

Full Length Research Paper

A comparative study upon determination of scientific literacy level of teacher candidates

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Accepted 6 September, 2013

It is of great importance that individuals should become scientifically literate apart from basic education in rapidly integrated world. Until the beginning of 20th century, while development level of countries were determined by literacy rates, today it is thought that one of the basic concepts which would determine development levels will be scientific literacy rate. Individuals should have qualities about scientific literacy in order to adapt to the world, access changing information, participate in discussions which take place in the society, as well as express their view and potential solutions. The aim of this study is to determine scientific literacy level of teacher candidates who have education at two universities (Marmara University and East Mediterranean University), analyze specific variables which have effect on scientific literacy level of teacher candidates through comparative analysis, and make suggestions about education that would be applied in order to improve scientific literacy. This study was designed as a screening model since the aim is to determine scientific literacy level of teacher candidates. Data collection tools included a scientific literacy survey and a variables survey, both developed by researchers. Results reflect that the scientific literacy level of teacher candidates at Marmara University is relatively higher than those in Eastern Mediterranean University.

Key words: Scientific literacy, teacher candidates, university.

INTRODUCTION

Science, defined as human's effort for having domination over nature, is closely related with any field in our lives. Therefore, while advancing in quick steps in this era, science brings together the concept of scientific literacy and provides it great importance. In fact, nations in a globalized world are aware that they should educate the citizens better in order to be successful in increasing competitive environment and give credit to being scientifically literate. Before, development levels of countries were determined by literacy rates. Today it is suggested that the basic concept which will determine development levels will be scientific literacy rate (Can, 1998; Tatar, 2006; Turgut, 2007). In this sense, raising scientifically literate individuals enables progress of a country in the areas of science and technology, takes

place among developed countries, and contributes to the development of individuals.

Although various definitions have been stated about the term scientific literacy, in general, scientific literacy includes the skill of comprehending key concepts and principles of the sciences, having the capacity of scientific thinking and using scientific thinking as a means for individual and social aims (YÖK, 1997; Çepni et al., 2003). Scientific literacy includes comprehending basic terms, restriction and principles of science, as well as its relation with nature and human. Scientific literacy supports the claim that science is the product of human brain; it does not only mean generating theories and laws but also means finding explanations for the solution of humans' problems (Yılmaz et al., 2000).

Individuals should develop scientific literacy skills in order to adapt to the world, access changing information, involve in discussions which take place in the society, and express their views and possible solutions. With a general evaluation, the following skills are suggested in order to be considered scientifically literate;

1. Use concept and values of science and technology to solve problems in daily life;
2. Take place in various activities in which he could demonstrate responsibility by considering possible results of choices he confronts, as well as defend views and actions rationally;
3. Believe in changeability of scientific and technology information and behave skeptically, recognizing the universe by using new proofs, making reasonable deductions, and thinking creatively;
4. Collect, analyze, and evaluate scientific and technological information resources, as well as use them in the decision making, action taking, and problem solving processes;
5. Understand the difference between scientific and technological evidence and personal views, deciphering reliable and unreliable information;
6. Evaluate advantages and disadvantages of scientific and technological developments and comprehend the influences of increasing human wealth, and relate these advantages, disadvantages, and influences them with human products; and
7. Reading and comprehending scientific texts considering the political, economic and ethical aspects of science and technology, and the correlations with personal and global issues (Çepni et al., 2006; Yager, 2000; Laugksch, 2000; Turgut, 2005; Miller, 2002; Miller, 2006; Holbrook and Rannikmae, 2009; Rubba et al. 1978).

For example, an individual who does not demonstrate the skill of scientific literacy would have difficulty in understanding why Turkey is behind Albania and Slovenia on the Human Development Index which is formed annually within the frame of United Nations Program. This individual would not understand the criteria of World Health Organization in classifying carcinogen, and the difference between possible and probable carcinogen (Sevgi, 2004).

Therefore, scientific literacy education is necessary in an era when science and technology are advancing rapidly. However, prior to providing education on scientific literacy, assessment should be done in order to determine the scope of education. This study seeks answers of four questions pertaining to the level of scientific literacy of teacher candidates at two different universities.

PURPOSE

The aim of this study is to determine the scientific literacy

levels of teacher candidates at East Mediterranean University (EMU) and Marmara University (MU), analyze specific variables which have effect on scientific literacy levels of teacher candidates through comparative analysis, and make suggestions about education that would be applied in order to improve scientific literacy. The research questions are:

1. What is the level of scientific literacy of teacher candidates attending EMU?
2. What is the level of scientific literacy of teacher candidates attending MU?
3. Is there a significant difference in the sense of scientific literacy between teacher candidates who attend EMU and MU?
4. What are the variables which affect the scientific literacy levels of teacher candidates who still attend EMU and MU?

IMPORTANCE

The term scientific literacy has increasing value in an era when science and technology are also high priority. Therefore, scientific literacy education is a key goal in education programs. This study is of importance for determining scientific literacy extent of teacher candidates who are the implementers of curriculum and understanding variables which influence the level of scientific literacy.

METHOD

Research model

This study was designed as screening model since the aim is to determine scientific literacy level of teacher candidates. Screening model is a research approach which aims to define a current situation as it is (Karasar, 2005). Studies which aim to understand the current situation have defining characteristics. This research is based on the screening model that has defining characteristics.

Universe and sample

The universe of study is composed of teacher candidates who still attend EMU Education Faculty and MU Atatürk Education Faculty. The sample of study is composed of 78 randomly selected teacher candidates from each university who have education and EMU and MU Education Faculties. 73 of the teacher candidates are male, 83 of them are female.

Candidates are senior students. Questions on whether they follow current news or read publications about world literature were asked to determine candidates' academic knowledge. The acquired information was correlated with the scientific literacy levels of candidates. In this case, the generalization based on the results of survey is valid only for this universe.

Collection of data

Data of the study was collected with scientific literacy survey

Table 1. Scientific literacy levels of teacher candidates

Scores*	MU		EMU	
	F	%	F	%
0-39	4	5.1	3	3.8
40-49	18	23.1	15	19.2
50-59	29	37.2	28	35.9
60-69	23	29.5	13	16.7
70-100	4	5.1	19	24.4
Total	78	100	78	100

* 0-39 Quite low, 40-49 Low, 50-59 Mediocre, 60-69 good, 70-100 Quite good.

(Yılmaz et al., 2000) which has validity and reliability and has been used in different fields before; and with variables survey which was formed by researchers and completed with expert opinion. The survey was conducted on paper.

Experts to whose opinions were referred consist of academicians from the field of educational sciences who have researches on scientific literacy. Scientific literacy survey and variables survey were performed by taking the accessible sample into account.

In its broadest sense, survey can be defined as "method of obtaining data in a way that responder gives answers to questions which were formed in pre-determined order and structure" (Altunışık et al., 2004).

The scientific literacy survey includes a wide range of questions, from "the inferred meaning of a scientific publication" to "the reader's acquisitions from a scientific publication".

Analysis of data

Data of the study were conveyed to electronic environment and analyzed using descriptive analysis. A chi-square technique was implemented to evaluate data to determine whether there was any relation between variables and scientific literacy scores.

FINDINGS AND INTERPRETATION

Findings about scientific literacy level of teacher candidates

Teacher candidates who participated in the study were administered the survey of scientific literacy determination. The survey consisted of statements about qualifications of scientific literacy with three options to select from. 2 points are given for the option which suits scientific literacy criteria best, 1 point is given for the option which suits scientific literacy criteria partially, and 0 points are given for the option which does not suit scientific literacy criteria. Teacher candidates were classified as *quite low*, *low*, *mediocre*, *good* and *quite good* according to the scores they have obtained from scientific literacy survey. Findings were summarized in Table 1.

As seen in Table 1, results reflect a similarity in the scientific literacy levels between teacher candidates in both MU and EMU who are at the level of *quite low*.

Table 1. Relation of variables effecting scientific literacy level of teacher candidates

Variables	MU (p)*	EMU (p)
Following different publications	0.000	0.000
Watching current news	0.000	0.000
Reading books other than his own field	0.000	0.000
Following World Literature	0.000	0.000
Following Turkish Literature	0.000	0.000

* p>0.005

While 23% of teacher candidates who attend Marmara University have *low* level of scientific literacy, this rate is 19% for those who attend Eastern Mediterranean University. According to being at mediocre level in the sense of scientific literacy scores; 37% of MU teacher candidates and 36% of EMU teacher candidates are scientifically literate in *mediocre* level (Table 1). Being at a *good* level in the sense of scientific literacy differs on behalf teacher candidates who attend MU. While 29% of teacher candidates who attend MU have *good* level of scientific literacy, this rate is around 17% for those who attend EMU. Being at *quite good* level in the sense of scientific literacy differs on behalf teacher candidates who attend EMU. However; when general arithmetic mean is considered in the sense of scientific literacy scores, arithmetic mean of EMU teacher candidates obtained from scientific literacy is 50.44; while arithmetic mean of MU teacher candidates obtained from scientific literacy is 54.93. From this point it can be said that in the sense of general scientific literacy of teacher candidates who form the sample of study, there is a relative difference on behalf of teacher candidates attending Marmara University.

Findings about variables effecting scientific literacy levels of teacher candidates

In this study, a chi-square technique was used to determine whether there was a relation between scores of teacher candidates from scientific literacy survey and various variables. There was no relation between gender, education status of parents, foreign language knowledge, type of high-school s/he graduated, high-school graduation grade, and level of scientific literacy of teacher candidates attending both MU and EMU. In Table 2, variables which are found to be related with level of scientific literacy level of teacher candidates were summarized and presented.

As it is seen in Table 2, there is a relation in $p>0.0005>0.000$ between scientific literacy of teacher candidates who participated in the study and variables such as following various publications, watching current news, reading books other than his own field, following World

and Turkish literature. Therefore, results reflect that the scientific level of those who regularly follow journal and similar publications about science, art, culture or popular culture, watch current news every day, read books which are not among his own field, with socio-cultural content and commonly known and accepted as classics in World and Turkish literature is higher than those who do not do these. This situation shows that it must be endeavored to provide reading habit which is increasingly lost at this century in order to adapt science and technology world. Because it is thought that reading habit would bring together the skill of scientific literacy.

RESULT AND DISCUSSION

As a result, this research shows that, in the sense of teacher candidates whose scientific literacy is at quite low, low, mediocre and good level; scientific literacy level of teacher candidates who study at MU Education Faculty is higher than scientific literacy level of teacher candidates who study at EMU. In the sense of teacher candidates whose scientific literacy level is at good level; scientific literacy level of teacher candidates who study at EMU is higher than scientific literacy level of teacher candidates who study at MU. When the variables which have effect on scientific literacy level of teacher candidates are considered, it is seen that reading habit has an important function. Apart from this, it is thought that watching current news regularly is an effective factor as well.

A similar study was carried out by Laugksch and Spargo (1999) in a research named as "*Scientific Literacy of Selected South African Matriculants Entering Tertiary Education: A Baseline Survey*" in order to determined scientific literacy level of 4223 students who are received at university for the first time. In this study it was concluded that males have higher level of scientific literacy compared to females. Results attained in the study of Laugksch (2000) contradict with the results of this study. Again in a study named "*Gender Differences in Scientific Literacy*" which is carried out by Manhart (1998); it was analyzed whether scientific literacy differs according to gender or not. In this study which was carried out at four schools; males obtained higher scores in two schools, females obtained higher scores in the remaining two schools. Manhart (1998) stated that gender is not an important factor which determined level of scientific literacy. Findings reflect that the level of scientific literacy does not differ according to gender, which in this sense is similar to the findings of Manhart (1998).

Bauer et al. (1998) carried out a practice including activities based on scientific skills (observation, investigation, interpretation etc.) in their research named "Improvement of Scientific Literacy at the Primary Level, Master's Action Research Project" which is carried out

with pre-school and elementary school students. Results reflect that the scientific literacy levels of students increases as they improve scientific skills.

As it is seen in the studies mentioned above, similar results are attained in this study when it is thought that following current news, various publications and reading habit are the elements which increase scientific skills.

Suggestions which are made depending on results of this study can be summarized as such.

1. Methods which would improve scientific literacy level of pre-service students should be applied in the courses. Activities should be arranged in order to improve students' skills of "understanding text", "interpreting and investigating".
2. The content of curriculum should be restructured in order to improve scientific literacy qualifications, education of scientific literacy should be elaborated at education faculties which especially train teacher candidates for scientific literacy education at schools.
3. If it is aimed to train individuals who know how science, technology and society are in interaction with each other and use this information in daily life, having scientific literacy qualifications should be aim not only for those who receive higher education or in physical science field but also for everyone. In fact, it is no doubt that a society which has well-trained and educated individuals would improve in every field.

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