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The Relationship Between Technological Research Skills and Research Self-Efficacy of Higher Education Students

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Abstract

Background: Today, one of the required skills for researchers' successes is the optimal use of facilities and capabilities of cyberspace. The present study aimed at investigating the relationship between technological research skills and research self-efficacy of higher education students at Bu-Ali Sina University.

Methods: The population of this correlational research was all graduate students at Bu-Ali Sina University in the academic year of 2014 to 2015. Using Krejcie and Morgantable and applying stratified sampling, 329 subjects were chosen as participants of the study. Data were collected through a researcher-made questionnaire of technological research skills that was validated by 6 experts and with a reliability coefficient of 0.84, and the questionnaire of research self-efficacy was validated by Salehi et al. with a reliability of 0.84. The technological research skills questionnaire had 33 items and the research self-efficacy had 54 items. To analyze the data, Pearson's Correlation Coefficient and multiple regression was used with the SPSS 19 software.

Results: The findings indicate that the level of technological research skills of the students was 2.71 with $P < 0.001$, while their research self-efficacy was 3.30 with $P < 0.001$. Also, the results show that there was a positive significant relationship between technological research skills and research self-efficacy ($r = +41.33$, $P < 0.001$). In addition, the components of technological research skills could explain research self-efficacy variances.

Conclusions: Technological research skills could improve students' research functions.

Keywords: Higher Education, Research Self-Efficacy, Technological Research Skill

1. Background

Higher education is one of the fundamental systems in every country, whose chief responsibility is providing professional services in science and technology. Universities are responsible to recognize scientific, technological, economic, social, and environmental problems of the society and attempt to solve them by research and science production (1).

There are various factors that promote research, including educational environment, curriculum, teachers' proficiency, research facilities, personal features, as well as cognitive and social variables, such as the researcher's self-efficacy. Enhancing students' knowledge and improving their research skills in areas, such as recognizing research problems, determining the research aims, setting theoretical principles, organizing research literature, determining research population and samples, choosing data collection instruments, analyzing and interpreting data and providing further suggestions based on the research findings are all among influential factor that promote research. The acquisition of these competencies can develop the students' recognition about various research aspects and improve their beliefs regarding research. In addition, students by acquiring these competencies, beliefs, and skills can gain better self-efficacy (2).

Self-efficacy is a key concept in the theory of social cognition. In this theory, self-efficacy implies the person's perception of his ability in having a specific behavior or doing a certain task. That is, when a person believes in his ability to organize and implement a future condition or location, he or she has a high self-efficacy. The person's perception of success in the future affects their motivation and perseverance in doing certain tasks. This theory emphasizes that any individual's self-efficacy roots in his cognition, emotional conditions, beliefs, and practices. A higher perception of self-efficacy of people results in greater motivation in specific activities (3). Therefore, one's belief in self-efficacy is related to conducting a task skillfully. According to this theory, self-efficacy is the result of complex inter-

actions between belief and practice from various sources, such as mastery experiences, vicarious experiences, social persuasions and encouragement, physiological and affective states. Mastery experience is related to the person's real skills in performing a specific task. If a person is able to overcome the obstacles in the past with perseverance and skills, they will be able to convey these experiences to new conditions. In contrast, when experiencing failure to do something due to negligence or lack of skills, the person develops a sense of failure in other situations. Vicarious experiences or using patterns of experience implies the situation where the person, observing a model behavior or action, imagines himself as a model and attributes his failure and success to himself. In this process, some factors, such as age, gender, social status, and cultural conditions may influence his acceptance. The other source is encouragement or social persuasion that occurs through verbal and non-verbal induction from others, such as teachers, parents, partners, and friends. These convincing factors must be realistic (4).

Researcher's self-efficacy is the individual's perception and belief about his ability to organize and implement a series of actions to achieve certain research functions (5). It could be said that the individual's perception of research capability plays an important role in conducting research, successfully.

Development of ICT, research and other areas has been affected by these changes. Doing research requires a combination of skills that enable the researcher to employ computer, applicable software, database, and other technological instruments in achieving appropriate jobs or academic and personal goals (6, 7). Using cyberspace, researchers are able to access different software, instruments, and facilities to prepare multimedia contents, present and exchange information and manage the contents. Interactive and collaborative capabilities are other important aspects of cyberspace that gives researchers the opportunity to convey their emotional and cognitive massages to group members to create a sense of community and a team-working environment (6). Interactive capabilities of social networks and virtual space can be divided to several categories in terms of helping researchers: including social networks that comprise text-based tools, such as blogs and wikis that help the researchers share their ideas using textual explanations and comments. Other categories are social networks, such as Facebook and YouTube that in addition to textual communication capability, provide possibilities to exchange pictures, videos, and other media forms to express their ideas or present research data. At a higher level, there are virtual games and three-dimensional communities, such as 'Second Life' and 'Virtual Games', that provide pseudo-realistic environment for users through a three-dimensional environment using strong media. Therefore, there are various tools and capabilities in virtual spaces that can be used in different phases of conducting research by students when equipped with required skills (8).

Post-graduate students, as the research arms of universities, gain research skills in their formal curriculum, including the research method course and thesis writing, and become familiar with other skills, such as using the internet in their formal or informal curriculum. However, some researches show that students have difficulties in searching data in cyberspace, collecting data, selecting data, working with the computer, and using internet services and software (9-12). The present research discusses the skills of postgraduate students in different dimensions of search for resources, content preparation and presentation, presence in cyberspace, participation and interaction. Siriparp showed that a longer duration and number of research-based education courses for the students lead to greater research self-efficacy and educational performance (13). By studying the relationship between research self-efficacy, tendency to do research and output dissemination, Hemmings and Kay showed that research self-efficacy is the most important predictor of output dissemination (14). Other researchers showed that desired educational and research environment improve students' research self-efficacy and productivity. Furthermore, attendance to research workshops and participation in research activities help students improve their research self-efficacy (15). Also, Anderson and McGreal showed that most researchers use social networks, such as Facebook, LinkedIn, and Skype to identify research opportunities and find colleagues in research projects (16).

Review of the literature showed that technology has different capabilities in facilitating the availability of academic resources and services that college student can employ to access newest research findings. There is a lack of studies on new capabilities of ICTs and its relationship with research self-efficacy. To address this gap in knowledge, the current study aimed at determining:

1. The level of technological research skills of higher education students.

2. The level of technological research self-efficacy of higher education students.

3. Students' demographic factors effect on their research self-efficacy and information technology skills?

4. How much the elements of technological research skills predict research self-efficacy of higher education students.

5. Whether there is a relationship between technological research skills and its elements with technological research self-efficacy of higher education students.

2. Methods

The method used for this research was descriptive and correlational. The statistical population of this research included all graduate students of Bu-Ali Sina University in the academic year of 2014 to 2015, the number of which was 3415 based on the existing statistics. Table 1 shows the Names of colleges, N and samples that were selected.

Table 1. The Names of Colleges, N and Colleges Samples

Names of Colleges	N	S
literature and humanities	667	68
veterinary	52	6
physical education and sports science	149	15
chemistry	332	33
social science and economics	320	32
fundamental sciences	490	49
engineering	465	46
agriculture	782	78
art and architecture	158	16
Total	3415	343

According to Table 1, in this research, among 343 distributed questionnaires, 329 questionnaires were filled and returned to the researcher, from which 14 questionnaires were omitted due to ambiguity of given data. In order to observe ethical considerations, each participant was assigned a special code and the necessary measures to protect the confidentiality of information were implemented.

For collecting data, two questionnaires of technological research self-efficacy and technological research skills were used. To measure students' research self-efficacy, the research self-efficacy questionnaire validated by Salehi, Karshaki, Ahanchian, and Karimi Mouneghi was used (17). This instrument was developed according to Lawrence Newman's 7 factors research self-efficacy including research conceptualization, method and implementing research, data analysis, writing reports, research ethics, qualitative research, and skills and proficiencies. This questionnaire consists of 54 items with a five-point Likert scale ranging from 1 to 5 (very little, little, average, much, and very much). The reliability of the research self-efficacy questionnaire and its sub elements were calculated as research conceptualization with 12 items (0.96), method and implementing research with 10 items (0.90), data analysis with 13 items (0.89), writing reports with 6 items (0.76), and research ethics with 3 items (0.82), qualitative research with 5 items (0.83), and skills and proficiencies with 5 items (0.72). The total items in this questionnaire was 54 items with Cranach's Alpha reliability of 0.84, which indicates appropriate reliability of the questionnaire. To measure technological research skills, a researcher made questionnaire, consisting of 33 questions based on a five point Likert scale from 1 to 5 (very little, little, average, much, and very much) was used. Minimum and maximum score from the questionnaire was 33 and 165, respectively. The face and content validity of technological research skills questionnaire was verified by 6 IT and education experts. The Cronbach's Alpha reliability of the technological research skills questionnaire was 0.84 and for the items, this was as follows; skills in using data searching tools and internet resources with 8 items (0.89), skills in using tools for preparing and presenting content with 7 items (0.83), skills in using tools or dissemination of ideas in online environment with 4 items (0.89), skills in using tools for online dialogue and participation with 4 items (0.87), and skills in using applicable software with 10 items (0.72). The data was analyzed with Pearson correlation and multiple regressions by using the SPSS 19.0 software.

3. Results

In this research, 58% (199 students) of participants were female and 42% were male (143 students). Furthermore, 78% (267 students) were studying at masters level and 22% (76 student) at doctoral level. The responses in the first research question about the level of technological research skills were examined by one sample T-test (Table 2).

Based on the result of T-test and the significance level in Table 2, and due to the fact that the observed mean, with 99% confidence, it could be said that Bu Ali Sina graduate students are at an acceptable level only in skill in searching internet information and resources, while they are not familiar with preparing and presenting content, presence in cyberspace, use of applicable software, and interaction in cyberspace for research purposes.

As seen in Table 3, due to the t test results in research self-efficacy and significance level of $P < 0.001$, it could be said that mean of research self-efficacy of Bu-Ali Sina graduate students in elements of statistical analysis, conceptualization, conduction method, qualitative research, writing report, research ethics, skills and proficiencies was higher than the average level.

According to Tables 4 and 5, the responses to the third research question was examined by independent t test and analysis of variance (F test). Regarding the effect of demographic factors on research self-efficacy and technological research skills and considering the test results and significance level of $P > 0.001$, it was shown that, there are no meaning full effects from gender, level of education and

Table 2. The Level of Technological Research Skills Using One-Group T-Test

Variable		Index			
		Observed Mean	Mean ± SD	T Value	P Value
Elements	Technological research skills	2.71	3 ± 0.74	-6.89	< 0.001
	Searching internet resources	3.27	3 ± 0.77	6.36	< 0.001
	Preparing and presenting e-content	2.14	3 ± 1.09	-13.97	< 0.001
	Dissemination of ideas in online environment	2.28	3 ± 1.13	-11.30	< 0.001
	Internet dialogue and participation	2.54	3 ± 1.01	-8.07	< 0.001
	Applicable software	2.90	3 ± 0.85	-2.07	< 0.001

Table 3. Research Self-Efficacy Value of Bu Ali Sina Graduated Students Using One-Group T-Test

Variable		Index			
		Observed Mean	Mean ± SD	T Value	P Value
Research self-efficacy		3.30	3 ± 0.60	9.03	< 0.001
Elements	Analytical and statistical self-efficacy	3.07	3 ± 0.76	1.78	< 0.001
	Conceptualization	3.50	3 ± 0.63	14.44	< 0.001
	Method and Research implication	3.20	3 ± 0.68	5.48	< 0.001
	Qualitative research	2.95	3 ± 0.80	-1	0.310
	Writing report	3.38	3 ± 0.83	8.37	< 0.001
	Skills and proficiency	3.55	3 ± 0.65	16.23	< 0.001
	Research ethics	3.77	3 ± 1.25	11.14	< 0.001

colleges types on research self-efficacy and technological research skills.

To answer the fourth question of the research according to Tables 6 and 7, Pearson correlation coefficient was used and showed a positive significant correlation between technological research skills and research self-efficacy in graduate students of Bu-Ali Sina at $P < 0.001$ and $r = 0.52$ (Table 6). Also, there was a positive and significant relationship between self-efficacy and elements of technological research skills and with 99% assurance, it could be concluded that higher the skills in using tools for searching internet information and resources, skill in internet dialogue and participation, and skill in application software, allow higher research self-efficacy and vice versa.

Table 7 shows the role of elements of technological research skills in the capability to predict research self-efficacy. Among elements of technological research skills, only elements of skills in using applicable software and tools for internet information and resources were positive and significant predictors of research self-efficacy, at $P < 0.001$ and beta value of 0.43 and 0.29, respectively. However, the role of skills in internet dialogue and participation, dissemination of data, presence in an online environment, and preparation and providing content were not significant predictors as P was > 0.05. In summary, regression equation, derived from multiple regressions, for predicting research self-efficacy, was as following:

Research self-efficacy = 0.43 + 1.76 (skills in applicable software) + 0.29 (skills in using tools for searching internet information and resources) + 0.01 (skills in internet dialogue and participation) - 0.05 (skills in dissemination of ideas and presence in online environment) - 0.05 (skills in preparing and presenting multi-media content) (Table 7).

4. Discussion and Conclusion

The present research aimed to examine the relationship between technological research skills and research self-efficacy of higher education students. Regarding the role of ICT in performing the research phases, and their capabilities in facilitating the process, and according to the purpose of the study, the research findings are discussed in the three following aspects:

According to the research findings, the level of technological research skills of Bu Ali Sina graduate students was lower than the average degree. This result is in line with the studies of Kesthi Aray et al. (9), Rezaie et al. (10), and Roshanian and Aghazadeh (11), which showed that some re-

Table 4. Effects of Demographic Factors on Research Self-Efficacy

	Demographic Factors			
	Frequency	**Mean ± SD**	**t**	**P Value**
Gender			0.90	0.367
Male	144	3.39 ± 0.36		
Female	199	3.25 ± 0.37		
Level of education				
Graduate level	268	3.35 ± 0.36	0.087	0.931
Doctoral level	76	3.37 ± 0.38		
Colleges type	**Frequency**	**Mean ± SD**	**F**	**P Value**
Literature and humanities	68	3.21 ± 0.92	0.72	0.571
Veterinary	6	3.12 ± 0.87		
Physical education and sports science	15	2.79 ± 0.35		
Chemistry	33	2.86 ± 0.82		
Social science and economics	32	3.34 ± 0.56		
Fundamental sciences	49	3.56 ± 0.49		
Engineering	46	3.11 ± 0.81		
Agriculture	78	2.97 ± 0.56		
Art and architecture	16	3.19 ± 0.69		

Table 5. Effects of Demographic Factors on Technological Research Skills

	Demographic Factors			
	Frequency	**Mean ± SD**	**t**	**P Value**
Gender				
Male	144	3.19 ± 0.65	-1.44	0.152
Female	199	3.22 ± 0.29		
Level of education				
Graduate level	268	3.01± 0.34	0.866	0.387
Doctoral level	76	3.12 ± 0.42		
Colleges type	**Frequency**	**Mean ± SD**	**F**	**P Value**
Literature and humanities	68	3.59 ± 0.9	0.68	0.725
Veterinary	6	3.11 ± 0.8		
Physical education and sports science	15	3.01 ± 0.5		
Chemistry	33	2.05 ± 0.83		
Social science and economics	32	3.13 ± 0.61		
Fundamental sciences	49	3.42 ± 0.53		
Engineering	46	3.01 ± 0.76		
Agriculture	78	2.69 ± 0.69		
Art and architecture	16	3.04 ± 0.66		

searchers do not use capabilities of internet efficiently in their researches process.

Another aspect of this research findings was that research self-efficacy of Bu Ali Sina graduated students was higher than the average level. It could be concluded that by understanding their mission and duties, higher education students recognize that they should improve their research knowledge, attitude, and research skills as much as possible during the education period. The third aspect of this research finding was that there was a positive correla-

Table 6. Correlation Coefficient of Technological Research Skills and Its Elements with Research Self-Efficacy

Variables	Correlation Coefficient	P Value
Technological research self-efficacy	0.52	< 0.001
Searching internet information and resources	0.50	< 0.001
Preparing and presenting e-content	0.28	< 0.001
Idea dissemination in the online environment	0.29	< 0.001
Internet dialogue and participation	0.34	< 0.001
Applicable software	0.55	<0.001

Table 7. Multiple Regression Analysis of the Role of Elements of Technological Research Skills in Capability to Predict Research Self-Efficacy

Model		Non Standardized Coefficient		Standardized Coefficient	t	P Value
		B	SD	Beta		
Simultaneous	Fixed value	1.76	0.12		14.29	< 0.001
	Skills in searching internet information and resources	0.23	0.04	0.29	5.07	< 0.001
	Skills in preparing and presenting content	-0.03	0.03	-0.05	-0.95	0.34
	Skills in dissemination of idea	-0.03	0.03	-0.05	-0.95	0.34
	Skills in internet dialogue and participation	0.01	0.03	0.01	0.28	0.77
	Skills in applicable software	0.3	0.04	0.43	6.98	< 0.001

tion between technological research skills and elements of research self-efficacy, and that technological research skills could predict 36% of research self-efficacy. These findings are asserted by other researches that emphasized on research skills, such as studies by Yuen et al. (2), Seraji and Khodaveisi (6) and Mysore (8). These researches showed that varied research skills could improve the power and confidence of the researcher.

It can be said that the major missions of universities is to train qualified and efficient researches to solve technological and academic problems of the country in various fields. Albeit, their efficiency in taking research responsibilities and fulfilling their duties accurately require researchers with certain skills and beliefs. Skills related to identifying research problems, setting objectives and research questions, methods of collecting and analyzing data, concluding and offering suggestions, and dissemination of report, as important parts of research skills, could play an important role in the perceptions and beliefs of researcher's regarding their self-efficacy.

In general, it could be concluded that higher education students should be responsible for some research duties at universities, and on the other hand, they must be responsible of research-based jobs in universities in the future. Accordingly, universities must provide the grounds for learning research activities and skills for students in different ways. Learning these skills will help students enhance their research self-efficacy so that they can undergo different phases of research, from recognizing problems to dissemination of findings, with high self-confidence in a stress-free environment. Acquiring technological research skills, which include acquiring various skills and optimum use of various internet capabilities in different research phases, among other factors, will help researchers improve their research self-efficacy. Thus, it is suggested for university managers and educational planners to emphasize on technological research skills and improve students' research self-efficacy.

Footnote

Conflict of Interest: None declared.

References

1. Duranczyk IM, Franko J, Osifuye S, Barton A, Higbee JL. Creating A Model For Graduate Student Inclusion And Success. *Contemp Issues Educ Res.* 2015;**8**(3):147. doi: 10.19030/cier.v8i3.9346.
2. Yuen SC, Yaoyuneyong G, Yuen PK. Perceptions, interest, and use: Teachers and web 2.0 tools in education. *Int J Technol Teach Learn.* 2011;**7**(2).

3. Mikre F. The roles of information communication technologies in education: Review article with emphasis to the computer and internet. *Ethiop J Educ Sci.* 2011;**6**(2):109–26.
4. Wang CH, Shannon DM, Ross ME. Students' characteristics, self-regulated learning, technology self-efficacy, and course outcomes in online learning. *Distance Educ.* 2013;**34**(3):302–23. doi: 10.1080/01587919.2013.835779.
5. Jones A. The research self-efficacy of counselor education and supervision doctoral students. University of Toledo; 2012.
6. Seraji F, Khodaveisi S. Comparing technological research skills of attending and virtual student. *Acad J E-Learn.* 2014;**5**(1):1–10.
7. Sun JCY, Rueda R. Situational interest, computer self-efficacy and self-regulation: Their impact on student engagement in distance education. *Br J Educ Technol.* 2012;**43**(2):191–204. doi: 10.1111/j.1467-8535.2010.01157.x.
8. Mysore AR. Teacher Education and Digital Equity: Research in the Millennium. Handbook of Research on Promoting Cross-Cultural Competence and Social Justice in Teacher Education. ; 2016.
9. Keshti Aray N, Yousefi A, Shahbazi. A. . Skills of Isfahan city higher education students in access, storage, and management of e-sources. *J Educ Res Knowledge.* 2010;**5**(4):43–60.
10. Rezaie M, Abbasi E, Moosavi S. Research experience of higher education students of University of Tehran, and Tarbiat Modares University. *J Agric Educ Res Manag.* 2014;**6**(1):82–100.
11. Roshanian R, Aghazadeh M. Research self-efficacy psychology & educational sciences. *Res Curric Q.* 2014;**10**(2):147–55.
12. Siriparp T. Examining Self-efficacy and Achievement in an Educational Research Course. *Proc Soc Behav Sci.* 2015;**171**:1360–4. doi: 10.1016/j.sbspro.2015.01.254.
13. Hemmings B, Kay R. The relationship between research self-efficacy, research disposition and publication output. *Educ Psychol.* 2015;**36**(2):347–61. doi: 10.1080/01443410.2015.1025704.
14. Bakken LL, Byars-Winston A, Gundermann DM, Ward EC, Slattery A, King A, et al. Effects of an educational intervention on female biomedical scientists' research self-efficacy. *Adv Health Sci Educ Theory Pract.* 2010;**15**(2):167–83. doi: 10.1007/s10459-009-9190-2. [PubMed: 19774477].
15. Chisenga J, Kedemi R, Sam J. The Use of Social Media in Agricultural Research Workflows in Ghana and Kenya. *Agric Inf Worldwide.* 2015;**6**:48–57.
16. Anderson T, McGreal R. Disruptive pedagogies and technologies in universities. *J Educ Technol Soc.* 2012;**15**(4):380.
17. Salehi M, Ahanchian MR. Validation of Research Self-Efficacy Scale for Postgraduate Students of Ferdowsi University and Mashhad University of Medical Sciences. *Iran J Med Educ.* 2012;**12**(6):396–409.