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Ranking the Scientific-Technology Literacy Indexes of Students from the Viwepoint of Faculty Members

Ali Khaleghkhah,[1,*] and Habibeh Najafi[2]

[1]Philosophy of Education; University of Ardabili Mohaghegh, Ardabil, Iran
[2]Educational Administration, University of Ardabili Mohaghegh, Ardabil, Iran

[*]*Corresponding author*: Ali Khaleghkhah, PhD of Philosophy of Education, Associate Professor, Faculty of University of Ardabili Mohaghegh, Ardabil, Iran. Tel: +98-9143536756, E-mail: alikhaleg@gmail.com

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Abstract

Background: Increasing scientific-technology literacy is a major educational purpose around the world. This concept is an umbrella that covers everything related to science and knowledge. The aim of this research is its scientific ranking - technological literacy indicators of students from the viewpoint of faculty members of Islamic Azad University, Tabriz Unit.
Methods: The research method is descriptive and survey. The population consisted of all faculty members of the Islamic Azad University of Tabriz, which included 350 people in 2015. The sample size was estimated according to the Cochran formula. A total of, 186 individuals were selected by using the stratified random sampling. The measuring tool includes a Researcher questionnaire of scientific - IT literacy Miller (2006) (10 components and 40 questions); its validity was confirmed by experts and its reliability was assessed by using Cronbach's alpha coefficient to 0.81 values. Data were analyzed with SPSS 18 software.
Results: Data analysis showed that the viewpoints of faculty members and scientific literacy indicators have a significant difference between the students ($\chi^2 = 127.5$; P = 0.00). The maximum rank was related to basic knowledge as well as foresight indexes and the lowest was related to the creativity index, however, no significant difference was found between the students for technology indexes ($\chi^2 = 2.667$; P = 0.264).
Conclusions: The students are in high rank in terms of basic and theoretical knowledge, which is a requisite for scientific literacy, however, in terms of creativity and curiosity, thinking manners (tendency to act) is ranked lower. Attention to critical thinking development and knowledge application in performance and real-life was recommended

Keywords: Scientific Literacy, Technological Literacy, Virtual University, Indexes, Students

1. Background

We have witnessed a dramatic economic growth resulting from the use of technology and globalization from the late 20th century to the early 21st century. The world is becoming more and more integrated and generalized with the changes in the types of software and information systems; with the full range that it has, it becomes more homogeneous and easier to access. In addition, the concept of the global village, which is raised today, also emphasizes this issue (1, 2). Researchers measured the level of scientific literacy in academic societies in different countries and concluded that the lowest level of scientific literacy is related to Turkey, which was about 3%. The highest was related to Sudan with approximately 35% (3, 4).

Studies have been shown that the level of scientific literacy in the United States has increased from 10% to 17% from the early 1990 to the late 1999. Further evaluation showed that scientific literacy has increased by 28%, however, although this increase is very promising, these figures are not enough for the needs of a modern society's democracy. In order to grow a democracy, people must have the capacity to attain a minimal understanding of the issues that are raised in a decision-making. In most writings, the concept of literacy of science and science literacy are used indifferently, literacy of science refers to literacy with respect to science, while scientific literacy refers to the nature of literacy in all its forms, such as science, language, technology, and so on. Scientific literacy is related to the purposes of science education, while scientific literacy refers to approaches to achieve literacy (5, 6). Despite the great popularity of scientific literacy, there is still no clear definition of it (7). Scientific literacy was the common term "science for all" in the 1980s. In 1990, scientific literacy term became common as a new slogan to achieve the desired goal at the university. Researchers believe that increasing scientific literacy is a major educational purpose around the world. This concept is as an umbrella that covers everything that is related to science and knowledge (8, 9). The concept of scientific literacy includes the ability to participate in scientific assemblies of decision making and change the requirements associated with it towards a multi-dimensional form that not only includes the content of knowledge (terms, truths, and concepts), but most importantly includes procedural skills (manual and subjective), tendencies (attitudes and behaviors), and understanding our relationship between knowledge, technology, and society as well as the history and nature of science (6, 10). Scientific literacy is as having an understanding of events and environmental events (11). According to the national education standards, scientific literacy is having the knowledge and understanding of the scientific concepts and processes required for individual decision making, participation in cultural and civil affairs, and economic efficiency (12). Scientific literacy has been considered as a functional ability, the ability to use scientific knowledge in real life situations (13). Scientific literacy is a collection of concepts, history, and thoughts that help us understand the scientific issues of our time. If anyone understands the scientific issues of journals and newspapers and if someone understands engineering papers or holes in the ozone layer as easily as sports, political, or artistic papers then he/she has scientific literacy (14, 15). Scientific literacy involves different perspectives as well as individual and social interests at the national and global levels. Therefore, it has many variations; the definition of technology literacy and its integration with educational elements is a really hard task. However, in recent decades, the unitary and integrated concept of scientific-technology literacy has become more common (16). In addition, many researchers believe that scientific literacy alone does not include science and technology, but also includes technology. Social issues, scientific issues raised in the reference of scientific literacy, in fact, had been initially technology-based (17-19). Understanding technology and its relationship with the society should be considered as the cornerstone of scientific literacy. In order to cope with social science-based issues, the understanding technology literacy and scientific literacy is to be emphasized in pairs (9). Accordingly, scientific literacy has been considered as a correct understanding of technology and its relationship with society. Researchers believe that the studies field of sciences and nanotechnology-provides another reason for the use of scientific-technological literacy in pairs. In the case of scientific-technology literacy, it has been proved that it is unnecessary to differentiate between Nano science and nanotechnology. As a result of this, there is no distinction between scientific literacy and technology literacy (20-22). Studies conducted in Nigeria show problems in student's understanding of sciences texts. Studies showed that the index of problems in texts is first in physics, next in chemistry, and then biology. A further study showed that 31% of subjects that are hardly understood by students are related to the cognitive needs about the subject, which are at a very high level than the student's perception (23, 24). Researchers, in developing the level of scientific literacy among students in their research, pointed out to the term "continuous learning", which refers to everyone and everywhere. They argued that the students are not satisfied with the classroom and the official form of learning. Furthermore, theyare always in the pursuit of learning science (25). Researchers, in a research that they conducted on 23 college students, concluded that students from different majors, such as non-technical students, are less interested in their performance than technical students, and are poor in applying theoretical knowledge in real life. Nowadays, the ability to apply knowledge in solving real life problems is one of the principles of scientific literacy (26, 27). If a large section of society gains quest and testing skills as well as uses them to solve society problems, then scientific literacy will be achieved. Researchers believe that the content of the curriculum that has been considered for students more than their perceived level is a major reason for reducing their interest in knowledge (7). From the scientists' point of view, in classical and traditional learning, learning was stagnant, dull, and energy-free. The teacher distributed knowledge and students were taught and transmitted on a superficial level. Therefore, they were inactive and lack in the spirit of critical thinking in learning. Certainly, this method cannot stimulate and motivate students to learn science, which is the main key to scientific literacy (11). The researchers state that today the greatest weakness in the transfer of knowledge and its application to the real issues of life and society is that some people, especially students, have not learned the basic knowledge properly and did not acquire enough knowledge. Learning basic knowledge is necessary and needed. With a full and correct knowledge, the student can take a step in the progression ladder (28). In this research, the basic question is answered: how is prioritizing the indexes of scientific literacy and technology literacy of students from the point of view of faculty members?

2. Methods

The research method is descriptive in terms of data collection and survey. This is by collecting the views of a particular group in the present (faculty) and is applied in terms of the goal. The population consisted of all faculty members of the Islamic Azad University of Tabriz, which included 350 individuals in 2015. The sample size was estimated according to the Cochran formula. A total of 186 people were selected using the stratified random sampling. The measuring tool included a researcher questionnaire based on the theory of Miller, which is 40 items. It is valued to the Likert 5 degrees, strongly disagree = 1 to strongly agree = 5. The questionnaire included a cross section regarding gender, age, and type of college. It also had a section that included 1 to 28 questions on scientific literacy index (creativity, questions: 1, 2, 3, and 4; lifelong learning, questions 5, 6, 7, and 8; critical thinking, questions: 9, 10, 11, and 12; the trend to act, questions: 13, 14, 15, and 16; the curiosity, questions: 17, 18, 19, and 20; foresight, questions: 21, 22, 23, and 24; and the knowledge, questions: 25, 26, 27, and 28) and questions 29 - 40 related to IT literacy index (IT thinking, questions: 29, 30, 31, and 32; technical knowledge, questions: 33, 34, 35, and 36; and IT skills, questions: 37, 38, 39, and 40). Experts confirmed face and content validity and its reliability was assessed using the Cronbach's alpha coefficient of 0.81 (scientific literacy =0.82, technology literacy = 0.81). Data were analyzed with SPSS 18 software. In this regard, the standard indicator of scientific-technological literacy, according to Miller (2006), was a questionnaire that was prepared and distributed to a random selection of faculty members from each college. The study included 350 faculty members of the Islamic Azad University, Tabriz to dissociation each college that teached in the year 2015. The sample size was acquired by using the Cochran formula. For a community with a volume of 350, 186 individuals were estimated. For participation, all faculties, in assessment, were selected by stratified random sampling to differentiation each college and was calculated by Equation 1.

3. Results

In this part, 2 descriptive and inferential statistics were used for answering research questions. Data analysis was done with parametric tests: Chi-square (chi), T 2 independent groups. Table 1 shows the number of male and female faculty members from each college.

In the section of the descriptive statistics, mean and standard deviation of scientific literacy and technology literacy indicators is used; these indicators is conveyed in Table 2 with different colleges.

4. Discussion and Conclusion

This research is aimed at ranking indicators of students' scientific-technological literacy from the viewpoint of faculty members of the Islamic Azad University, Tabriz Unit.

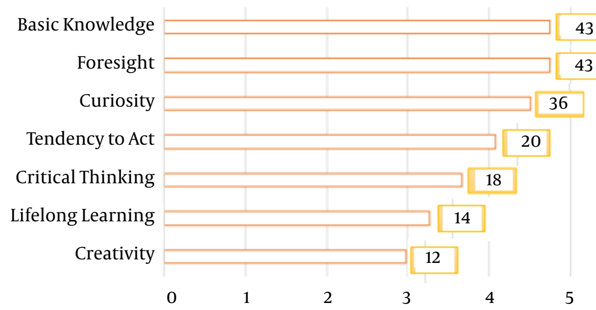

Figure 1. Prioritize Scientific Literacy Indicators, According to all Respondents

According to the findings, the result of the Chi-square test showed that, in the point of view of the faculty members, scientific literacy indexes among students are significantly different, (x^2 = 127.5; P = 0.000). The findings of the research are consistent with findings of Fensham (7), Moravcisk (27), Perry (25), and Bromide (24). The highest level is related to 2 index of basic knowledge and foresight to value (4.75) and indicators of curiosity (4.50), manners of thinking (4.08), critical thinking (3.67), lifelong learning (3.27), and creativity (2.98), respectively, which are placed in 2nd-6th ranks. According to Miller's theory, if there are 7 above indexes in a population, that population has a scientific literacy. According to the results of the findings, the critical thinking index of lifelong learning and creativity has a low rank. Studies have been shown that successful development can be well imagined when the spirit of inquiry, critical thinking, and the tendency to experiment and innovation penetrate among people on a large scale.

In classical and traditional learning, learning the science is also stagnant, dull, and energy-free. The teacher distributes knowledge while the students learn superficially. The students are inactive and lack the spirit of critical thinking in learning. Certainly, this method cannot stimulate and create students' motivation and interest in creativity and innovation in science, which is the main key to scientific literacy. At the university, the concept of more learning is the distribution of knowledge by the teacher, the acquisition of it by the student, and delivery of knowledge in the test page to obtain a degree. There is no spirit of critical thinking. In parallel with it, creativity is much less. Therefore, the faculty members have given a very low rate to creativity.

Lifelong learning refers to learning at all times and places. This index also has a low rating. As Green and his colleagues pointed out in 2011, to increase scientific literacy in their research, students should not be satisfied with only learning science in the classroom or the

$$\text{The Size Each Class} = \frac{\text{Number of Members of Each Class} \times \text{Sample Size}}{\text{Population Size}} \quad (1)$$

Table 1. The Number of Male and Female Faculty Members from Each College

Colleges	Faculty	Men	F, %	Age	Women	F, %	Age
Computer Engineering	23	15	12.71	33 - 47	8	11.76	37 - 49
Mechanics Engineering	10	10	8.47	35 - 43	0	0	-
Literature and Foreign Language	13	6	5.08	34 - 41	7	10.29	35 - 43
Law and Political Science	18	10	8.47	37 - 40	8	11.76	34 - 45
Agriculture	19	14	11.86	38 - 43	5	7.35	35 - 40
Architecture and Arts	8	5	4.23	34 - 41	3	3	33 - 42
Science	27	17	14.40	37 - 45	10	14.70	40 - 43
Medical Sciences	18	8	6.77	39 - 47	10	14.70	41 - 53
Humanities and Education	18	10	8.47	38- 50	8	11.76	39 - 48
Veterinary	19	13	11.01	40 - 52	6	8.82	39 - 55
Management, Economics and Accounting	13	10	8.47	37 - 54	3	3	41 - 49
Total	186	118	-	-	68	-	-

official form, they should be looked for knowledge at all times. No significant difference was found between students in terms of technology indexes ($x^2 = 2.667$; $P = 0.264$). The findings of the research are consistent with the findings of Jarvis (26), Martin (28), and the department for education and employment (12). Furthermore, indexes of scientific-technological literacy between the 2 faculties of computer and education sciences was compared to determine whether the technology indexes have a higher rank among computer students and how much knowledge is used in practice in the second stage of the research, with respect to the dealing of computer science students with technology and software in a purposeful way. The results of the t-test of 2 independent groups showed that the indexes of "basic knowledge, critical thinking, and creativity" at the faculty of educational Sciences and the indexes of "curiosity, tendency to practice, futuristic, lifelong learning, and technological skills" have a higher rank and rate in computer faculty. Therefore, the type of students' who major in the ranking of indexes is determinant and effective; thus, the students gets the science-technology scientific skills based on their major. As Jarvis et al. concluded in their research on 23 faculties in 2010, students from different majors, including non-technical students, are not interested in performance compared to technical students. In addition, they are weak in the application of theoretical knowledge in real life. However, today, the ability to apply knowledge in solving real life problems is one of the principles of scientific literacy. Therefore, paying attention to the application of theoretical knowledge in real life and practice, as well as the development of educational policies for the expansion of all scientific-technological literacy indexes for students in all majors are recommended in the same way. Due to the lack of internal researches to examine the indexes of scientific-technology literacy, the researcher has used external researches. In a transnational look, the 21st century society is a learning society and the need to survive in such a society is equipped with the necessary tools of it. The cornerstone of this society is known as scientific literacy. Whatever the people of this society are more seriously connected with for learning and education, the need to pay more attention to scientific literacy becomes more evident (29, 30).

At present, it can be said that the level of scientific literacy among students is very low. This claim is based on the poor performance reported in various majors in external evaluations (31-33). This issue was an important variable and it encouraged the researcher to carry out a research in this regard. In this regard, Miller's Technology - Scientific Literacy Indexes were reviewed and ranked among the students. Scientific-technology literacy is a tool for sustainable development in the global village. Governments are asked to work together to enhance the capacity of countries to design, plan, and execute programs to increase technology-scientific literacy for all. The first starting point for expanding the level of scientific-technology

Table 2. Descriptive Statistics for Indexes of Science Literacy and Technology Literacy of Colleges

Colleges	Variable	Indicators	Mean	Mean	SD
Computer	Scientific literacy	Basic knowledge	11.391	10.522	3.301
		Foresight		10.391	3.526
		Creativity		11.652	3.601
		Curiosity		11.957	3.561
		Critical thinking		12.13	4.06
		Lifelong learning		11.696	4.714
		Tendency to act		12.783	2.954
	Technology literacy	IT knowledge	18.231	17.304	2.141
		Technological thinking		18	1.279
		IT skills		19/391	0.839
Education	Scientific literacy	Basic knowledge	14.416	13.5	3.015
		Foresight		13.722	2.927
		Creativity		13.899	4.042
		Curiosity		14.556	4.579
		Critical thinking		15.167	4.328
		Lifelong learning		15.667	3.01
		Tendency to act		14.778	3.37
	Technology literacy	IT knowledge	12.870	12.722	4.254
		Technological thinking		12.611	5.226
		IT skills		13.278	5.664
Other Colleges	Scientific literacy	Basic knowledge	9.351	8.207	4.547
		foresight		8.745	4.254
		creativity		8.952	4.697
		curiosity		9.503	4.638
		Critical thinking		10.255	4.635
		Lifelong learning		10.448	4.951
		Tendency to Act		10.145	5.125
	Technology literacy	IT knowledge	10.004	10.014	5.268
		Technological thinking		10	5.555
		IT skills		10	5.29

Table 3. Survey of Reliability

Variables	Cronbach's Alpha
Scientific literacy	0.82
Technological literacy	0.81
Total	0.81

literacy in order for sustainable development in a country is the implementation of training courses for future generations' masters. Recent works in this direction is to point out to Namibia that it has adopted programs as a unit for educating teachers about technology scientific literacy, however, these programs are exceptions, they are still not legitimate or global and there are many things in this respect still left that should be done. In the future, no job will suffer as much as basic and fundamental challenges like teaching. It is not forecasted. There is no possibility that ismore efficient than the teacher's technology to scientific literacy to mitigate these challenges (34, 35). Accord-

Table 4. Chi-Squared Test Results For Prioritize Scientific Literacy Indicators

Scientific Literacy Indicators	SD	df	FO	FE	Chi Square	P Value	Prioritize
Creativity	2.334	6	12	26			6
Lifelong Learning	2.122	6	14	26			5
Critical Thinking	3.022	6	18	26	127.5	0.00[a]	4
Tendency to Act	1.234	6	20	26			3
Curiosity	2.654	6	36	26			2
Foresight	3.009	6	43	26			1
Basic Knowledge	1.876	6	43	26			1

[a] $P < 0.05$.

Table 5. Chi- Squared Test for Prioritization of IT Literacy Indicators[a]

Technological Literacy Indicators	SD	df	FO	FE	Chi Square	P Value	Prioritize
IT knowledge	2.112	2	41	62			same
Technological thinking	2.009	2	73	62	2.667	0.264	same
IT skills	1.789	2	72	62			same

[a] $P < 0.05$.

Table 6. Results of Independent T (2 Groups) Test

Indicators	College	SD	df	Mean	t	F	P Value
Critical Thinking	Computer	1.21	185	16.739	2.56	1.540	0.010[a]
	Education	1.34		26.444			
Curiossity and questioning	Computer	2.34	185	25.417	4.23	1.320	0.036[a]
	Education	2.12		17.543			
Creativity	Computer	1.09	185	25.083	1.33	1.830	0.053
	Education	1.06		17.804			
Basic Knowledge	Computer	2.00	185	16.63	2.66	1.345	0.328
	Education	2.22		16.583			
Lifelong learning	Computer	3.12	185	27.022	3.98	1.980	0.220
	Education	3.90		27.361			
Tendency to Act	Computer	3.09	185	25.028	4.61	1.657	0.005[a]
	Education	2.67		17.848			
Foresight and Planning	Computer	2.87	185	27.028	1.90	1.456	0.004[a]
	Education	2.90		16.283			
Technological Skills	Computer	1.98	185	26.478	2.23	1.990	0.001[a]
	Education	1.60		14			

[a] $P < 0.05$.

ing to the national technology education association, politics states that the government should provide the necessary infrastructures and training for the integration of scientific and technological literacy in the university system for faculty members and students. In addition, the role of scientific and technological literacy should be recognized in advancing knowledge and skill in the modern world (36, 37). This research has been carried out at Tabriz Islamic Azad University and should be cautious in generalizing its findings to other universities and organizations. The honesty of the subjects in answering questions is one of the main constraints of the research. Future researchers are recommended to examine the effective factors on each of the above indexes in universities. In addition, the relationship between scientific-technology literacy of university and policy planning should be examined in a higher education.

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Footnote

Conflict of Interest: None declared.

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