities does not affect media literacy as these services are mostly offered for business purposes. In Volman, Van Eck, Heemskerk, and Kuiper (2005), students who reported to belong to ethnic minorities felt a lack of readiness with ICT skills required to use word-processing, Internet, illustrations, e-mail, presentation software, Windows and bookmarking favorites.

In addition, the findings of Scherer, Rohatgi, and Hatlevik (2017) indicated that the education area of the students was associated with their competency. For example, students studying technical and technological fields performed better at play and the students in natural and mathematics group demonstrated better at collective intelligence. Accordingly, Suwana (2017) found that academic practices in Spanish universities do not include ICT and information literacies as a part of students' academic literacy. According to Cope and Kalantzis (2000), it seems that a new pedagogy is a requirement for the use of digital media. The change in pedagogy toward incorporating digital competence will develop this competence within academic literacy (Johnston & Webber, 2003; Lea & Jones, 2011). Abdollahyan and Ahmadi (2011) studied digital literacy level among undergraduate students of a university in Iran. According to their findings, factors of age, years of study in university, possession of digital devices and time of use were highly correlated with students' digital literacy level. The review of previous research indicated that there is a dearth of studies on digital literacy in Iranian contexts. The only case found in the literature review was that of Abdollahyan and Ahmadi (2011); however, it seems they have focused mainly on the technological aspects of digital literacy. In addition, they have studied the digital literacy of students at just one university. They also tested the relationships of different variables with digital literacy like age, gender, year of study, ownership of digital tools, time spent on web and self-efficacy. Therefore, in order to achieve conclusive evidence, help in the generalizability of findings, and add to the literature as regards to digital literacy, the present study tried to determine the digital literacy of students of Iranian universities. Moreover, this research tried to investigate the students' digital literacy across different fields of study, levels of universities, their place of residence, gender, IT background, and access to digital tools. The research hypotheses in this study were as follows:

Research Question One: There is not a significant difference in the mean scores of digital literacy of the male and female students.

Research Question Two: There is not a significant difference in the mean scores of digital literacy between the students of state cities and state capital.

Research Question Three: There is not a significant difference in the mean scores of digital literacy between the students who have previously attended an IT course and those who have not had such an experience.

Research Question Four: There is not a significant difference in the mean scores of digital literacy among students of level 1 to 4 universities.

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Research Question Five: There is not a significant difference in the mean scores of digital literacy between students of different fields of study.

Research Question Six: There is not a significant difference in the mean scores of digital literacy among the students using different numbers of electronic devices.

3. Methodology

3.1. Study Sites

Iran has a large network of private and public universities offering degrees in higher education. Public universities of Iran are under the direct supervision of Iran's Ministry of Science, Research and Technology (for non-medical universities) and Ministry of Health and Medical Education (for medical schools). It offers a variety of programs in different fields of study under five main categories of 'mathematical sciences,' 'experimental sciences,' 'humanities,' 'arts,' and 'foreign languages.' Decision on including public universities (not specialized and medical universities) and excluding other types of universities (Private, Payame-e Noor, Teacher training colleges, comprehensive technology, technical institutes, etc.) was made after considering issues like: a) population of students; public universities account for a considerable amount of the students' population, b) structure of the students' population; students at public universities are at the same years of age and full-time students which are likely to provide exact information on digital literacy, c) ranking of universities; public universities have recently been ranked by the Ministry of Science, Research, and Technology (MSRT). According to the statistics released by the MSRT, public comprehensive universities are categorized into four levels of 1, 2, 3, and 4. As Table 1. Shows, to proceed with the sampling of the students, 2 universities from each level and in total 8 universities were randomly selected from all public comprehensive universities.

Table 1: The List of the Selected Universities in the Study

Level	Universities	
1	Ferdowsi University	Shiraz University
2	Mazandaran University	Semnan University
3	Hormozgan University	Shahid Madani University
4	Gonbad-e kavus University	Torbat heydarieh University

3.2. Sampling

The participants in this study were undergraduate students of the public universities in Iran. Sampling method was quota sampling which follows the same procedure as in stratified sampling but differs in that 'typical cases are selected from diverse strata of the population' (Ary, Jacobs, & Sorensen, 2010, p. 156). In this study, according to Iran Statistical Yearbook (2015-2016), the population of the undergraduates was estimated to be approximately 400,000 students and one percent of the population was selected according to convenience sampling to consist the sample. Table 2 represents the characteristics of the participants in the study.

Table 2: The Distribution of the Participants in terms of Demographic Variables

Sex	Field categories	University	Year in university	Access to digital tools	Place of birth	IT background
Male (48.7%)	Mathematical sciences 45.7%	Level 1 29.8%	Freshmen 30.5%	1 tool 25.7%	State city 41.9%	Yes 8.6%
Female (51.0%)	Experimental sciences 17.4%	Level 2 20.1%	Sophomore 28.6%	2 tools 42.9%	State capital 41.8%	No 77.4%
Missing 0.3%	Humanities 30.1%	Level 3 26.1%	Junior 19.8%	3 tools 22.7%	Missing 16.3%	Missing 14%
	Arts 0.7%	Level 4 23.9%	Senior 15.7%	4 tools 7.6%		
	Foreign languages 5.2%	Missing 0.1%	Above 4.4%	Missing 1.0%		
	Missing 0.9%		Missing 1.0%			

As the Table 2 shows, there was an approximately equal number of males and females in the sample. The sample was mainly dominated by mathematical sciences students (45.7%) which correctly reflects the structure of the public universities (non-medical universities) in Iran in terms of population. Level 1 which includes well-known and highly ranked universities accounted for the major part of the sample (29.8%). Level 2 category (20.1%) was slightly underrepresented in comparison with level 3 (26.1%) and level 4 (23.9%). In addition, the frequency of the first-year students was higher than other students (30.5%). Most of the students reported that they were using another digital tool along with their smartphones (42.9%). The students in both state capitals and state cities were equally distributed and the percentage of students who have previously experienced any digital course or workshop was dramatically lower than those who have not attended these courses or workshops (8.6% to 77.4%). The distribution of the participants in the current study was demonstrated in terms of university in Table 3.

Table 3: Distribution of Students across Different Universities

Level	University	Number of questionnaire	University	Number of questionnaire
1	Ferdowsi University	700	Shiraz University	700
2	Mazandaran University	500	Semnan University	500
3	Hormozgan University	500	Shahid Madani University	500
4	Gonbad-e kavus University	300	Torbat heydarieh University	300

3.3. The research Instrument

The criteria for conceptualizing digital literacy was its appropriateness in covering the necessary skills or the concepts that are expected from the generation of the students who are currently studying their bachelor's degree program at universities. In this study, as it was defined in the previous section, Ng's (2012) definition of digital literacy which includes three components of technical, cognitive, and socio- emotional was selected. As Table 4 shows, for designing a questionnaire that neatly followed the definition of the component, the researchers followed a two-step guideline as recommended by Shahsavar and Tan (2012).

Table 4: Stages in Questionnaire Development

Step	Substep
instrument construction	Step 1: defining construct
	Step 2: item generation
	Step 3: determining the format
instrument validation	Step 1: item judgment (reviewing the item pool by panel of experts)
	Step 2: pilot testing the instrument
	Step 3: instrument assessment (concluding the interview, item scale correlation, coefficient alpha) (p.2)

Following the steps in Table 4, the final version of the questionnaire consisted of 43 five-point Likert type items in which 1 represented 'not true of me,' 2 represented 'somehow true of me,' 3 represented 'not sure,' 4 represented 'somehow true of me,' and 5 represented 'true of me.' Table 5 represents some of the statements investigating different dimensions of the selected concept for the digital literacy in this study.

Table 5: Different Dimensions of Digital Literacy with Samples of Corresponding Statements

Technical	cognitive	socio-emotional
1. I can use the web for web conferencing (e.g., using Adobe Connect or Skype, etc.).	22. I can narrow my search down to specific types of files with the file type extensions (.doc, .xls, .ppt. pdf. etc.).	36. I know what to do if my user account is hacked or used illegally.
4. I can create an online text with an appropriate number of hyperlinks (links to other websites).	23. I can use Boolean operators (or, and, not) to find exactly what I am looking for.	41. I use the same password for most of my online accounts.
17. I can edit video clips 18. I can customize a web browser	25. I often review the information to make sure that what I share or comment on is valid. 28. I can evaluate the information I find online (due to factors such as content, copyright, update date, etc.).	42. I accept friend request after careful examination of the sender's profile. 43. When I join an online discussion, I respect others and their comments.

The internal consistency of the different subscales and the total scale are represented in Table 6.

Table 6: Cronbach Alpha for the Different Components of the Questionnaire

Component	Value
Socio-emotional subscale	0.626
Cognitive Scale	0.842
Technological scale	0.902
Total scale	0.921

3.4. Data Collection

Data was collected at the end of the second semester of 2017-218 academic year from 5-16 of May. During the data collection period, the research assistants started their task from 8 in the morning till the late hours and administered the questionnaires to the students who met the criteria and accepted to cooperate. They exhausted all possible techniques of findings the respondents. Table 7 indicates the number of the questionnaires that was not used, completely answered, and discarded. As Table 7 indicates, the reason for the significant number of the questionnaires that was not returned was that the male research assistants were prohibited from entering the women section of the library, as a result they chose the only option of administrating the questionnaire through library staffs or administrating the questionnaire at the entrance door and waiting till the closing hours to collect the questionnaire. This problem resulted in losing many questionnaires.

Table 7: Descriptive Statistics about the Questionnaires

Original copies	Selected for the analysis	Not used	Discarded	Not returned
4000	2316	379	626	679

4. Results

To examine hypotheses 1 to 3, descriptive statistics related to total digital score across variables of "IT experience," "place of residence," and "gender" were obtained. To facilitate the analysis, students' answers to the place of birth were recorded into 'state city' if they were living in the cities

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and 'state capital' if they were living in the capital of provinces. In addition, the third hypothesis, compared the mean digital literacy scores of the students who had previously attended a course or workshop on digital literacy with those who had not. Table 8 represents the descriptive results for the hypotheses number 1 to 3.

Table 8: Mean Digital Literacy Scores for the Students with and without Experience in IT

	Dimension		N	Mean	Std. Deviation	Std.Error of Mean
	IT experience	yes	199	154.88	26.21	1.86
		no	1792	140.43	26.99	0.64
Total digital score	place of residence	state city	969	140.86	27.40	0.88
		state capital	968	145.35	27.33	0.88
	gender	male	1127	146.73	26.25	0.78
		female	1181	137.42	28.13	0.82

According to Table 8, the mean score for the students with previous attendance in IT related classes was 154.88 with a standard deviation of 26.21 which is higher than the mean scores of those reported not having these experiences with a mean of 140.43 and a standard deviation of 26.99. In addition, the mean score for students living in the capital of the states was 145.35 with a standard deviation of 27.33 which is higher than the mean scores of those reported to be living in state cities with a mean of 140.86 and a standard deviation of 27.40. The table also shows that the mean of males (M=146.73) exceeded that of females (M=137.42). To examine the significance of the observed differences between categories in hypotheses 1 to 3, an independent samples t-test was conducted. The results of this analysis for all three categories are represented in the Table 9.

Table 9: Independent Samples t-test for IT Experience, Place of Residence, and Gender

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	DF	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
digital score- IT experience	Equal variances assumed	0.02	0.89	7.18	1989	0.00	14.44	2.01	10.50	18.39
digital score-residence	Equal variances assumed	0.07	0.79	-3.61	1935	0.00	-4.48	1.24	-6.92	-2.05
digital score-gender	Equal variances assumed	6.23	0.01	8.22	2306	0.00*	9.32	1.13	7.09	11.54

According to Table 9, there was a significant difference in the scores for the students with and without previous experience in digital literacy; t (1989) =7.18, p=0.00, two-tailed). The magnitude of the differences in the means (mean difference=0.85, 95% CI: 10.50 to 18.39) was very small (eta squared=0.02). Also, there was a significant difference in scores between the students of the state cities and state capitals; t (1935) =3.61, p=0.11, two-tailed). The magnitude of the differences in the means (mean difference=0.85, 95% CI: -6.92 to -2.05) was very small (eta squared=0.01).

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In addition, as the table shows, there was a significant difference in scores for the males and females; t (2306) = 8.22, p = 0.00, two-tailed. The magnitude of differences in the means (mean difference = 9.31, 95% CI: 7.09 to 11.54) was small (eta squared=0.03).

In examining the fourth hypothesis, descriptive statistics indicates that mean score of students in the level 1 universities (M=144.83) was higher than the universities in the other levels. The universities in level 2 had a mean of 141.81 which was lower than mean of the level 1 universities but higher than the other levels. The universities in the level 3 did not follow the predicted pattern and their mean score (M=139.80) was ranked fourth among the levels. The universities in the level 4 reported a slightly better knowledge of the digital literacy and their mean (M=140.90) exceeded the mean of the level 3 but was lower than that of the level 1 and level 2. Table 10 represents the total mean score of the students in digital literacy for the different levels of the universities.

Table 10: Mean Total Score of the Students in Universities 1 to 4

University	N	Minimum	Maximum	Mean	Std. Deviation
level 1	690	62	213	144.83	29.74
level 2	465	64	203	141.81	25.72
level 3	605	62	207	139.80	26.68
level 4	553	62	210	140.99	27.22

As it is clear from Table 10, the mean score of the students in the level 4 was unexpectedly higher than the mean score of the students in level 3. Therefore, to further differentiate, the results are reported in Table 11 across 5 main field categories for the universities in the two levels of 3 and 4.

Table 11: The Mean Digital Literacy Scores of the Students across Field Categories

University		level 3		level 4	
		Frequency	Percent	Frequency	Percent
Fields	1 mathematical sciences	269	44.5	305	55.2
category	2 experimental sciences	95	15.7	130	23.5
	3 humanities	193	31.9	108	19.5
	4 arts	1	0.2	0	0
	5 foreign languages	41	6.8	8	1.4
	Total	599	99	551	99.6
Missing	System	6	1	2	0.4
Total		605	100	553	100

As Table 11 shows, the percentage of the students studying in the fields related to mathematical and experimental sciences was higher in the level 4. However, in other three categories of humanities, arts, and foreign languages, the mean score for the students in the level three universities was higher than that for the level 4 students.

In order to examine the significance of the result, a one-way between-groups analysis of variance was conducted. The differences between means of the students in the four levels were compared to find out the significance of these differences. Table 12 shows the result of this analysis:

Table 12: One-way Analysis of Variance of the Mean Scores in the Four Levels

	Sum of Squares	DF	Mean Square	F	Sig.
Between Groups	9037.48	3	3012.49	3.96	.01*
Within Groups	1754773.21	2309	759.97		
Total	1763810.68	2312			

*The mean difference is significant at the 0.05 level.

As the results in Table 12 show, there was a statistically significant difference at the p<0.05 level in total digital literacy scores for the four university levels: F (3, 2309) = 3.96, p=0.01. Despite

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reaching statistical significance, the actual difference in mean scores between the groups was quite small. The effect size, calculated using Eta squared was 0.01. In order to find out where exactly the difference between the levels occurs. A post hoc test was conducted which is represented in Table 13.

Table 13: Post- hoc Analysis of Difference between the Mean Scores

Tukey HSD

(I) university	(J) university	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
level 1	level 2	3.02	1.65	0.26	-1.23	7.27
	level 3	5.03*	1.53	0.01	1.08	8.98
	level 4	3.84	1.57	0.07	-.20	7.89
level 2	level 1	-3.02	1.65	0.26	-7.27	1.23
	level 3	2.01	1.70	0.64	-2.36	6.38
	level 4	0.82	1.73	0.96	-3.64	5.28
level 3	level 1	-5.03*	1.53	0.01	-8.98	-1.08
	level 2	-2.01	1.70	0.64	-6.38	2.36
	level 4	-1.18	1.62	0.88	-5.35	2.99
level 4	level 1	-3.84	1.57	0.07	-7.89	0.20
	level 2	-0.82	1.73	0.96	-5.28	3.64
	level 3	1.18	1.62	0.88	-2.99	5.35

* The mean difference is significant at the 0.05 level.

According to the results in Table 13, post-hoc comparisons using the Tukey HSD test indicated that the difference between the mean scores of the level 1 and 3 was statistically significant (MD: 5.03, p= 0.01). Level 1 mean scores did not differ significantly from other levels.

In order to examine fifth hypothesis, again a one-way between groups analysis of variance was conducted to explore the effect of the students' groups in the national entrance examination on digital literacy level as measured by the digital literacy questionnaire. Table 14 represents the mean scores of different groups in digital literacy.

Table 14: Total Mean Score of Digital Literacy across Field Category

	N	Mean	Std.Deviation
1 mathematical sciences	1059	148.30	26.41
2 experimental sciences	402	139.73	27.71
3 humanities	697	133.19	27.29
4 arts	16	141.00	17.76
5 foreign languages	121	145.31	24.82
Total	2295	142.00	27.56

As it can be seen from Table 14, the groups from the highest rank to the lowest rank were mathematical sciences, foreign languages, arts, experimental sciences, and humanities respectively with the means of 148.30, 145.31, 141.00, 139.73, and 133.19. In order to find out whether these differences in means were significant, a one-way between groups analysis of variance was conducted. The result of this analysis is represented in Table 15.

Table 15: Analysis of Variance of Mean Scores of 5 Main Field Category

	Sum of Squares	DF	Mean Square	F	Sig.
Between Groups	99608.31	4	24902.08	34.71	0.00
Within Groups	1642906.68	2290	717.43		
Total	1742514.99	2294			

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Table 15 indicates that there was a statistically significant difference at the p<0.05 level in digital literacy scores for the 5 main groups: F (4, 2290) = 34.71, p=0.00. In addition, the actual difference in mean scores between the groups was a medium effect size. The effect size, calculated using eta squared, was 0.06. In order to further differentiate the groups in terms of their effect on digital literacy level, as Table 16 shows, post-hoc comparisons using the Tukey HSD were conducted.

Table 16: Post-hoc Comparisons of Means of the Groups Using Tukey HSD

field category	field category		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
1 mathematical sciences	2 experimental sciences		8.58*	1.57	0.00	4.29	12.86
	3 humanities		15.11*	1.31	0.00	11.55	18.68
	4 arts		7.30	6.75	0.82	-11.11	25.72
	5 foreign languages		3.00	2.57	0.77	-4.02	10.02
2 experimental sciences	1 mathematical sciences		-8.58*	1.57	0.00	-12.86	-4.29
	3 humanities		6.54*	1.68	0.00	1.96	11.12
	4 arts		-1.27	6.83	1.00	-19.91	17.37
	5 foreign languages		-5.58	2.77	0.26	-13.16	2.00
3 human sciences	1 mathematical sciences		-15.11*	1.31	0.00	-18.68	-11.55
	2 experimental sciences		-6.54*	1.68	0.00	-11.12	-1.96
	4 arts		-7.81	6.77	0.78	-26.30	10.68
	5 foreign languages		-12.12*	2.64	0.00	-19.32	-4.92
4 arts	1 mathematical sciences		-7.30	6.74	0.82	-25.72	11.11
	2 experimental sciences		1.27	6.83	1.00	-17.37	19.91
	3 humanities		7.81	6.77	0.78	-10.68	26.30
	5 foreign languages		-4.31	7.12	0.97	-23.76	15.15
5 foreign languages	1 mathematical sciences		-3.00	2.57	0.77	-10.02	4.02
	2 experimental sciences		5.58	2.78	0.26	-2.00	13.16
	3 humanities		12.12*	2.64	0.00	4.92	19.32
	4 arts		4.31	7.12	0.97	-15.15	23.76

*The mean difference is significant at the 0.05 level.

It is clear from Table 16, that the mean score for group 1 (M= 148.30, SD=26.41) was significantly different from group 3 (M=133.19, SD=27.29) and group 2 (M= 139.73, SD=27.71). There was also a significant difference between group 2 and group 3. Group 5 (M=145.31, SD=24.82) also significantly differed from group 3.

To examine the sixth hypothesis, students were asked to select digital devices they use from the given options of desktop computer, smart phones, laptops, tablets, and others. To analyze the results, a one-way between- groups ANOVA was conducted. Preliminary analyses were performed to ensure no violation of the assumptions of independency of observations, normality of distribution, and homogeneity of variance. The results of this analysis is represented in Table 17 and 18.

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Table 17: Number of Digital Devices Used by the Students of Universities

	N	Mean	Std. Deviation
1	596	129.27	26.36
2	993	143.22	25.45
3	526	150.43	26.93
4	176	154.76	27.74
Total	2291	142.13	27.53

According to Table 17, students using 4 digital devices ranked higher than the other three groups with a mean of 154.76. The second highest mean was related to the students utilizing 3 digital devices with a mean of 150.43 and the next rank belonged to the students who were using 2 digital devices at the time of responding to the questionnaire with a mean of 143.22 and the lowest rank was related to the students who were using only one digital device with a mean of 129.27. In order to examine the significance of these differences, a one-way analysis of variance was conducted. Table 18 shows the results of this analysis.

Table 18: Between Groups Analysis of Variance of Digital Literacy Scores

	Sum of Squares	DF	Mean Square	F	Sig.
Between Groups	163968.632	3	54656.21	79.55	0.00
Within Groups	1571244.084	2287	687.03		
Total	1735212.716	2290			

According to the results as represented in Table 18, the mean differences of total digital literacy scores among the students using different numbers of digital tools were significant at the P<0.05 level. (F (3, 2287) = 79.55, p=0.00). The effect size as calculated by eta squared was 0.09 which is a medium effect. In addition, a post –hoc test was conducted to locate exactly where the significant differences are among the students with the different number of digital tools. Table 19 represents the results of the analysis.

Table 19: Post- hoc Test Using Tukey HSD

Number of digital tools	Number of digital tools		Mean Difference	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
dimension2	1	2	-13.95*	1.36	0.00	-17.44	-10.45
	dimension3	3	-21.15*	1.57	0.00	-25.19	-17.12
		4	-25.48*	2.25	0.00	-31.26	-19.70
	2	1	13.95*	1.36	0.00	10.45	17.44
	dimension3	3	-7.21*	1.41	0.00	-10.84	-3.57
		4	-11.54*	2.14	0.00	-17.05	-6.03
	3	1	21.15*	1.57	0.00	17.12	25.19
	dimension3	2	7.21*	1.41	0.00	3.57	10.84
		4	-4.33	2.28	0.23	-10.20	1.54
	4	1	25.48*	2.25	0.00	19.70	31.26
	dimension3	2	11.54*	2.14	0.00	6.03	17.05
		3	4.33	2.28	0.23	-1.54	10.20

* The mean difference is significant at the 0.05 level.

It is clear from Table 19, that the mean score for group 1 (M= 129.27, SD=26.36) was significantly different from the other three groups. The mean of group 3 (M= 150.76, SD=26.93) also significantly differed from group 2 and 1. The difference between group 2 (M=143.22, SD=25.45)

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also significantly differed from group 4. However there was not a significant difference between group 4 and 3.

5. Discussion

The current study focused on the digital literacy of undergraduate students in the public universities of Iran. As it was expected, there was a difference in digital literacy among the different levels in a way that the level of digital literacy decreases from level 1 to level 4 universities. However, the mean digital literacy scores of level 4 universities did not follow the pattern and preceded level 3 in terms of mean digital literacy scores. A close examination of the structure of these two levels showed that the percentage of the students from the two groups of mathematical and experimental sciences in the level 4 was noticeably higher than the percentage in the level 3. These two main groups were usually believed to have an acceptable level of digital literacy. As a result, the level 4 which consisted mainly of these students reported higher mean digital literacy scores than the level 3. That being said, the steps need to be taken to narrow the gap between the groups in terms of digital literacy. This result is in accordance with Cope and Kalantzis (2000) in highlighting the role of a new pedagogy as a requirement for the use of digital media. It seems that high level universities have already initiated a change in their pedagogy toward incorporating digital competence. In addition, according to the results, the mean of the males in all four levels was higher than the mean of the females and there was a statistically significant difference between the males and females in mean digital literacy scores. Many studies have repeatedly reported similar results (e.g., Jones et al., 2010; Shashaani & Khalili, 2001). It seems that the males tend to outperform the females especially in technical component of digital literacy; however, the females show a great interest and skill in using technology for socializing and entertainment. This result is in accordance with Bunz et al. (2007). However, the result may not be due to innate abilities and may be associated with sociocultural reasons. The agents socially forming our lives, like parents, teachers, and peers may unintentionally transfer the stereotypical view of gender, educational, and career achievement (Shashaani & Khalili, 2001).

As it was mentioned earlier in this section, a comparison of the means of the four groups indicated that the mean of the groups decreases as the level increases except for the levels 3 and 4. The higher mean scores of the students in the level 1 and 2 universities might be due to many reasons which barely include available resources at schools or universities because most of the population of the country especially younger generation have access to at least a smartphone which is usually connected to the internet. It seems that the mind set of an individual contribute significantly to whether or not he/she will efficiently utilize technology. That being said, the level 1 and level 2 universities may have intentionally or unintentionally affected the mind set of their students through for example curriculum, syllabus, workshops, incentives, competitive environment, and so on. According to Janssen et al. (2013), the main issue is the appropriate use of technology by students to benefit education and this can be achieved by introducing a pedagogically- sound methodology and suitable teaching material into an appropriate technology-based environment that inspires active learning through cooperation and collaboration (Johnston & Webber, 2003; Lea & Jones, 2011). According to the results and as it was predicted from previous studies (e.g., Scherer et al., 2017), there was a significant difference between the groups and mathematical group ranked first and the humanities group ranked last. In contradiction to our expectation, the students studying foreign languages reported to have a higher mean digital literacy scores than the experimental group. This result is not surprising considering the fact that the internet content, software, and applications are dominated by English. The knowledge of English allows them to walk into a world which may still be unknown to a significant proportion of the society. This fact adds to their interest and tendency to accumulate more knowledge and skills related to digital tools. This result is in accordance with the social cognitive theory (Bandura, 1986; Pajares, 1997) which states that a successful experience in an activity gradually enhances individual's self-efficacy related to the activity and encourages him/her to achieve excellency in the activity. Whether we like it or not, English has gained the status of an international language. As the country in which English is a foreign language, education system has not succeeded in increasing the

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competency levels of young generation. Consequently, it is needed to direct the attention in order to improve English language among different generations of the society. The results of the study also indicated that there is a statistically significant difference in the mean digital literacy scores among the students who use different numbers of digital tools. To elaborate on this result, it can be said that smartphones in the country are usually used for communication and entertainment, so if a student reported to be using more than one digital tool, he/she is likely to utilize technology for other purposes like learning. This finding is in accordance with the findings of Abdollahyan and Ahmadi (2011) who examined digital literacy level among undergraduate students of a university in Iran. To examine the role of residency place, the students' reported birthplaces were categorized into state capital and state cities. Iran is consisted of 31 provinces. Each province is governed by a local capital which is usually the largest city in the province. According to the results, the students who were living in the state capitals were significantly higher in mean digital literacy scores than those who were living in the state cities. This finding contradicts Arsenijević and Andevski (2016) who found that there was not a significant difference in media literacy between students in rural areas and towns. This result may be due to the fact that any new initiatives regarding technology are usually introduced in large cities and state capitals and the residents of these cities are familiar with and well-versed in these technologies. For example, new start-ups like DigiKala or Snapp were introduced in large cities and then gradually expanded their operations throughout the country, so the users of these products automatically learn installation, searching, evaluating, and validating websites, conducting a safe transaction and so on. And finally, according to the results, students who reported to have previously attended a course or workshop on technology or digital tools scored higher in terms of digital literacy than the students who did not have such an experience. Indeed the users need to be nurtured into using technology efficiently and merely using technology does not necessarily result in digital literacy. Mahboudi et al. (2017) mentions, existence of technology does not necessarily result in technological applications in education and this commonly held belief that digital natives are digitally literate is disputed according to the evidence that shows many students encounter problems in accessing, evaluating, and integrating from the internet (Greene et al., 2014).

6. Conclusion and Implications

The current study examined the students' digital literacy according to their level of university, gender, field of study, digital devices they use, the city they live, and background IT information. The findings indicated that the mentioned factors contribute to the digital literacy of the students since the students who were studying in the high ranked universities tend to report higher digital literacy. According to the findings, the male students felt competent in digitally related issues. As it was expected, the students studying in the fields categorized under the umbrella term 'mathematical sciences' were the most digitally literate students in the universities and the main category of 'humanities' reported to have the lowest familiarity with digital literacy. It was found that the students who possess and use several digital tools during their daily life tend to report higher digital literacy than their peers who limit their digital activities to mobile phone. Findings indicated that the students who are the residents of state capitals generally exceed their counterparts in the state cities and finally there was an effect of education and learning on digital literacy. The students who reported to be digitally literate were those who have previously attended a course or workshop on digital and IT related issues.

One implication of this study is that educators become aware of the existence of a digital divide between different academic disciplines. In most cases, knowing a problem is a good starting point. They also need to learn how to use these tools and obtain information about their affordances in education. Then, they can model the efficient use of these tools for their students. It is less likely that students will deliberately integrate technologies in their learning and they will limit their use for obtaining information in their daily life unless teachers encourage them through different activities.

Another implication is that literacy programs in society need to be enhanced and strengthened. It also needs to be acknowledged that digital literacy is an ever-changing and multi-

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faceted concept. To have digitally literate citizens, literacy programs like workshops, seminars, TV programs, short courses, in-service and preserve training, books, skill-based programs will be effective.

The researchers acknowledge that self-reports do not measure knowledge or actual behavior of the respondents. Subjects are not always able to report their competence accurately. And more importantly, subjects may or may not know the terms or concepts used. It is suggested that future studies can hold an informal discussion with students both before and after completing the questionnaire or involve students in a short-term course on digital literacy to see how the experience of completing the questionnaire or attending the course works as a type of learning experience. The future studies can replicate the study after they have accessed to the recent data and further extend the scope of the study to include more universities from each strata or select the required sample through randomization. This study will only allow us to cautiously generalize the findings to the population of undergraduate students in public universities of Iran. It will not be possible to draw a clear picture of society in terms of digital literacy of the undergraduate students unless the future studies report the situation in the other types of universities in the country.

Acknowledgement

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